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[In this Index subjects, titles and authors' names are all included, for convenience, in one alphabetically arranged list. Where necessary, articles are indexed under two or more headings. Often the Index is consulted by persons who have only a vague or general idea of the title or nature of the article sought. In such case a search under every heading that might relate to the subject should be made. A number of cross-references are given to assist in this purpose. The asterisk (*) is equivalent to "Illustrated."]

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Production and Sale of Electric Current in Detroit.

By B. J. Denman.

When the Delray power station of the Detroit Edison Company was completed, about a year ago, it supplanted a number of smaller stations that furnished power for the Edison Illuminating Company of Detroit and the Peninsular Electric Light Company.

An exterior view of the Delray station is shown in Fig. 2 (on the next page). The building is a brick and steel structure, with concrete foundations. The floors and roof are of concrete, reinforced by Kahn bars. A fire wall extending transversely across the building separates the engine and boiler rooms. The switchboard, bus-bar compartment and oil switches are located on galleries on the engine-room side of the fire wall.

The plant was designed for a capacity of 12,000 kilowatts in four units of 3,000 kilowatts each (see Fig. 1), but a fifth unit is being installed, bringing the capacity up to 15,000 kilowatts.

The station is laid out on the unit plan, as shown by Fig. 3, a turbine and battery of six boilers comprising a unit, and each unit has an independent economizer, feed-water heater, feed pump and induced-draft fan.

Coal and Ash-handling Apparatus.

Coal is brought to the station by rail and taken up an incline to a trestle running through the coal tower, which is located at one corner of the boiler room. A view of the trestle and coal tower is given in Fig. 2.

The coal is shoveled or dumped into a hopper, from which it is spouted to a skip, which elevates it to a hopper located at the top of the tower. From this hopper it passes to a second hopper located below the first, either directly or through a crusher. From this second hopper the coal may be delivered directly to a third hopper located below, or to a revolving screen which delivers the screenings to the third hopper and the nut coal to the fourth hopper located on the same level as the third.

The screenings in the third hopper, or the nut coal in the fourth, is delivered to an industrial cable railway which distributes it in the concrete coal bunkers located over the boilers, separate bunkers being provided for the nut coal and the screenings.

From the bunkers it is spouted by gravity into the stokers, each spout being connected to both compartments of the bunkers, as shown by Fig. 4, which is a transverse section of one-half of the boiler room, so that by proper manipulation of the valves in the spouts, which may be done by means of chains extending to within reach of the boiler-room floor, either nut coal or screenings may be fed to the stokers.

By keeping the different grades of coal separated, and using the nut coal when required, the boilers may be forced to a considerably higher output than would be possible when using the coal as it comes from the crusher.

The ash is delivered from the stokers into concrete hoppers, as shown in Fig. 4, from which it is spouted into cars operating over an industrial railway which extends outside the basement to low ground which is being filled.

Boiler Room.

The boiler room contains 24 520-horsepower Stirling boilers, arranged in four batteries of six boilers each, each of which contains 4,834 square feet of heating surface and 2,000 square feet of superheating surface, and delivers steam at 200 pounds pressure and 250 degrees superheat.

The arrangement of the superheaters is shown in Fig. 5, the middle bank of tubes being the superheater.

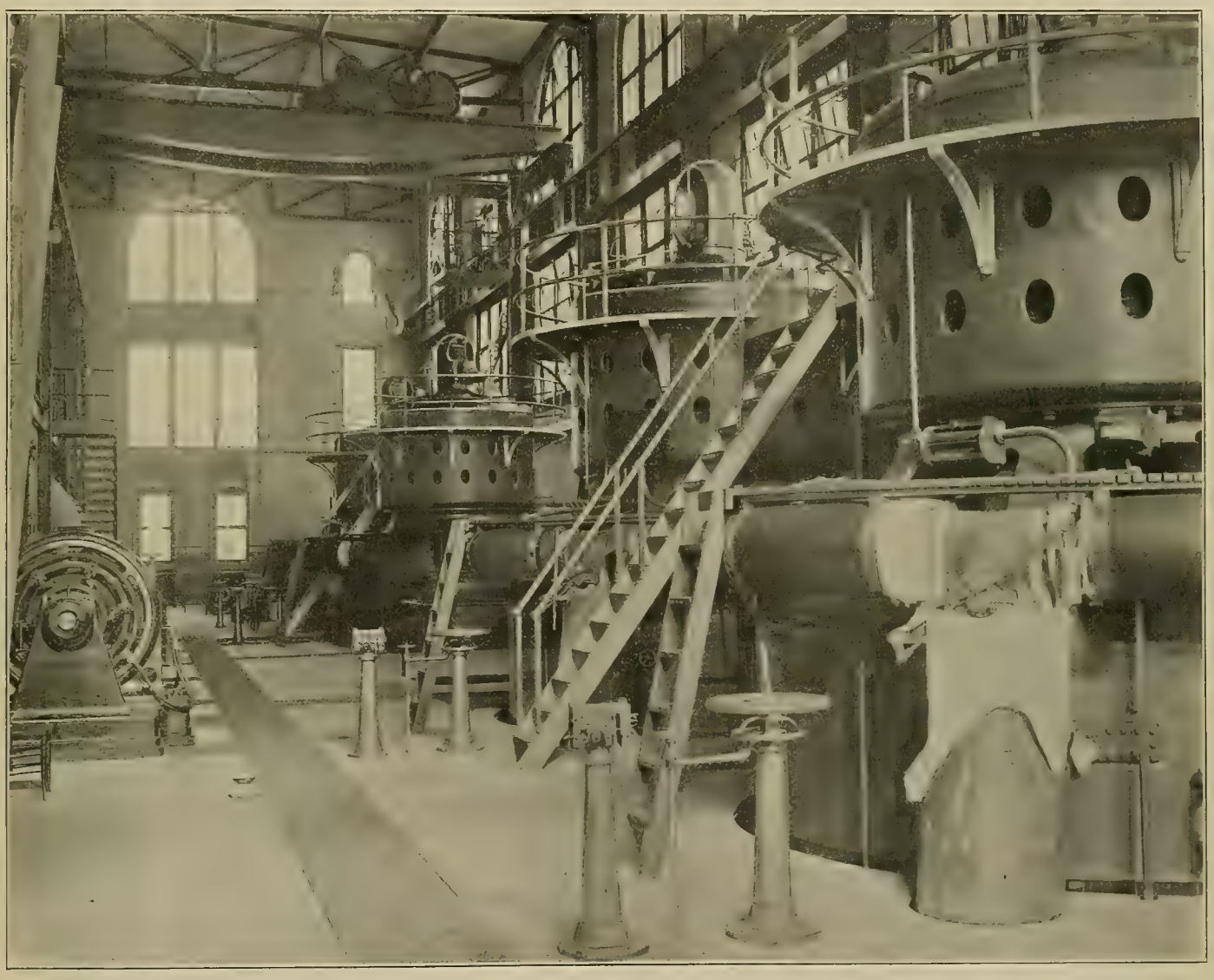


Fig. 1. View of Turbine Room in Delray Power House, Detroit.

Each boiler is provided with two Roney stokers, each having 63 square feet of grate surface giving a ratio of water heating to grate surface of 38.3 to 1. This low ratio is due to the large superheating surface contained in the boilers.

With the four turbines for which the plant was designed there are 1.13 boiler horsepower per kilowatt, but when the fifth turbine is installed there will be 0.9 boiler horsepower per kilowatt, a more usual ratio. In practice, during peak loads, each 520-horsepower boiler under steam supplies steam for 900 kilowatts output.

The unusually large boiler capacity was installed to provide the possibility of operating the plant non-condensing, it being proposed eventually to use the exhaust steam in the manufacture of salt.

The possibility of using the exhaust in this manner was one of the reasons for the location of the plant on the salt lands at Delray, together with the facts that a large tract of land could be secured; that railway facilities were good; and that, being located on the Detroit River front,

FIG. 2. EXTERIOR VIEW OF DELRAY POWER HOUSE, DETROIT, SHOWING COAL TOWER, COAL TRESTLE, PUMP HOUSE AND WATER TANKS

ample water could be obtained for condensing and feed water, and docks could be built for receiving coal by water, and for salt shipments if desired.

There are three steel stacks, two 11 by 132 feet for the outside batteries and one 16 by 132 feet for the two middle batteries. The stacks are supported on platforms over the induced-draft fans, one of which is provided for each battery.

The fans are 15 feet in diameter and are driven by Chandler & Taylor engines and operate at very low speeds, so that the amount of steam required by the fan engines is small. The flues are cross-connected at the fans, so that any one of the fans may be shut down when required.

Turbine Room.

Extending transversely across the building, as shown on the plan, the turbine room contains at present four 3,000-kilowatt four-stage Curtis steam turbines (turbo-alternators) and one 1,000-kilowatt motor-generator set, which supplies current to the Detroit United Railway. A cross-section of the turbine room is shown in Fig. 6, and an interior view in Fig. 1.

A fifth turbine is being installed at the opposite end of the room from the motor generator set.

The four alternators forming parts of the four turbo-generators now in service are 12-pole machines operating at a speed of 600 revolutions per minute and generate 60-cycle three-phase current at a pressure of 4,600 volts. The new turbine will operate at a speed of 720 revolutions per minute and will have the condenser in the base.

There is an extension of the turbine room at one end through which a track runs and over which runs the 35-ton crane spanning the turbine room, so that the machinery may be unloaded by the crane directly from the cars.

The turbine room is unusually well lighted by large windows on three sides. The artificial lighting is by Nernst lamps. The room is faced with light pressed brick, with a wainscoting of dark enameled brick.

At the center of the room is a hydraulic accumulator, which, in connection with two duplex pumps, 12 by 3¼ by 15 inches, and four electric-driven pumps, 1½ by six inches, driven by five-horsepower direct-current motors, maintains a pressure of about 800 pounds per square inch on the step bearings. The electric pumps are held in reserve.

There are two motor-driven exciter sets in the turbine room, each consisting of a 75-horsepower three-phase induction motor, direct-connected to a 50-kilowatt 125-volt generator.

A storage battery, made by the Electric Storage Battery Company, with a capacity of 556 amperes at the one-hour rate, 429 amperes at the 1½-hour rate and 140 amperes at the eight-hour rate, floats on the exciter system.

The turbine room also contains a 300-volt 450-ampere railway booster driven by a 550-volt motor.

The condenser room extends parallel with the turbine room, as shown in Figs. 3 and 6, and contains four Wheeler surface condensers, with Edwards air pumps. The condenser room is only one story high.

Piping and Auxiliaries.

As shown in Figs. 2 and 3, the pump house is a separate building, and contains four 18-inch Wheeler centrifugal circulating pumps, direct-connected to 75-horsepower three-phase motors, and two eight-inch Worthington centrifugal pumps direct-connected to 60-horsepower three-phase motors, for supplying feed water.

The pump house is located near the river, and a short intake canal extends underneath it. The water enters through a trash rack and two screens arranged in series located near the center of the pump house. Either screen may be removed for cleaning. The pumps are located about seven feet above the level of the water, in which there is a maximum variation of only four feet. The discharge lines from the circulating pumps extend underground to the condenser house, and the discharge from the condensers is sealed in the discharge canal, which extends lengthwise below the condenser room, as shown in Fig. 6.

The air pumps discharge into a hot well located just outside the pump house, from which the two eight-inch pumps take their suction.

The hot well is connected with the intake through a large swing check valve, so that the make-up water is automatically supplied and the level of the water in the hot well maintained constant.

Each of the eight-inch centrifugal pumps has an eight-inch discharge line, cross-connected, extending the full length of the building and then running across the fan-room basement below the heaters. Just outside the pump house these lines are connected to two elevated tanks, shown in Fig. 2, with a combined capacity of 75,000 gallons, for use in an emergency or in case of a total shutdown.

Each battery of boilers is provided with a 5,000-horsepower Cochrane open feed-water heater which receives the exhaust from feed pumps, fan and stoker engines.

Steam-driven auxiliaries will be provided for the

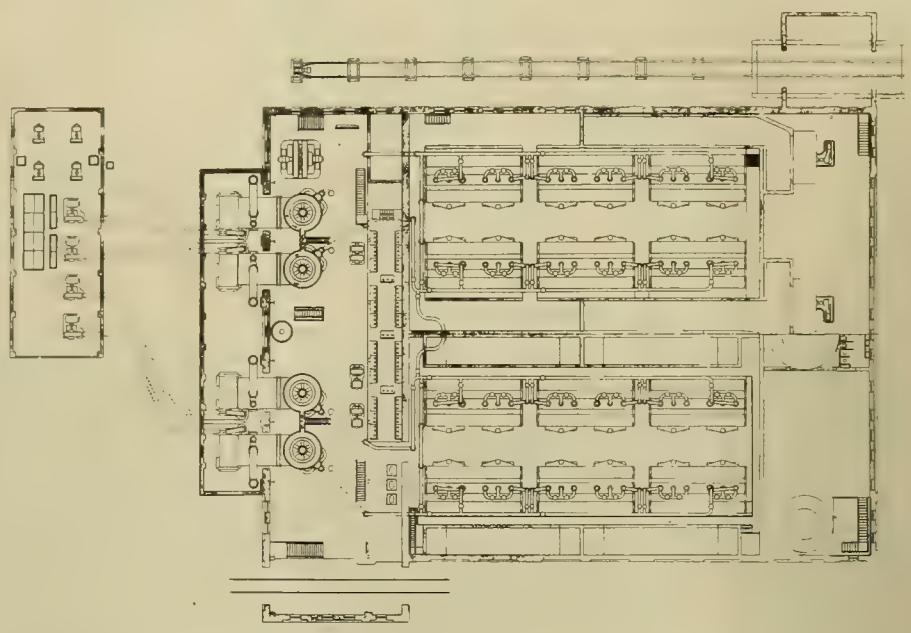


FIG. 3. PLAN OF DELRAY POWER STATION AND PUMP HOUSE.

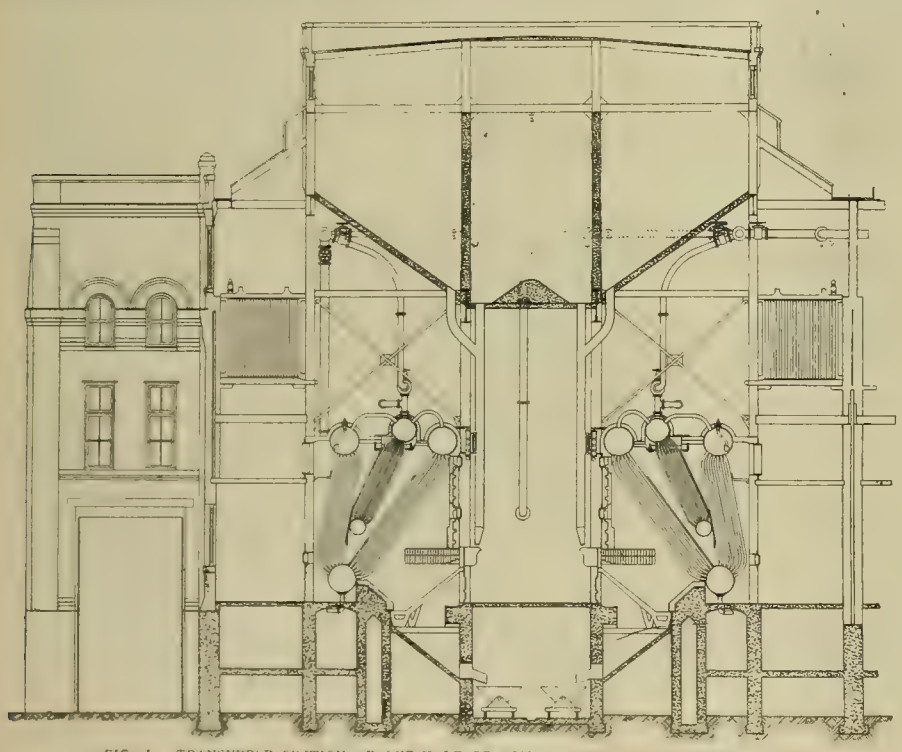


FIG. 4. TRANSVERSE SECTION OF ONE-HALF OF BOILER ROOM, DELRAY POWER HOUSE.

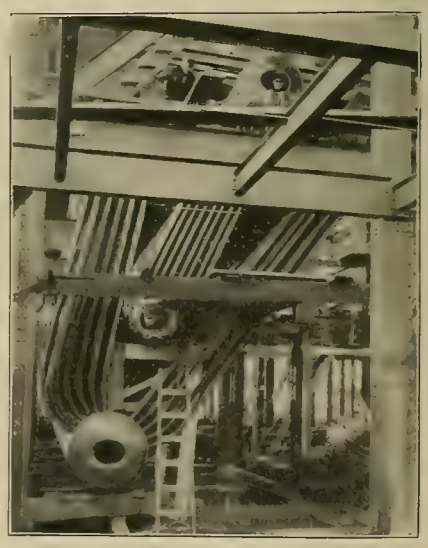


FIG. 5. BOILERS AT DELRAY POWER HOUSE DURING CONSTRUCTION, SHOWING ARRANGEMENT OF SUPERHEATER.

new turbine, so that the temperature of the feed water leaving the heaters will be higher.

From the heaters the water flows by gravity to the 12 and 18 by 8½ by 18 Worthington compound duplex boiler-feed pumps, which are outside-end-packed pumps with rolling valves.

The heaters are cross-connected, so that any one may be cut out for cleaning, and they are also by-passed, so that the pumps may take their suction directly from the hot-well line.

Each battery has a duplicate feed line, cross-connected, extending to the economizers, and from the economizers to the boilers, and so arranged that any economizer may be by-passed.

There are two Green economizers for each battery of boilers. The economizers raise the feed water from 95 degrees to 240 degrees and reduce the temperature of the flue gases from 500 degrees to 250 degrees.

The effect of the economizers on reducing the volume of the flue gases and increasing the capacity of the induced-draft fans is obvious.

In addition to the duplicate feed mains, each boiler is provided with a Penberthy injector, with suction connected to the lines supplying the heaters, so that the suction is under pressure.

On account of the division of the plant into units, the steam piping is unusually simple, as will be seen by reference to Figs. 3, 4 and 6.

Each boiler delivers steam through an eight-inch boiler branch, which rises with long-radius bends and connects with the 12-inch steam main running to the turbines. These mains are cross-connected on the boiler-room side of the fire wall by U-bends.

After passing through the fire wall the mains drop below the turbine-room floor and extend below the floor to the turbines, where they rise and branch to the nozzle casings on either side of the turbines. The throttle valves are located below the floor and are motor-operated, with hand-operated by-passes.

The floor-stands for operating the main and by-pass valves by hand and the switch for controlling the throttle motor are shown in Fig. 1. This also shows the automatic speed-limiting device, which closes when any desired speed is exceeded.

The gaskets in the superheated steam mains are corrugated copper and corrugated iron, the corrugated-iron gaskets giving the best service.

On account of the height of the steam mains above the boilers and the use of superheated steam, the only provision for removing condensation is a Bundy trap, located at each turbine.

The auxiliaries are supplied with steam through a 200-pound saturated-steam line, which is connected to the boilers in such a manner that there is no possibility of the auxiliaries receiving superheated steam.

The exhaust passes to the condensers through short rectangular exhaust passages, which have copper expansion joints. There is a 24-inch galvanized-iron atmospheric exhaust for each machine, extending to the roof and terminating in an exhaust head, as shown in Figs. 2 and 6. A combination relief and back-pressure valve is provided, the back-pressure feature being necessary if the plant should be operated non-condensing in connection with the manufacture of salt.

The condensers were made by the Wheeler Condenser and Engineering Company, and the air pumps are Edwards triplex pumps, geared to 50-horsepower three-phase induction motors.

Switchboard.

The switchboard is located on the engine-room side of the fire wall, on galleries, the controlling board being on the third floor, from which the operator has a view of the entire engine room;

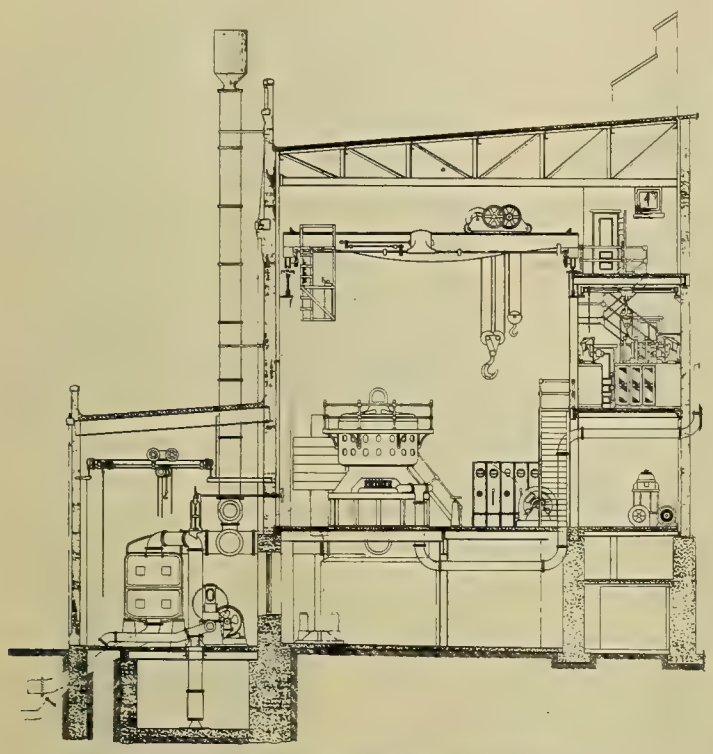


Fig. 6. Cross-section of Turbine and Condenser Room.

Fig. 8. Controling Board and Switches.

DELRAY POWER HOUSE OF THE DETROIT EDISON COMPANY.

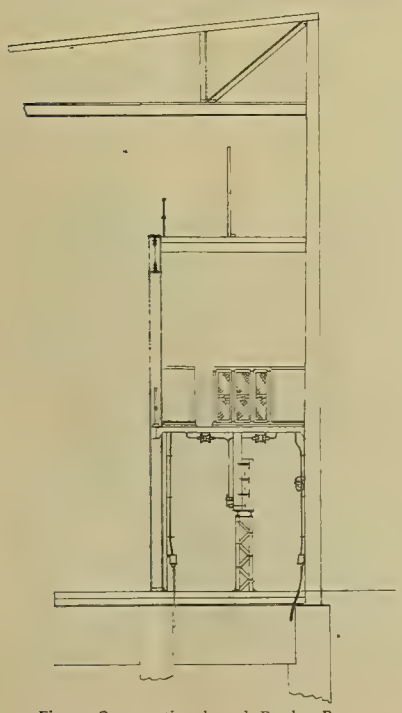


Fig. 7. Cross-section through Bus-bar Room.

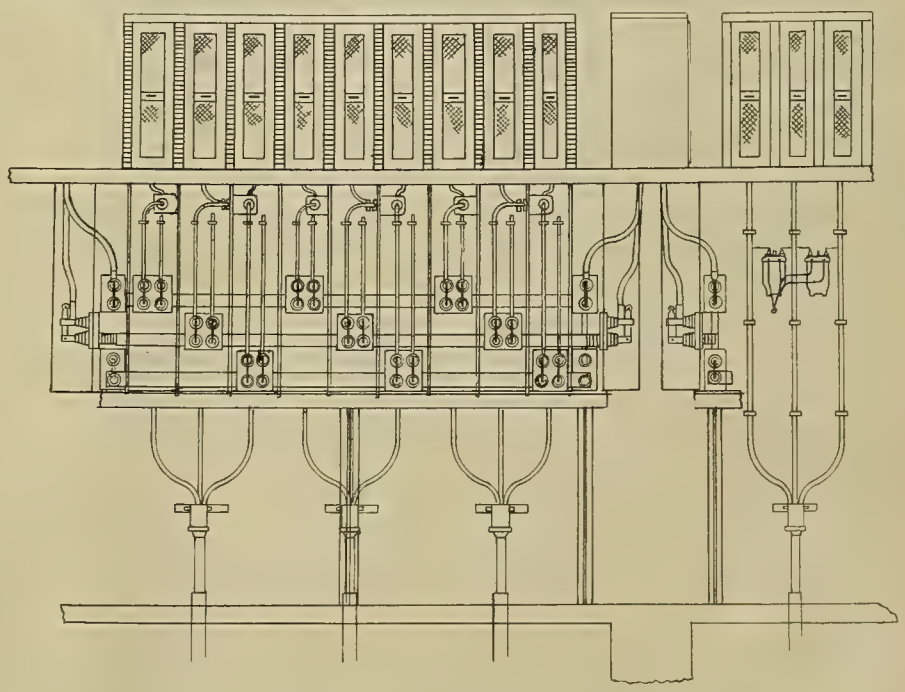


Fig. 9. Longitudinal Section through Part of Bus-bar Room.

DELRAY POWER HOUSE OF THE DETROIT EDISON COMPANY.

the oil switches are on the second floor, and the bus-bar room on the first.

The leads from the turbine extend up the wall of the bus-bar room to the oil switches located on the second gallery, then from the oil switches along the ceiling of the bus-bar room to the bus-bar compartment, which is supported on latticed columns in the center of the bus-bar room, as shown in Fig. 7.

The arrangement of the oil switches is shown in Figs. 3 and 8, there being a group of six switches for each turbine, one machine and five feeder switches.

All these switches connect with the bus-bars, and there are three bus-sectionalizing switches arranged at right angles to the switches in each group, by means of which the bus-bars may be divided into sections, one for each turbine, if desired.

Fig. 9 shows the method of connecting the bus-bar sectionalizing switches. The outgoing feeders or trunk lines are connected like the machine leads, each line extending from the bus-bar compartment to the ceiling, thence to the oil switches above, and thence down the wall to the pot-heads. Part of the trunk lines are on one side of the room and part on the other.

All the machine leads and trunk lines are provided with disconnecting knife switches, so that the oil switches may be entirely disconnected when necessary.

Soapstone barriers separate the different phases where they enter the bus-bar compartments.

Twenty feeder panels, three exciter panels and four machine panels make up the controlling board.

Each feeder panel has two indicating wattmeters, one ammeter and a controlling switch for operating the oil switches, with their pilot lamps, and on the rear of the panel two recording wattmeters and overload relays, with time limit, for controlling oil switches.

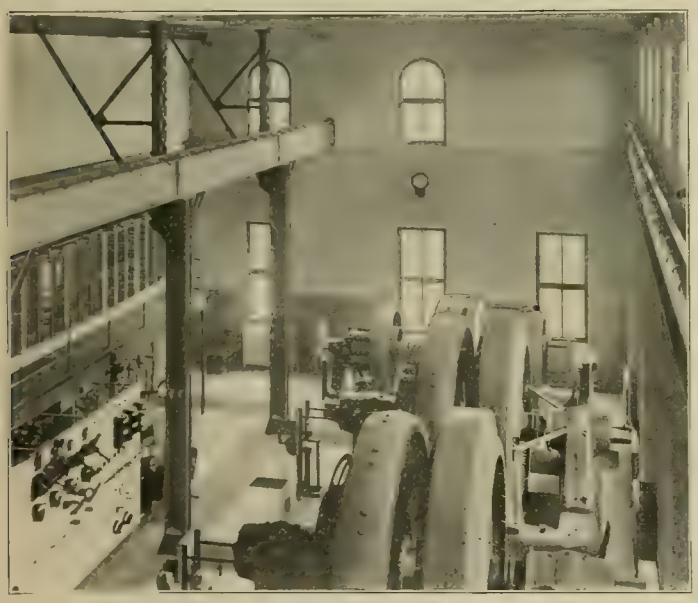


FIG. 11. GENERAL INTERIOR VIEW OF SUB-STATION I.

Each machine panel has a frequency indicator, voltmeter, ammeter, field ammeter, rheostat, two indicating wattmeters, controlling switch and pilot lamps, a switch for controlling the motor on the turbine governors, and two recording wattmeters on the rear of the panel.

The three exciter panels are equipped with a reverse-current circuit-breaker, ammeter, rheostat and balance indicator.

At the end of the board, on a swinging bracket, is a synchronizer and double-scale ammeter for indicating charge or discharge of battery.

The storage battery is located on the third floor of the gallery, and the switchboard for controlling it is located just outside the battery room.

There is a frequency indicator on each turbine.

All instruments on the controlling board are of the horizontal edgewise type.

The switchboard for controlling the direct-current side of the 1,000-kilowatt motor-generator is located on the main floor, as shown in Fig. 6, and consists of one machine panel, one meter panel and four feeder panels, all standard railway panels.

Sub-stations.

There are at present 13 trunk lines running to the various sub-stations, the scheme being to have a separate trunk line for 1,000 kilowatts of normal load.

In addition to the trunk lines, the sub-stations are connected by tie lines, so that the possibilities of shutdowns due to feeder troubles are remote.

The capacities of the various sub-stations are as follows:

A	3	1,000-K.W. two-unit sets
	2	230-K.W. three-unit sets
B	1	500 K.W. three-unit set.
	1	400-K.W. two-unit set.
	1	250-K.W. three-unit set.
	2	600-K.W. D.C. engine-driven.
	1	300-K.W. A.C. engine-driven.
C	2	500 K.W. two-unit, 600-volt.
	2	1,600-K.W. three-phase transformers.
D	1	75-K.W. two-unit set.
	3	330-K.W. single-phase transformers.
E		Storage battery, 11,000 amp.-hours at one-hour rate.
F	1	1,000-K.W. two-unit set
	1	450-K.W. three-unit set.
G		Not completed.
H	1	500-K.W. three-unit set.
	1	150-K.W. three-unit set.
I	2	1,000-K.W. two-unit sets.
	1	450-K.W. three-unit set.
J	3	225-K.W. two-unit sets.
K	1	500-K.W. three-unit set.
	2	150-K.W. two-unit sets.
L	3	1,600-K.W. three-phase transformers.
Highland Park	2	500-K.W. two-unit, 600-volt.
	3	330-K.W. single-phase transformers.
Grosse Pointe	3	50-K.W. three-phase transformers.
	2	35-H.P. induction motors.
	1	125-H.P. induction motor.

The motor-generator sets listed above as a rule have synchronous motors and are started from the direct-current side. This use of synchronous motors gives perfect control of the power factor of the load on power house and trunk lines.

At least one motor-generator set in each station has either an induction motor or a "synchronous-induction" motor, to avoid delay in starting in case direct-current starting should be impossible. The "synchronous-induction" motor is not as well known as the other types. It has a squirrel-cage winding on the revolving field, in addition to the regular field winding. As this winding is used only in starting, it has a high resistance, to give good starting torque.

The machine is started with a compensator as an induction motor. It comes up rapidly to speed, and when near synchronism the field switch is closed and the machine goes into step without synchronizing.

Station I, views of which are shown in Figs. 10 and 11, contains two 1,000-kilowatt two-unit and one 450-kilowatt three-unit motor-generators, and is a typical sub-station. There is room for two additional 1,000-kilowatt units.

The switchboard here consists of four direct-current feeder panels, one bus-connecting panel, two blank direct-current machine panels, two 1,000-kilowatt direct-current machine panels, two 250-kilowatt direct-current machine panels, two blank alternating-current machine panels, two 1,000-kilowatt alternating-current machine panels and one 500-kilowatt alternating-current machine panel, with a synchronizer and voltmeter on a swinging bracket.

The oil switches are located above and to the rear of the switchboard, with the alternating-current bus-bars below them. The alternating-current bus-bars are not continuous, being in three sections, one for each machine, with a machine, trunk line and tie-line switch for each section, the unit plan being carried out in feeders and sub-stations as well as in the power house.

FIG. 10. EXTERIOR VIEW OF SUB-STATION I, DETROIT.

The three oil switches for each section are controlled by three controlling switches on each machine panel.

The different sections of the alternating-current bus-bars may be connected by means of flexible jumpers. The station is served by a traveling crane, having hand-power traverses and motor-power hoist.

Commercial Department.

During the last year the company has been waging an aggressive new-business campaign, the results of which are apparent by an inspection of the load curves for the corresponding days in 1905 and 1906, in Fig. 12.

The increase in the output is 79 per cent. and in the maximum 63 per cent. The increase in the load factor is due to the large power and railway load which has been secured. The effect of this is shown in the day load, which has more than doubled.

The total increase in the connected power load during the last year is 4,154 horsepower, the total connected-motor load being 11,071 horsepower.

Detroit is the center of the automobile industry, and of the 15 plants in the city 13 are operated by the company.

Although the power business has been actively

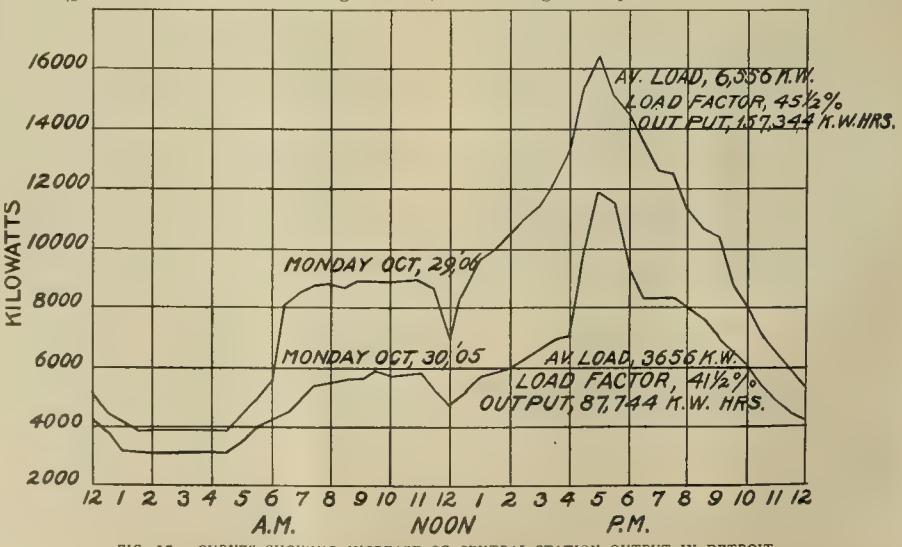


FIG. 12. CURVES SHOWING INCREASE OF CENTRAL-STATION OUTPUT IN DETROIT.

pushed, commercial and residence-lighting business has been equally successful, there being an increase of 82,313 16-candlepower lamps, 391 arcs and 534 three-glower Nernsts.

The total connected load in lamps and motors is 564,831 16-candlepower equivalents, and the increase during the last year 150,727 16-candlepower equivalents.

The two forms of agreement for power supply offered are known as the "open-order" and the "energy contract." The "open-order" agreement may be discontinued at any time, and the rate is four cents per kilowatt-hour, with discounts for prompt payment of five per cent. up to $100 per month and 10 per cent. for the excess over $100 per month, with a minimum of $1 per horsepower and a maximum minimum of $10 per month.

Under the "energy contract" there is a fixed charge of $4.50 per kilowatt of demand, and an additional charge of one cent per kilowatt-hour for all current used, with the same discount as on the "open-order" business.

With a consumption equivalent to the use of the maximum demand 10 hours per day and 25 days per month, the resultant rate under this contract is 2.66 cents per kilowatt-hour, and for 20 hours' use per day 1.81 cents per kilowatt-hour.

For customers agreeing to conform to a schedule which keeps them off the peak, this same contract is modified and called a "limited-service contract," with a charge of $3 per month per kilowatt of demand, and one cent per kilowatt-hour for current used, with same discounts.

With a consumption equivalent to eight hours' use of the maximum per day, 25 days per month, the rate under this contract is 2.38 cents per kilowatt-hour, and for 16 hours use of the maximum per day 1.67 cents per kilowatt-hour.

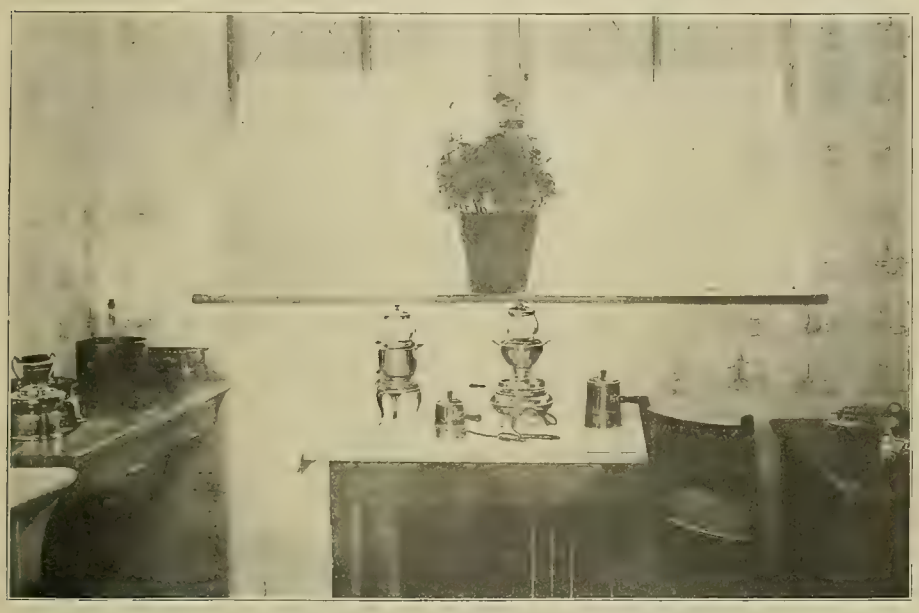


FIG. 13. ELECTRIC KITCHEN IN THE CONTRACT DEPARTMENT OF THE DETROIT EDISON COMPANY.

FIG. 14. REST ROOM IN CONTRACT DEPARTMENT OF DETROIT EDISON COMPANY.

For power the demand is ascertained by periodical wattmeter tests.

Elevator-service demands are based on the motor ratings, and vary from one-half the rating for one elevator to one-quarter for 10 elevators supplied through the same meter.

The minimum bill for the "energy contract" is $4.50 per month per kilowatt of demand, and for the limited service $3. These contracts are written for three years, with the privilege of discounting them on the 15th of October of any year.

For commercial lighting, the form of contract called a "demand agreement" is used, under which contract the company furnishes free lamp renewals; also furnishes and maintains arc and Nernst lamps.

With this contract the rate is 16 cents per kilowatt-hour for the first 30 hours use per month of the maximum demand and four cents per kilowatt-hour for any excess, with discounts of 10 per cent. on bills less than $50 per month, 15 per cent. on bills $50 and less than $100, and 20 per cent. on bills $100 or over. The minimum bill is 30 hours use of the maximum demand at 16 cents per kilowatt-hour. This contract is written for one year. Demands are ascertained by demand indicators.

With a consumption equivalent to six hours use per day of the maximum demand, the rate under this contract is 4.8 cents per kilowatt-hour.

For residence lighting, an open order is accepted, with a rate of 16 cents per kilowatt-hour for the first two kilowatt-hours per month per room and four cents per kilowatt-hour for any excess, with discounts of 10 per cent. for bills under $50 and 15 per cent. on bills of $50 or more.

Two kilowatt-hours per room per month is equivalent to 40 hours use per room per month of one 16-candlepower lamp.

In reckoning rooms in residences, the halls, stairways, servants' rooms, kitchen, pantry, bathroom, porch, vestibule and barn are omitted from the count, the intent being to reckon family and guest rooms only. The minimum bill is 50 cents per month.

For throw-over or "breakdown" service, a time-differential contract is used, with a rate of 16 cents per kilowatt-hour for all current used between 1 p. m. and 6:30 p. m. and four cents per kilowatt-hour at all other times, with a minimum of $1 per kilowatt per month up to 25 kilowatts.

No contracts are written except those outlined above, and no special contracts are taken.

In the contract department, in addition to the general contract agent and an office force of six, there are 10 solicitors, of whom four are commercial engineers, devoting their time to power and the larger lighting deals.

The lighting solicitors work in districts, but the district lines are not sharply drawn.

The entire lower floor of the office building is occupied by the contract department. Adjoining the main office is a large display room where all types of lamps and heating appliances may be seen. There is a glass-cased meter connected to a bank of lamps, so customers may observe the operation of the meter.

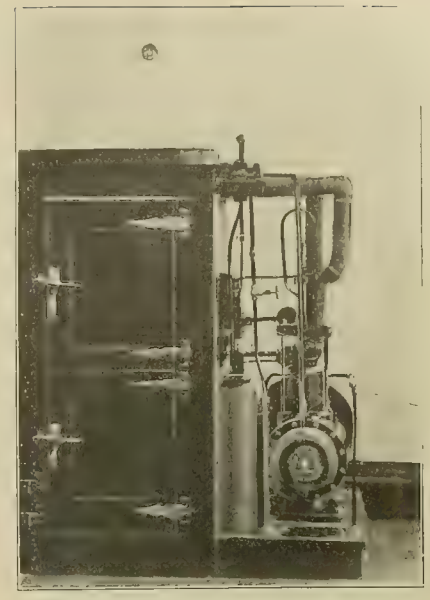


FIG. 15. ELECTRICALLY DRIVEN REFRIGERATING MACHINE IN CONTRACT DEPARTMENT OF DETROIT EDISON COMPANY.

The display room also contains a refrigerating machine, sewing machine, washing machine, motor-generator set for charging storage batteries, etc.

Opening from the display room on one side is a rest room and on the other side a completely equipped electric kitchen, where all kinds of cooking and heating appliances may be seen in operation.

A series of lectures in cooking by electricity was recently given which attracted much attention.

Views of the display room and kitchen are given in Figs. 13, 14 and 15.

The principal advertising mediums used are newspapers and billboards.

Large attractive newspaper advertisements are used daily and copy changed weekly. The newspaper advertising is concentrated on selected specialties.

The billboards are lighted by incandescent lamps at night. A view of one of these boards is shown in Fig. 16.

The distribution in the business district is by means of direct current, both for light and power.

The manufacturing districts not reached by direct current are served by three-phase 60-cycle power lines, which form a belt around the city and from which branches are run where necessary.

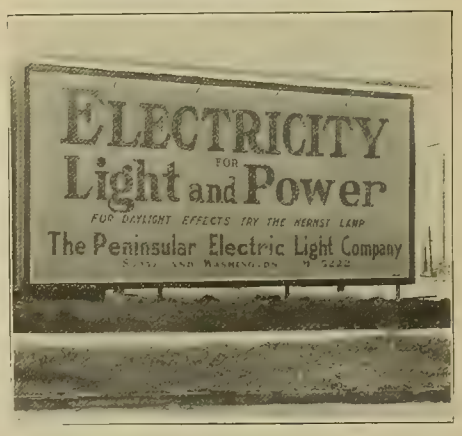


FIG. 16. BILLBOARD ADVERTISING ELECTRICITY IN DETROIT.

In districts served only by single-phase lighting circuits, single-phase motors are used, the practice being to provide a separate transformer capacity for motors at the rate of one kilowatt per horsepower. Motors of less than five horsepower, located very close to the transformers, are occasionally connected to lighting secondaries.

ORGANIZATION.

The Detroit Edison Company sells current wholesale only, at the switchboard, the only customers being the Edison Illuminating Company, which distributes direct current, the Peninsular Electric Light Company, which distributes alternating current, the Solvay Process Company, with a load of 500 kilowatts, and the Detroit United Railway, with a load of 3,000 kilowatts.

ELECTRICAL PROGRESS IN UNITED STATES IN 1906.

By Henry H. Norris.

EACH year the field of electrical engineering application becomes more expanded; each section of it represents a higher degree of specialization; and the individual engineer finds increasingly difficult the task of keeping in touch with his fellow-workers. For these reasons the completion of the United Engineering Building, in New York city, with accommodations for the several engineering societies under one roof, is a

THE NEW ENGINEERS' BUILDING IN NEW YORK CITY

cause for general congratulation. Not only will the many sections of the electrical field be united, but the intimate relation existing among all branches of engineering will be emphasized. It is estimated that the membership tributary to the societies which will use the building numbers not less than 20,000. The structure is well adapted to its purpose, both in dignity of appearance and convenience of arrangement. The cost has been $1,050,000 for the building and $500,000 for the site, the former sum having been given by Mr. Carnegie, the latter being the joint gift of the three societies forming the United Engineering Society. The three societies have been successful in raising their apportionments, and it is probable that the building and site will be dedicated in April free from debt. A visit to the building is an inspiration to any engineer, as he contemplates the possibilities of the enterprise. The Union Library for study, the splendid auditoriums for meetings, the ample office room for routine work and the convenient lobbies for small group conversations all unite to form an ideal center for engineering activity.

Work of the Institute.

Whatever may be the effect of the new environment upon the work of the American Institute of Electrical Engineers, there is no cause for regret in regard to the work of 1906. The membership continues to expand at a healthy rate, the numbers on December 1st being 528 members, 3,602 associates and 625 enrolled students. The papers and discussion have been of excellent quality and quantity. A remarkable feature has been the expansion of the branches, now numbering 16 in cities and 16 connected with colleges. The branches are doing a great work, and everything is being done to strengthen and encourage them and at the same time keep them within the control of the parent organization. Other improvements have been made, and in a constantly increasing degree the Institute is becoming a body representing the entire electrical interests of this country.

Electric Lighting.

The improvement in efficiency in light production which is promised by recent types of incandescent and luminescent lamps must soon result in a radical change in lighting methods. These developments consist in the elimination of the faults of existing forms of arc and incandescent lamps, and in the use of (1) more refractory materials as incandescent-light sources and (2) substances possessing the property of selective radiation.

Tantalum and tungsten-filament incandescent lamps have received a large share of attention during the last year. The former is now well developed and may be obtained in any desired quantities in this country. The filaments are well adapted to use with direct current, but it now appears that they disintegrate rapidly when supplied with alternating current, particularly at the frequency ordinarily available on lighting circuits. This fact limits the field of the tantalum lamp to isolated plants and to the congested districts in large cities. The metal tungsten possesses the same desirable properties as tantalum, and, in addition, is not affected by the variety of current furnished. While not yet available for commercial purposes in America, it is being marketed in Europe, and undoubtedly our lamp manufacturers will soon be equipped to meet the demand which is sure to develop.

The tungsten lamp under test has shown remarkable efficiency and durability. A useful life of over 1,000 hours and a power consumption of less than 1.2 watts per mean horizontal candlepower have already been obtained. The lamp as sold abroad bring a price of four or more times that of the carbon-filament lamp, but with a smaller current-consumption bill a customer can well afford the extra cost.

Tungsten filaments cannot be drawn as arc those of tantalum, but by a rather roundabout process an apparently excellent wire is produced. This wire must be made of small diameter in tantalum, tungsten and all other lamps using metallic filaments, on account of the low specific resistance. The result is a long, slender wire somewhat difficult to support; and even when made as small as practicable the resistance is still so low that the power drawn at standard pressures produces a large candlepower. The metals possess one great advantage over carbon in their positive temperature coefficients, which make them less sensitive to changes in the line pressure.

Although attracting less attention than tungsten and tantalum, the "metallized" carbon-filament lamp is now a commercial article, produced in a number of factories. Its use results in a fair increase in life and efficiency, and the lamp occupies a position between the old and the new forms.

MACHINE SHOP LIGHTED BY VACUUM-TUBE SYSTEM.

This lamp and the preceding ones owe their excellence to their high temperature, and the effect is one of incandescence. The limit of this progress in increasing temperature is soon reached, and further development must be expected from substances possessing the property of selective radiation. The best known of these is mercury vapor, which is now a well-established commercial source of light. Another example is low pressure gas in the Moore vacuum tube, recently developed commercially and now being installed upon a large scale. This tube has an efficiency somewhat better than the present types of incandescent lamp, and it has also a low luminous intensity. For the latter reason the tube must be quite long, in order to give sufficient light, but excellent illumination is produced, and the effect upon the eye is not distressing. As it is possible to color the light by the use of different gases, it may be adapted to different service conditions. From the information now available it appears that a long life of the tubes may reasonably be expected.

For the lighting of interiors and locations where distribution of light is important, the incandescent lamp still remains the popular form of light source. The arc lamp, with increasing intrinsic brilliancy, is confined to a more limited field, that of the efficient lighting of large areas. The past year has witnessed the rapid introduction of the flaming arcs for outdoor lighting, with at least five times the light output of the ordinary carbon arc consuming the same power. The addition to the carbons of substances capable of becoming luminescent has brought about this result.

If quantity were the only desirable feature of light production, the flaming arc would be ideal, but an important problem in illumination is the transmission and distribution of light in addition to its production. This is difficult when several thousand candlepower is produced at a point. The flaming arcs also give off fumes, and they require frequent trimming. They, however, mark the most important recent advance in electric arc lighting.

Power Generation and Transmission.

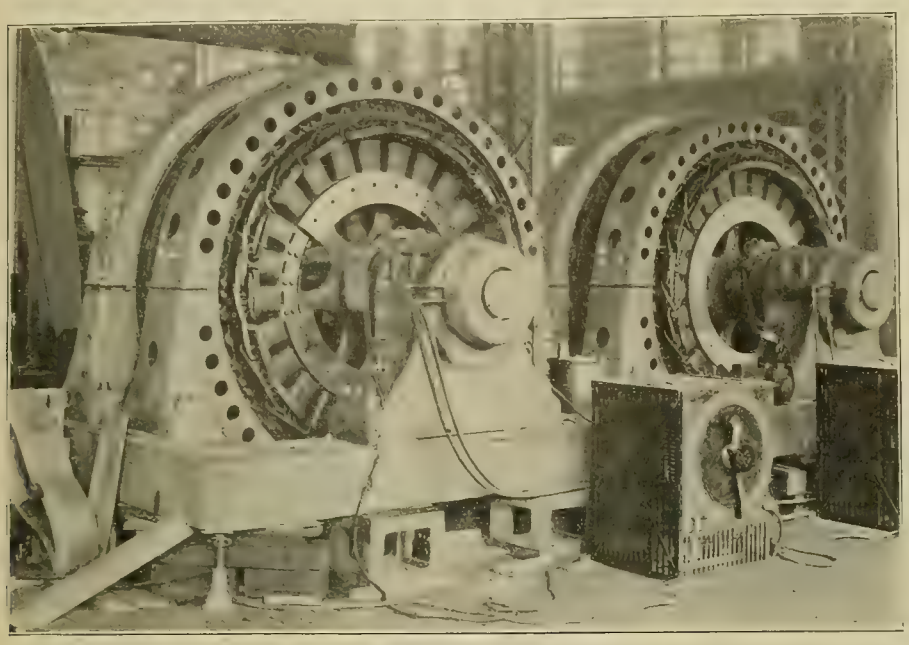
In power plants the tendency toward larger sizes of units continues without much diminution. There appears to be no limit to this increase. The new large prime-mover units are principally steam turbines, which are especially well adapted to the generation of large power outputs. A dozen 8,000-kilowatt Curtis turbines have been under construction this year, and four are in operation. These great engines will be used by the Edison lighting companies in Chicago, New York and elsewhere.

Several excellent makes of steam turbines are now in use, and the demand for them exceeds the capacity of the plants. Mere bigness, however, is not the most significant feature of turbine development, as the arguments advanced for their use in large units apply also to the smaller sizes. The De Laval turbine in small sizes has been popular for a long time, and now the other types are being constructed in units from 15 kilowatts capacity upward. The speed of these is moderate, so that they can be direct-connected to direct-current generators.

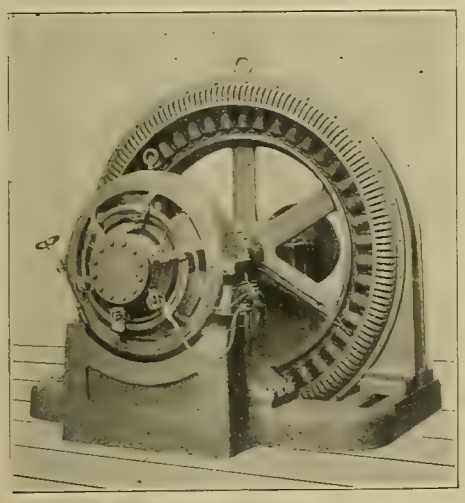
An interesting application of the steam turbine has been made during the year in the station of the Scranton (Pa.) Railway Company. A 500-kilowatt turbo-generator unit draws steam from the exhaust of the reciprocating engines through a standpipe open to the atmosphere. The turbine unit delivers direct current to the trolley system, the load being adjusted to consume as nearly as possible all of the reciprocating-engine exhaust. This virtually adds another cylinder to the engines

and is in accord with suggestions that have been published within the last two years.

The steam turbine has forced new requirements upon the designers of alternators, particularly in regard to the mechanical strength of the rotating field magnet. Under the strains produced by centrifugal forces it has been difficult to support and insulate the coils. A radical step has been taken by the General Electric Company in the use of a distributed field winding, the coils being placed in slots like those of an armature. It is thus possible to provide for the better support of the coils, which are in smaller sections. The turbine has also brought forward the unipolar direct-current generator, which has been the hobby of inventors for decades. The high peripheral speed of the turbine permits the generation of a large direct electromotive force without the use of commutators, thus eliminating the most troublesome feature of the machines. The unipolar generator is now being built in 50, 500 and 2,000-kilowatt sizes, producing from 300 to 600 volts.



SYNCHRONOUS MOTOR-GENERATOR SET WITH A DIRECT-CURRENT OUTPUT OF 1,500 KILOWATTS.



A NEW ALTERNATOR WITH DIRECT-CONNECTED EXCITER.

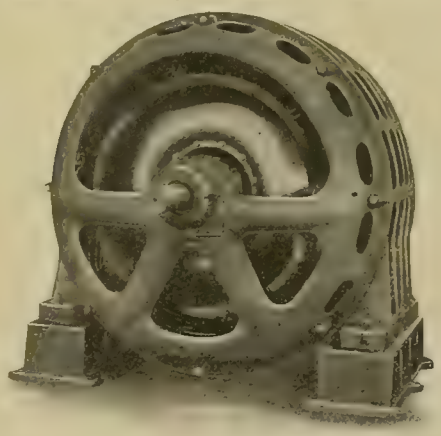
While turbo-generators are the most novel, there is still a great demand for the slower speed types, particularly for electrolytic work and for use in motor-generator sets. The Allis-Chalmers Company has installed in the power stations of the illuminating companies sets of 1,000 kilowatts and more for the purpose of helping over the peaks of the load. Without these sets it would be necessary to provide both alternating-current and direct-current generator capacity for the heaviest load on each. The motor-generators permit one set of generating units to help out the other.

A new field for the slow-speed generator is furnished by the increasing interest in gas engines. In last year's review attention was called to the 4,000-kilowatt gas engines coupled to Crocker-Wheeler generators in San Francisco. These went through the earthquake and fire safely, through a fortunate accident by which the walls of the building fell away from the machines. During 1906 the Boston Elevated Railway Company has installed two gas-engine sub-stations, and progress has been made in reliability and durability.

A most natural place for the gas engine is in steel mills where blast-furnace gas is available as fuel. Now that reliable engines are obtainable, the business in this field is rapidly increasing. The Allis-Chalmers Company alone has under construction 30,000 kilowatts of engine-generators for the purpose, and other manufacturers are proportionally busy. The induction motor is the connecting link between the rolls and the generators, and this particular application has forced during the past year the design of a 6,000-horsepower induction motor now under construction by the General Electric Company for the Indiana Steel Company.

A good evidence of the increasing use of alternating-current machinery is the number of companies now in this field. In addition to the Westinghouse and other companies mentioned, which have been producing alternators and induction motors for many years, there are now the Western Electric, Fort Wayne, Crocker-Wheeler and others with well-developed lines. The designs are more or less standard with all manufacturers, and these have improved remarkably. The induction motor of to-day is a compact, well-ventilated, efficient and cheap machine, and it is being produced in great quantities and in all sizes.

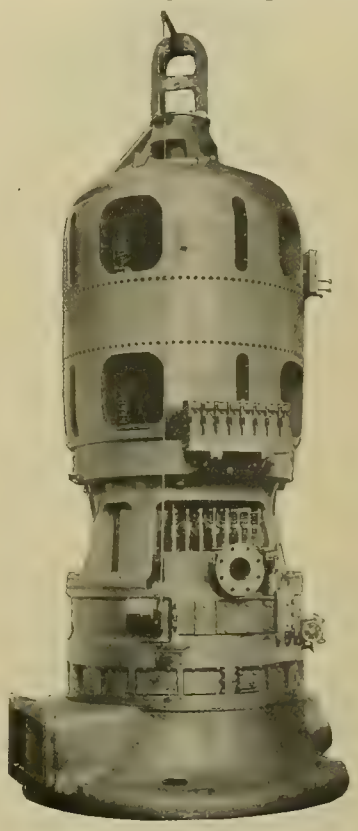
A few years ago a 500-kilowatt transformer was considered very large. Last year the General Electric Company constructed a number of 7,500-kilowatts capacity each, thereby breaking the record for size These are owned by the Great Northern Power Company and are designed to raise the pressure from 6,000 or 12,000 volts to 30,000 or 60,000 volts for transmission. The Stanley company also produced a remarkable type of transformer for the Pittsburg Reduction Company. The output, 2,000 to 4,000 kilowatts, is not in itself a claim to distinction, but the fact that the secondary delivers 80,000 amperes at from 25 to 50 volts shows what is possible in keeping down heat losses with very large currents.



INDUCTION MOTOR OF 800 HORSEPOWER FOR NEW YORK FIRE SERVICE.

Coupled with the demand for larger transformers is that for higher pressure. The insulation problem is therefore receiving the closest attention. A patent recently granted to Prof. H. J. Ryan and assigned to the Westinghouse Electric and Manufacturing Company indicates one way in which insulation may be improved. The transformer is enclosed in an air-tight case, and air at a high pressure is admitted above the oil. The pressure improves the dielectric strength of the air above the oil, and it also improves that of the oil itself by eliminating the effect of the air in and under it. It is said that at a pressure that can be easily maintained, say 40 atmospheres, the dielectric strength of air is equal to that of the best of other insulators.

Progress in power generation and utilization necessitates improved transmission. Hence, the present large number of projects and actual transmissions, particularly near waterpower sites, represent a logical development. During the year the traditional 60,000-volt pressure limit has been exceeded on the Grand Rapids-Muskegon line. After operation at 66,000 volts for six months, the pressure was raised to 69,000 volts, at which it is now successfully operating.



UNIPOLAR GENERATOR OF 500 KILOWATTS RATED CAPACITY FOR FULL-LOAD OPERATION AT 50 TO 600 VOLTS INCLUSIVE.

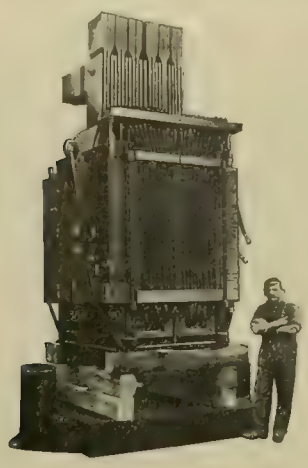
Niagara power is making its way through the center of New York state, and is now in Syracuse, 160 miles from the power house. While this distance was exceeded long ago in California, it is remarkable in a district of cheap coal. Sixty thousand volts is used at present, but the line was designed for a higher pressure, which must undoubtedly be used as the load increases. This line is supported partly upon steel towers, partly upon wooden frames. The wire is mostly aluminum, but some steel is used where great tensile strength is necessary.

Another interesting power development is that of the Southern Power Company near Charlotte, N. C. The company is planning to deliver eventually 150,000 horsepower in the two Carolinas, the power to be generated at a number of sites. Of these but two are now developed. These examples are typical of the power-transmission movement throughout the country.

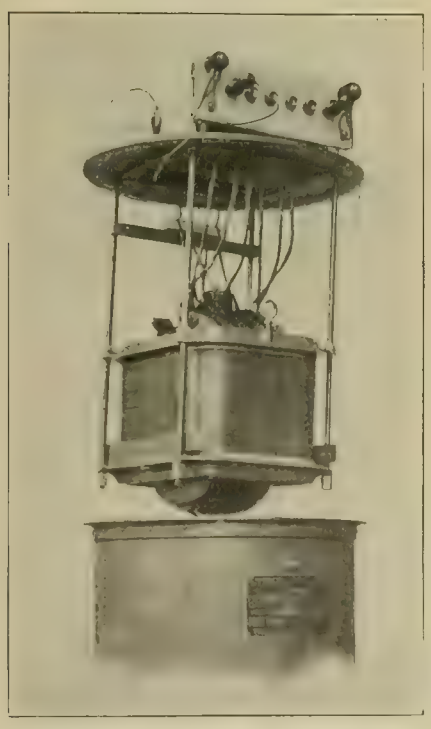
Intimately connected with the problem of power transmission is the agitation aroused by the threatened destruction of Niagara Falls. For some years the American Civic Federation has endeavored to secure legislation by the state and federal governments to limit the use of water from the Niagara River. This year its efforts have been successful, and the federal government has undertaken to control the use of the water. Although

the state of New York had granted almost unlimited privileges to the power companies, it has been determined that, as the Niagara River is an international waterway, the United States government can regulate its use. The secretary of war has authority to issue permits for the use of water and for the importation of electrical energy under the restrictions of the Burton bill.

Secretary Taft has made temporary grants by which the Niagara Falls Power Company may use 8,000 cubic feet per second, the Niagara Power Company 4,000 cubic feet, and the Lockport Hydraulic Power Company 883 cubic feet (including water drawn from the lower level of the Erie Canal). In addition, the Ontario Power Company and the Canadian Niagara Power Company may send over the border 25,000 horsepower each. The total proposed diversion at present is 46,000 cubic feet, out of a total estimated flow of 165,000. On the Canadian side there is not much interest in the preservation of the Falls, for the larger part of the water passes over the Horseshoe Fall, which is not materially threatened. The American Fall will probably not be seriously injured by the Canadian plants, as their draft of water is mainly from the larger fall. In a popular article Mr. H. W. Buck compares the power waste at Niagara to a great conflagration in which $122,500,000 is annually lost.



A TRANSFORMER HAVING AN OUTPUT OF 80,000 AMPERES.



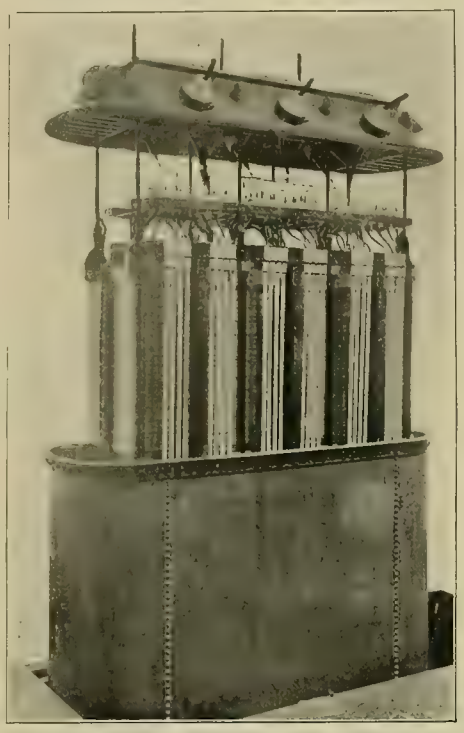
A SMALLER TRANSFORMER OF RECENT DESIGN.

Electric Railways.

A number of large undertakings under way at the beginning of the year have made steady progress. The long endurance test of electric locomotive No. 6000 of the New York Central Railroad ended June 12th. The distance covered was 50,000 miles, and the repair bill was found to be 1.26 cents per mile. A large number of similar locomotives were ordered, and many of these are now in operation. The first electric train entered the Grand Central Station in New York city on Sunday, September 30th, and regular operation upon the "Inner Zone" began some weeks later. The range of electrical operation is restricted to a small area until the matter of grade crossings is adjusted with the state railroad commissioners.

For the New York Central terminal electrification there are two power stations, nearly identical and practically complete, one located at Yonkers, the other at Port Morris. The latter has now four 5,000-kilowatt turbine units in operation, and two more will be added. The rolling stock of the road comprises both locomotive and multiple-control units, and the whole equipment and system mark the beginning of a new era in electric railroading. The Grand Central Station, so long a landmark in New York city, is to be rebuilt to meet the new demands upon it.

The Pennsylvania Railroad is also making rapid progress on its electrical terminal in New York city. In spite of accidents, the tunnel boring has gone steadily on, and is as far advanced as the rest of the work. Steel cars weighing nearly 52 tons will be used, and the Pullman company will also use fireproof cars through the tunnel.



THE LARGEST TRANSFORMER IN THE WORLD (7,500 KILOWATTS CAPACITY).

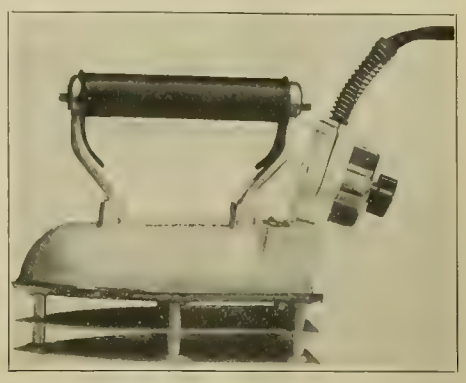
During the year the Pennsylvania Railroad made the rapid transformation of a steam road between Philadelphia and Atlantic City (the West Jersey and Seashore) into a third-rail electric road. This was probably one of the quickest changes on record, and it was made quietly and efficiently. A 33,000-volt transmission furnishes power to eight sub-stations, one being located in the power house at Newfield. Three-phase Curtis turbo-alternator units are the prime movers. The first days of operation were marked by a sad accident in which the cars were derailed on a drawbridge and a large number of passengers were drowned.

Single-phase traction, which aroused great interest a short time ago, is making steady although less sensational progress. The increasing use of alternating-current motors has forced the adaptation of the multiple-unit control to this class of work, and such apparatus is now procurable. The Washington, Baltimore and Annapolis Railway, the projected predecessor of which was one of the first to select alternating-current series motors, has decided upon this type. Four 125-horsepower motors will drive each car, drawing current from the trolley wire at 6,600 volts, 25 cycles. The transmission pressure is 33,000 volts.

A sample alternating-current locomotive has been submitted by the Westinghouse Electric and Manufacturing Company to the New York, New Haven and Hartford Railroad and has been found very satisfactory. A number of these are under construction, and will shortly be put into operation. The successful completion of this contract will be an incentive to the further use of alternating-current locomotives.

The Erie Railroad is being electrified, in parts, under the direction of Westinghouse, Church, Kerr & Co. Thirty-five miles of track between Rochester and Mt. Morris, N. Y., will soon be in operation. Alternating-current motors, with cars controlled by the multiple-unit system, will be employed.

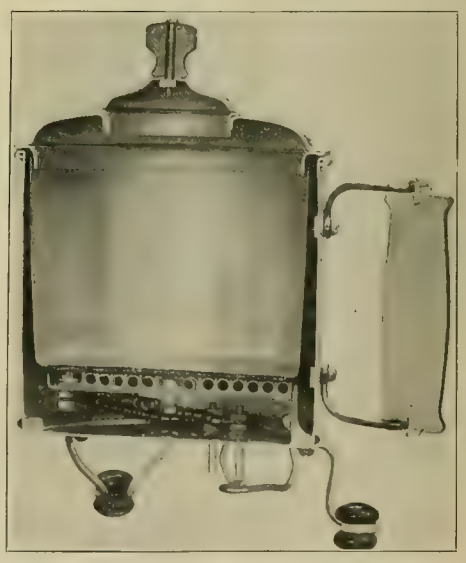
The amount of literature and the number of patents devoted to alternating-current motors show that the subject is a live one. On the other hand, there is a vast amount of capital tied up in direct-current apparatus. This equipment can only be discarded slowly. Improvements are also being made in direct-current motors and accessories. A notable example is in the application of the commutating pole to railway motors, reducing sparking and allowing the use of pressures up to 1,200 volts. Such motors are to be furnished to the Central California Traction Company and others by the General Electric Company.



SIX-POUND ELECTRIC FLATIRON WITH COMBINATION SWITCH AND PLUG.

Such are some of the new matters in traction work, but these are exceptional. More ordinary, but still significant, is the discontinuance of cable-car service in Chicago, on October 21st, and some day an efficient substitute for the horse may be found for the cross-town lines in New York city.

The October meeting of the American Street and Interurban Railway Association was the first held under the new constitution. The purposes of the reorganization were to bind together the affiliated societies and to increase their usefulness and its own. The convention city was Columbus, Ohio, and here the attendance broke all records. The discussion of papers was general, and there was an apparent tendency toward standardization of equipment. Efficient committee work has been inaugurated, the secretary's office is accumulating valuable data, and the income has been sufficient to cover the augmented running expenses.



SECTIONAL VIEW OF ONE-QUART ELECTRIC WATER HEATER.

Communication.

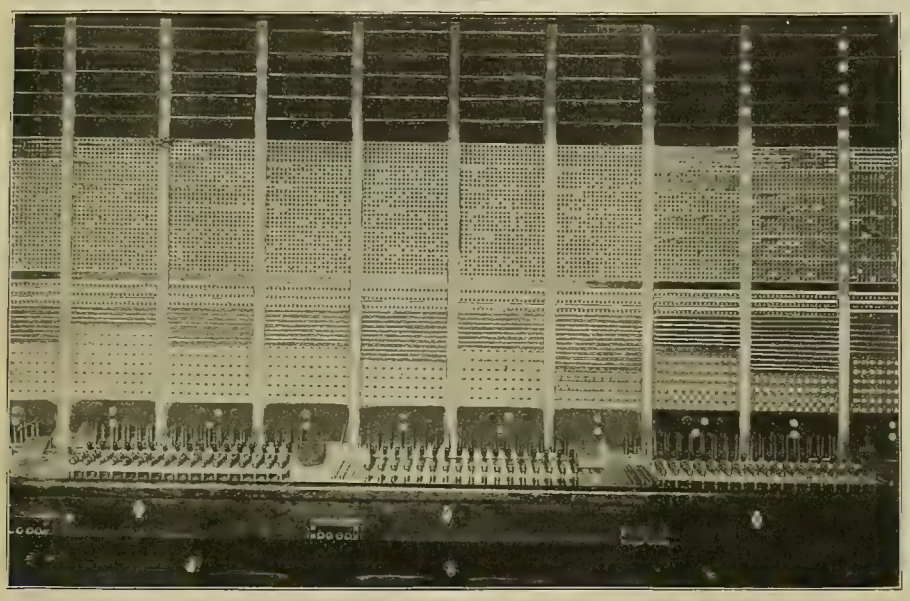
In the telephone field the year has been one of business expansion. The operating companies have entered upon a campaign to popularize the use of the telephone, and attractive forms of contract have been devised. In each of the large cities new equipment is under installation, the total aggregating over $50,000,000. Advances in the details of construction, tending to increase reliability and speed of connection, are a matter of course in view of the complication of a modern central office. Scientific researches are not neglected, special attention being devoted to the increase of

transmission efficiency by means of loading coils and devices to prevent the highest frequency currents from being obliterated.

Wireless telephony has within a few months begun to take a promising form as a natural outgrowth of wireless telegraphy. Another important achievement has been the simultaneous transmission of telephone and telegraph messages over long distances. This gives a method for increasing the service capacity of a line. There appears to be almost no limit to distance over which the double messages can be sent.

Dr. Thaddeus Cahill has recently put into operation a novel machine for producing music by means of the control of the wave form of an alternating current. This current is produced by a large number of generators giving different frequencies, which are combined in a "mixing" transformer at the will of the operator. The current is received in telephones, which give out sounds corresponding to its frequency and wave form. The first concert was given at the September meeting of the New York Electrical Society, and the music was well received. The current will be furnished to subscribers over special telephone wires, and it is proposed to begin public service at once.

In telegraphy the "wireless" still continues to contribute to the space in the daily papers, and new discoveries are of frequent occurrence. A recent investigation by the Navy Department showed the existence of 88 stations in this country, out of a total of 250 in all countries. Practically all transatlantic liners are now equipped with "wireless," and regular business is carried on over an entire voyage. The desirability of controlling the direction of the electric waves has led to successful experiments, so that in the near future it may be possible to focus them to some extent. The business expansion has become so extensive that it has become necessary for the governments to agree upon some code of rules to prevent international complications. An important official congress met at Berlin during October and framed a code for submission to the several governments concerned.



FACE OF ONE SECTION OF SUBSCRIBER'S SWITCHBOARD, PROSPECT CENTRAL OFFICE, NEW YORK AND NEW JERSEY TELEPHONE COMPANY.

Education and Science.

The American Association for the Advancement of Science returned last year to the practice of holding midsummer meetings. The Ithaca meeting was a success in every way, and a number of electrical-engineering teachers were present and contributed to the discussion. In connection with the association meeting, the engineering teachers also convened as the Society for the Promotion of Engineering Education. Prof. D. C. Jackson, the new head of the electrical department of the Massachusetts Institute of Technology, was elected president. The pedagogical side of electrical activity received careful attention at these meetings.

The phenomenal growth in registration in all of the electrical-engineering schools continues unabated, and the graduates secure satisfactory business opportunities immediately upon graduating. The demand for technically trained men far exceeds the supply. Manufacturing and operating companies realize that a real engineering education is the best possible preparation for business life. They are developing graduate-apprentice courses for the purpose of giving the young men the practical part of their education, so that as soon as the graduate "finds himself" he may be given responsible work. The technical schools, also, are realizing their opportunity and are increasing equipment and teaching force. The University of Pennsylvania on October 19th dedicated to engineering education what is probably the finest building in this country devoted to the purpose. It cost, equipped, nearly $1,000,000, and is in every way an ideal structure. Worcester Polytechnic Institute has a new electrical building under way, and Cornell dedicated in June the Rockefeller Hall of Physics, costing nearly $300,000, and placed at the disposal of the electrical department, Franklin Hall, which has long been a center of scientific influence. Harvard has established a graduate school of applied science in which advanced electrical engineering will be taught; and recently the news of a $100,000 endowment for electrical instruction at California has been received. This university and its sister at Palo Alto have recovered splendidly from the effects of the earthquake, which did not seriously interfere with the work of instruction.

The year 1906 marked the bi-centennial of the birth of Benjamin Franklin, and the anniversary was appropriately celebrated in Philadelphia, where the best part of the philosopher's life was spent. The festivities continued from April 17th to 20th and included addresses by eminent physicists, a visit to Franklin's grave, receptions, international courtesies, the conferring of degrees and a great banquet. It was a sad coincidence that at the very time of the celebration word reached this country that Mr. Pierre Curie had been killed in a street accident in Paris. Science thus lost a patient, conscientious investigator while commemorating the life of an illustrious predecessor.

General Summary.

The impression created by a general survey of the year's work is first one of wonder at the size of the undertakings. Bigness seems to be the order of the day. Money is not lacking for enterprises of great magnitude. There is a determination to improve the efficiency of electrical devices, notably light sources, telephone details and electric motors. The electrification of steam railroads has begun in earnest, and for this purpose the alternating-current motors have the lead. The use of small direct and alternating-current motors in factories has become general and no longer causes comment except upon the large number of motors demanded. The steam turbine is largely displacing the reciprocating engine in power stations, although the gas engine is more than ever in evidence. Finally, the educational institutions are doing their best to produce embryo engineers by insisting upon thorough and practical mastery of the elements of electrical engineering. The trade-school idea is dying out of these schools, consequently their real educational value is increasing.

The annual meeting of the Indiana Engineering Society will be held in Indianapolis on January 17th, 18th and 19th, at which time Prof. Arthur Berry Smith of Purdue University will read a paper on "The Principles of the Telephone."

Electrical Exports for 1906.

Electrical exports from the United States for the calendar year 1906 were the largest of any year on record. The figures following are from the records of the Bureau of Statistics, Department of Commerce and Labor, and are complete with the exception of those for the month of December, which are necessarily estimated. The total value of the electrical exports for the year just closed was $16,747,790, an increase of $3,690,113 over 1905, which year showed the largest business up to that time. The annual value of electrical exports from this country during the last six years was as follows: 1906, $16,747,790; 1905, $13,057,677; 1904, $11,039,758; 1903, $9,856,047; 1902, $9,997,195; 1901, $7,452,783.

The following table shows the value of electrical exports from the United States by months (December estimated) for the year 1906. The first column of figures represents goods classified as electrical appliances, which includes telegraph and telephone instruments; the second column is for electrical machinery and the third the totals:

Exports by Months for 1906.

Month.	Appliances.	Machinery.	Total.
January	$529,253	$799,939	$1,329,192
February	544,906	646,532	1,191,438
March	590,328	705,037	1,295,365
April	750,579	810,686	1,561,265
May	709,875	681,955	1,391,830
June	815,846	639,561	1,455,407
July	577,084	631,705	1,208,789
August	744,775	624,304	1,369,079
September	677,821	726,600	1,404,421
October	863,287	743,749	1,607,036
November	749,357	624,611	1,373,968
December	*800,000	*760,000	*1,560,000
Total	$8,353,111	$8,394,679	$16,747,790

*Estimated.

The two classes of goods exported last year—electrical appliances and electrical machinery—were very nearly equal in value, but appliances show the larger gain as compared with 1905. The comparison is as follows: Appliances—1905, $5,648,435; 1906, $8,353,111. Machinery—1905, $7,409,242; 1906, $8,394,679.

Institute Meeting in New York.

The last meeting of the old year of the American Institute of Electrical Engineers was held in New York city December 28, 1906. President Sheldon occupied the chair.

Secretary Pope announced that at the meeting of the board of directors held in the afternoon there were 77 associates elected, and further announced that the Institute members had been invited to attend the monthly meeting of the American Society of Mechanical Engineers, to be held in the new Engineers' Building, 33 West Thirty-ninth Street, on January 8th. The business of the meeting will be an address by Frederick P. Fish, president of the American Telephone and Telegraph Company, on the subject of "The Ethics of Trade Secrets in Relation to the Patent System." Mr. Fish is an associate of the Institute.

President Sheldon called attention to the efforts which are being made by the committee for the increase of membership, of which Mr. Thomas is chairman. There are 150 applications in the office going through the process of posting and being made ready for election, and 77 associates had just been elected as mentioned above. The paper for the evening was on the subject, "Recent Investigation of Lightning Protective Apparatus," by R. P. Jackson of the Westinghouse Electric and Manufacturing Company. Following the reading of the paper there was an interesting discussion in which Ralph D. Mershon, C. P. Steinmetz, Percy H. Thomas, E. E. F. Creighton, H. B. Alverson, Paul M. Lincoln, J. F. Vaughan and the author took part. An abstract of the paper and the discussion will appear in a later issue of the Western Electrician.

Engineering Society of the South.

The eighteenth annual convention of the Engineering Society of the South was held in Atlanta, Ga., on December 14th and 15th. Representatives were present from the Nashville, Birmingham, Atlanta and other sections. A. V. Gude of Atlanta was chosen presidnt for the ensuing year. Granberry Jackson was elected president of the Atlanta section; G. H. Harris, Birmingham, R. M. Clayton, Atlanta, vice-presidents; H. M. Jones of Nashville, secretary and treasurer. The annual banquet was held at the Kimball House Saturday night. The society inspected the terminals in Atlanta and specimens of reinforced concrete work.

ELECTRICAL ENGINEERING IN GREAT BRITAIN IN 1906.

[From the London correspondent of the Western Electrician.]

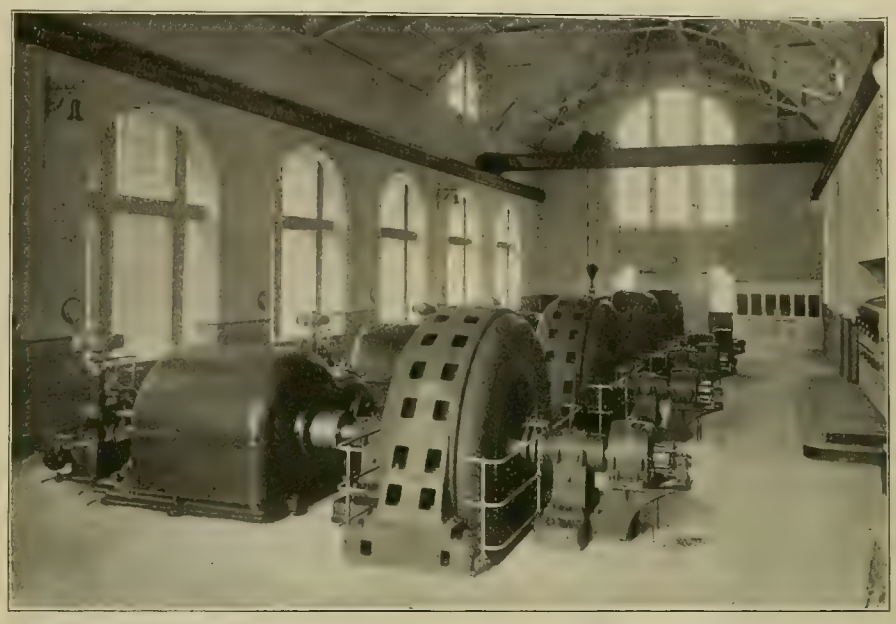
THE success of any industry depends not only upon its industrial activity, but upon the economical conditions governing that activity. A close study of the industrial conditions of the electrical profession in Great Britain during 1906 points to a depression which gradually assumed more serious proportions as the year advanced, and which, toward autumn, led to a meeting of representatives of leading manufacturers, whose object was to evolve a more satisfactory solution than that of the survival of the fittest, or, in other words, that the weaker, financially, must go to the wall.

In a short sequence of years of low dividends, 1906 has witnessed the stage at which any further decrease must end in disaster to some. Admittedly there are two causes for the conditions now prevailing: (1) Overproduction, by the multiplication of firms, in home factories, and (2) foreign competition. In connection with the latter, an uncommon fact may be recorded, and that is that the British determination to fight Continental competition has been carried to such a pitch that I have heard a case quoted in which prices are being offered by English firms which are 10 per cent. less than the actual price of the particular article, say in Berlin. This may be an exaggeration, but leading British firms have declined on more than one occasion to enter into open competition for certain classes of plant in consequence of the extremely low prices prevailing. These, of course, are those firms who happen to be fortunate enough to have their works well filled with other classes of goods.

Another case within my knowledge is that of a firm which is just now doing a large amount of business in steel trucks and carriages of all descriptions at good prices; yet its electrical department, although working full time and with plenty of orders, is unable to pay more than the men's wages and establishment charges. It is possible to refer to numerous annual speeches at companies meetings this year at which the same complaint has been made—"We are too numerous," or "The supply is greater than the demand." Whether the market will be eased in any way by the action of one or two leading firms, who intend to devote their whole energies to foreign and colonial contracts, remains to be demonstrated. Generally speaking, the cost of raw material seems to have varied inversely to the ruling prices of contracts, while hard and fast rules of trade unionism prevent any decrease in the rate of wages.

Commercial Development.

Before commencing the usual technical record of the year, one matter is deserving of especial reference, and that is the extraordinary activity in what is termed "commercial development." In the case of central stations, for instance, the duty of looking after the business side of the undertaking has hitherto devolved upon the engineer, but it is now being realized that to heap a multitude of duties upon one individual is not good either for the individual or the undertaking. Consequently, the last twelvemonth has been an era of advertisements for "commercial assistants," and the publication of innumerable "Bulletins," "Electrical Pioneers," and so on—the names given to the monthly or quarterly pamphlets which every electrical undertaking possessing a commercial department seems to regard as a bounden duty to produce, at the penalty of being branded not in the fashion. Add to this a constant stream of literature from the "publicity" departments of manufacturing firms, and a new kind of publicity inaugurated in the technical press, and it will easily be conceived that the electrical industry in Great Britain is suffering from a flux de bouche, not always to the point, it is to be feared, but stimulated, presumably, by a desire for business. It is intended to be an effective means to a desirable end; but the complaint has been heard that it is toujours perdrix.



INTERIOR OF GENERATING PLANT FOR NORTH WALES HYDRO-ELECTRIC POWER DEVELOPMENT.

Power Supply.

As in 1905, the electric power-supply question in London has attracted attention, practically throughout the year, and it is a blot upon our parliamentary methods that one scheme should have been allowed to proceed to the obstruction of all others. Having decided that this scheme, i. e., the London County Council's proposal, did not meet the case, the parliamentary committee which considered it (and incidentally heard the views of the other promoters in opposition) calmly recommended that it should be rejected, that no other bills should proceed, and that the London County Council be recommended to bring forward a new proposition for 1907, practically based on the views expressed by the opposition.

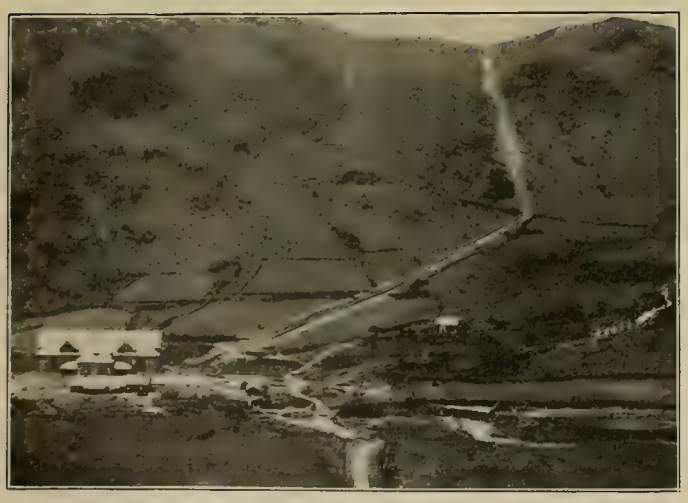
Two years have passed since the question was first placed before Parliament, but the issue now rests in the hands of politicians who know little of the difficulties of electric supply over large areas. The question will be the one at the County Council elections in March, and already, in view of a reverse at the recent borough-council elections, the party in office shows signs of modifying the past uncompromising attitude toward private enterprise.

London, with its 60 odd generating stations with varying equipments, etc., presents a problem of intense interest to the power engineer, but there are no insuperable difficulties except those created by the politicians.

It is to be regretted that we were not allowed the privilege last year of investigating the details of the proposed scheme to supply London from a distance of some 60 miles outside, and if the present attitude be maintained, the advice or opinions of certain very experienced engineers, and which might have an important bearing upon the final decision, may never be made public or even ascertained.

Technically, the item of the year is the opening of the North Wales hydro-electric power-transmission scheme—the first of its kind here. I give a few photographic illustrations of the undertaking. This scheme is in the hands of a company which has a parliamentary franchise for an area of 2,100 square miles in North Wales, a district which includes many slate and stone quarries more or less languishing for an efficient supply of power.

The generators are driven by Pelton wheels, which are supplied with water through a pipe line fed by a lake, Llyn Llydaw, situated on Mount Snowdon, some 1,500 feet above the level of the sea. Some 6,000 horsepower is thus available. As will be seen from the illustration, there are four generating turbine units, the alternator voltage being 10,000 and the frequency 50 cycles. The alternators were supplied by Bruce, Peebles & Co.,



View of Power Station and Pipe Line

Overhead Mains Crossing a Public Road.

NORTH WALES HYDRO-ELECTRIC POWER DEVELOPMENT.

in conjunction with Ganz & Co. of Budapest, who supplied the Pelton wheels.

The pipe line is double, each pipe being 27 inches in diameter, and the head of water at the turbines is 1,150 feet. The full technical features of interest in this installation cannot be given now, obviously, and I will only draw attention to the very extensive use of overhead wires, which constitutes pioneer work which will be of inestimable benefit in the future.

Considerable development is also taking place in Scotland with the use of waterpower in connection with the manufacture of aluminum.

An equally interesting power proposal, which was sanctioned in the last session of Parliament, is the Cumberland Electricity and Power Gas scheme. How soon it is likely to come into being, I am unable to say, but its inception marks a welcome departure from orthodox methods. A company with a capital of $2,250,000 has been authorized, and it is proposed to erect three generating stations, using the waste gases from the blast furnaces in the area in order to drive gas engines for producing electrical energy. Agreements have been made with the owners of three of the largest iron works for the supply of such gas, it being estimated that at the present time 60,000 horsepower is running to waste in this manner.

Financially, the position of the electric power companies has not caused much enthusiasm, mainly for the reason that many of the preconceived notions of electric power supply over large areas have fallen somewhat wide of the mark. The collieries, for instance, which were regarded as a fruitful source of income, have not "come in," so to speak, and the explanation is very plain. It was imagined that one or two power stations would suffice for most of the areas granted to power companies; but experience has shown that the cost of long lines of transmission mains, a large proportion of which hitherto have had to be underground, precludes giving a supply at a price equal to that which a large colliery company, or a close group of small ones, can generate upon the spot from independent plants.

There are one or two notable examples of this. A special company has been formed in the Durham Power Company's area to supply electrical energy to a cluster of collieries, while in the South Wales District the Powell Duffry Colliery Company has a special plant from which it delivers current to transmission lines for its various collieries at a cost of 0.365d. per unit, which includes 10 per cent. for interest and depreciation on the power station. In a paper read before the Institution of Electrical Engineers in March, Mr. C. P. Sparks, the consulting engineer, stated that when the full generating plant was at work he expected a load factor of 45 per cent. and to reduce the cost to under 0.3d. per unit, delivered to the colliery mains. A view of the Durham collieries' power station is given.

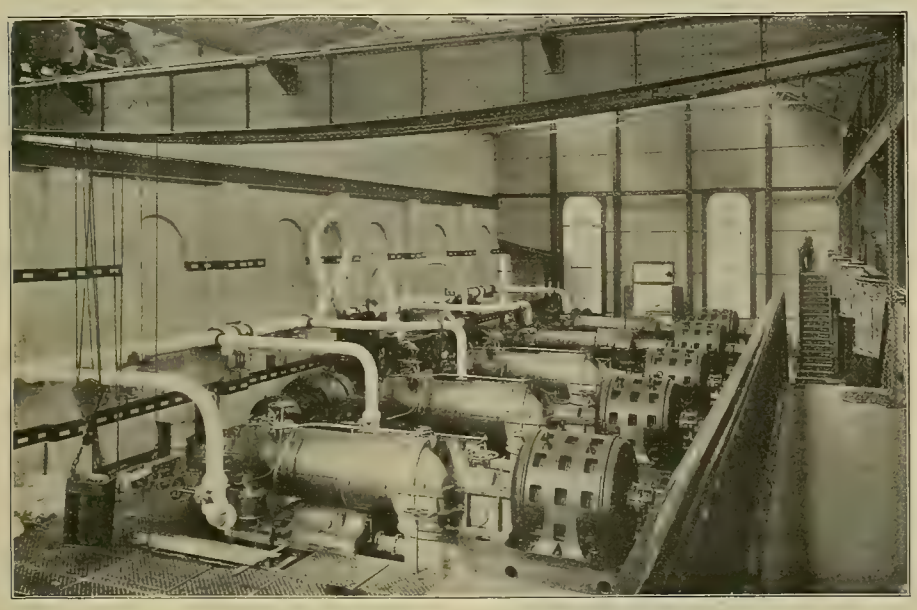
It will thus be seen that the original conditions have changed somewhat, and it is not surprising to note that power companies show a tendency to erect more stations, with a corresponding reduction in the length of transmission lines from each.

There has been a consolidation of electric-power interests in the Northeast of England which should have an important influence upon this industrial center of England. The Newcastle, County of Durham and Cleveland and Durham companies are now controlled by the Merz group of financiers and engineers. Cables to carry 30,000 volts are being laid in this district.

Some very interesting tests upon two 1,500-kilowatt Curtis turbines were made at a London generating station in March. The test conditions specified were 150 pounds steam pressure, 60 degrees superheat, and the recorded result with a vacuum of 29 inches of mercury and the barometer at 30.15 inches was 17¼ pounds of steam per hour at 1,500 kilowatts (makers' full-load rating). It may here be mentioned that the manufacture of the Zoelly turbine has been commenced in England.

A set of Board of Trade regulations dealing with extra high pressure was published and much criticized in the technical press. I believe that they will be thoroughly revised before being put into force.

The power stations at Greenwich and Birmingham (the former supplying the London County Council tramways and the latter the lighting and tramway supply in Birmingham) have both been described in the Western Electrician. At Manchester some Bruce, Peebles-La Cour motor-converters have been installed which have special points, the chief of which is that the rotor, instead of being short-circuited, is connected to the armature of the direct-current machine. The effect is an improved efficiency and power factor, the former being 91 per cent. at full load. These machines are coming into favor, quite a number being installed in various power houses and sub-stations.



DURHAM COLLIERIES POWER STATION, SHOWING TURBO-GENERATORS.

Electric Traction.

The pronounced divergence of opinion upon the railway-electrification problem, coupled with the disappointing financial results upon the London railways working on the direct-current third-rail system, has focused exceptional public attention to this matter. There has been some trouble, too, with the rolling stock in London, and the fact that the Metropolitan company has converted some compartment rolling stock to electrical working is a sufficient indication that the saloon type of car is liable to be superseded. An accompanying photograph shows one of these converted cars which are now in use. This type certainly obviates the expense of carrying "gatemen," which seems to have been largely instrumental in keeping up the working expenses under the new regime. The carrying capacity is also greater, while the time for loading and unloading is shorter. Passengers seem to manage this much better by themselves than under the supervision of a gateman, and through only one entrance to a car, instead of a dozen.

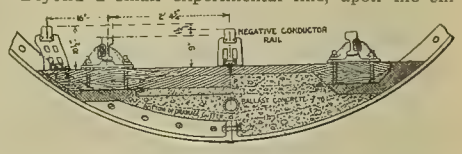
The operation of the Baker Street and Waterloo Railway has opened up another link in the chain of railway communication in London. This line runs from the west to the southwest in London, while before this article is published a further tube railway, among the Yerkes group, running from north to southwest, will be put into operation. This latter is called the Great Northern, Piccadilly and Brompton Railway, and the construction in both cases is identical. The diagram gives a sectional view of the track. An interesting feature of the latter undertaking will be the provision of a moving staircase at one of the stations. The use of steel in the construction of electric-railway rolling stock in London is completely superseding wood treated with a fire-resisting compound. Orders for no less than 210 steel coaches for the Great Northern, Piccadilly and Brompton Railway have been placed. In the case of the cars for the Baker Street and Waterloo Railway, the steel cars were sent over from America and erected near Manchester.

METROPOLITAN RAILWAY COMPARTMENT COACH CONVERTED FOR ELECTRICAL OPERATION IN LONDON.

Following close the death of Mr. C. T. Yerkes came a general modification of the internal methods of working upon the District Railway, and the increase in the fares, diametrically opposed to the oft-quoted opinions of Mr. Yerkes, caused a public outcry, which, however, died a natural death. The directors remained steadfast in their intentions and had the moral support of most level-headed people.

The other aspect of railway electrification has its interest solely centered upon the lines of the London, Brighton and South Railway Company, between London Bridge and Victoria, a semicircular route of some 12 miles. It is true that a proposal was put before Parliament to construct a huge semicircular railway, some 30 miles of route, around Greater London, and to adopt single-phase traction, but as the promoters failed to convince a parliamentary committee of the business prospects of the undertaking, it met the usual fate. Under the advice of Mr. Philip Dawson, however, the London and Brighton company is pushing forward with its single-phase conversion, most of the electrical equipment for which is now under construction at Rugby, in the works of the British Thomson-Houston Company. The plant is being built upon the Winter-Eichberg patents.

Beyond a small experimental line, upon the single-phase system, which the Midland Railway Company is installing on the west coast of England, there have been no notable heavy electric-traction developments. In fact, the unsatisfactory results upon those lines already working electrically have led to a greater conviction than ever on the part of other railway managers that we are no nearer a solution of the problem, and that the wisest policy is still to sit and watch.



GREAT NORTHERN, PICCADILLY AND BROMPTON TUBE ELECTRIC RAILWAY IN LONDON.—PERMANENT WAY CONSTRUCTION.

In the domain of tramways, the London County Council has continued to add to its responsibilities. With the acquisition of the horse tramways in the North, the council became the proud possessor of all the London tramways. Unlike the South, it is intended to adopt a combination of conduit and trolley. Part of the northern lines have already been completed, and the greater facilities offered between the city and the northern suburbs are much appreciated.

In the provinces, the opening of a surface-con-

tact system at Lincoln has to be chronicled. The system adopted is the Griffiths-Bedell, which is well known in America, I believe. The conductor is carried in an ordinary glazed vitrified stoneware pipe, five inches internal diameter, which is laid under the center of the track and embedded in concrete. The conductor is a galvanized-iron cable, and the studs are held in solid granite blocks. Two views of the Lincoln installation are given.

Two other undertakings are in progress upon the Dolter system, one at Torquay and the other at Rawmarsh, but there seems to have been considerable delay, especially at Torquay.

Tramway accidents have been notorious, but in practically all cases it has been proved that the drivers lost nerve and precipitated matters. The question of brakes, however, is receiving close attention. Another matter which seriously affected a few tramway undertakings was disputes with the employes, whose demands are said to constitute a serious menace to efficient control and operation.

Rail corrugation has been a fruitful source of controversy, and many theories have been put forward, notably the one that this is caused by the arcing which takes place between the wheel and the rail. Germane to this is the question of rail reconstruction, and a system of laying a new running surface to worn tram rails without taking up the track has had some interesting trials at Leeds.

There are now a large number of private electric-motor cars to be seen in the streets of London, but, despite promises, nothing in the nature of a public service has yet put in an appearance.

Electric Lamps and Electric Lighting.

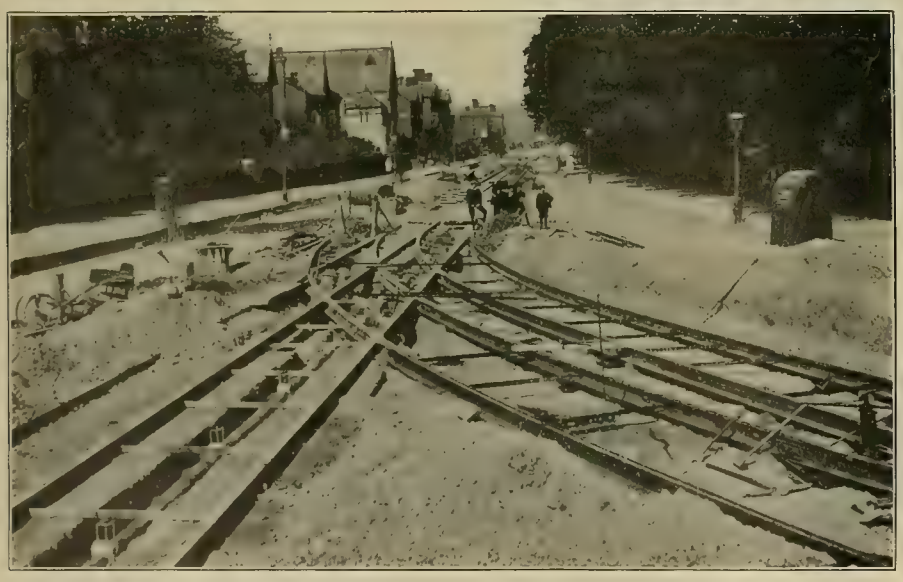
New lamps of all descriptions have made their appearance with startling rapidity, the number of new flame arcs being quite a record; and yet they come. The full possibilities of the flame lamps is now fully appreciated not only by electrical engineers, but by their friends, the gas companies. Two most interesting papers were read before the Institution of Electrical Engineers by Mr. L. Andrews and Mr. Harrison, the discussions upon which were full of practical utility.

Equally, metallic-filament lamps have made their appearance in such numbers as to create a feeling of insecurity in some weak minds. It has absurdly been suggested that the greater efficiency of such lamps is a menace to the central stations—a curious argument, scarcely worth the recording. Mention may be made of the Kuzel and the wolfram lamps, of which tests have been published, but I am not aware yet of their production in any large quantities. The number of tantalum lamps now in use has increased to a very large extent, the fact of two having to be burned in series upon the 200-volt circuits, now so general over here, apparently not being any drawback. Reductions in price have taken place, all tending to their popularity. At Ealing, too, "Osmi" lamps have replaced 16-candlepower incandescents in competition with tantalum lamps, which were said to have too short life for street lighting. Nernst lamps are now made to fit the ordinary bayonet holder.

The battle of electric versus gas lighting for street work has been fought out once again bitterly, with varying success. From all accounts the keen competition between gas and electricity for exterior lighting is a phenomenon peculiar to Great Britain. In the city of London gas has won the day in a few streets, while at Sheffield the corporation has defeated the gas company. At one of the London Railway termini, electricity, having obtained a fair field with no favor, secured the day on its merits. Yet at another terminus close by, the result was the reverse. Unfortunately, the gas companies frequently secure contracts through "influence," and the result is placarded a success for gas over electricity. A glaring instance of this occurred in the city of London.

SURFACE-CONTACT ELECTRIC-RAILWAY SYSTEM AT LINCOLN, ENGLAND.

Altogether, there is greater activity in the electric-lamp industry than probably in any other branch. Hitherto development has been very slow, and this fact is being realized more and more. Thus it comes about that a proposal to form a society of illuminating engineers was taken up at once, while many are the schemes which have been proposed for the more intelligent and efficient utilization of electric lamps by the consumer.



SURFACE-CONTACT SYSTEM OF ELECTRIC RAILWAY DURING CONSTRUCTION AT LINCOLN, ENGLAND.

As a conclusion to this section, a word may be said of the new train-lighting systems, one, the Verity-Dalziel, with which the Midland Railway Company is experimenting, and the other, the Leitner-Lucas system, which has undergone a severe and exhaustive trial at the hands of the Great Western Railway. Attention may also be drawn to the instance of exterior lighting by mercury-vapor lamps, shown in one of the illustrations.

Telegraphy, Telephony and Radio-telegraphy.

The year 1906 has sounded the death-knell of municipal telephony, and by the irony of fate the original champion of corporation telephones, the Glasgow Corporation, was the first to realize the futility of attempting to carry on small local systems against the definitely expressed wish of a majority in favor of comprehensive state control. Brighton quickly followed the lead of Glasgow, and the remaining three systems at Hull, Portsmouth and Swansea are bargaining with the postmaster-general with the same end in view. Municipal telephony was created and killed by the municipalities themselves. The government has opened new exchanges in London and in Birmingham. The former represents a departure, the object attained being the collection of a greater number of subscribers in a single room. The growth of the London Postoffice telephone system quickly filled up the first exchange, which accommodated 15,000 subscribers, and the experience has been put to useful account in the second exchange. At the request of agriculturists and fruitgrowers, too, the Postoffice is bestowing great thought upon urban facilities, market gardeners and others hitherto having been untouched by telephonic facilities which can be called adequate.

One hears little of the telegraph system of the country, and excepting a general extension of underground trunk lines, it is impossible to say much.

Radio-telegraphy has been rather prominent, but no official information as to the Berlin Conference will be published at the instigation of our own government until the report of the conference is issued. The Marconi company announced that it could have paid 12 per cent. dividends this year, but no distribution was made in view of the heavy expenses which it anticipated in the near future for the natural expansion of the business. The agreements between the company and the Postoffice and Admiralty were published in the summer, the latter being several years late. As showing the trend of events, the report upon wireless-telegraph business is a useful document. Applications were received from both American and German syndicates, in addition to a large number of British, and the general results vindicate the action of the government in securing the control of such licenses. Both the De Forest company and the National Electric Signaling Company sought licenses for sending transatlantic messages from the western coasts of the British Isles, and the station of the latter has already been erected at Mackrihanish Bay, Scotland. The extension of the state supervision in this matter for a further two years has met with general approbation.

Mention should also be made of a unique series of tests upon wooden telegraph and telephone poles, the results of which, however, have not yet been published.

Colonial.

It would not be far wrong to state that, relatively, India has shown the greater progress in the colonies during the last twelvemonth. Thanks to the intervention of both British and American engineers and financiers, electric-lighting and tramway equipments are being installed in all the leading towns. Calcutta, Bombay and Delhi are notable examples of the additions during 1906, and in all these instances British capital and energy have formed the initiative. The most ambitious scheme on the whole, however, is the proposal to incorporate a company with $10,000,000 capital, to construct a hydro-electric installation on the Jhelum River in Kashmir, a first plant of 20,000 horsepower being intended. Probably by reason of the success of the Cauvery Falls scheme, American engineers have secured most of the contracts.

The gas-driven central station at Johannesburg, South Africa, has now been completed.

The Adelaide tramway controversy, the Melbourne electric-light tariff squabble and magnetic brake tests, and the revolt of the telephone subscribers over a proposal to introduce the toll system of charging, may be classed among the chief electrical features during the year in Australia.

Miscellaneous.

Among a mass of miscellaneous events, of course the visit of foreign engineers during the summer stands pre-eminent. This visit coincided with the opening of the new electrical laboratory at the National Physical Laboratory, and thus our visitors were afforded an object lesson in the neglect of science by British governments. Among the various parliamentary and other official decisions appertaining to the electrical industry may be mentioned the success of the London County Council

in at last securing authority for the borough councils to carry on the wiring and fitting of consumers' premises, and the clause granting to the St. Pancras council relieving it of liability for nuisance in connection with vibration caused by its electricity works. A report on an electric time service in Glasgow, the adoption of electric ambulance service in the city of London, and an installation of a sewage purification plant on the Hermite process at Poplar, indicate a few directions in which municipal activity has developed. The Manchester Corporation, also, having vindicated its position in a court of law as a carrier of parcels and foods on its tramways, has been forced to modify its intention considerably, owing to financial failure. The depreciation of electricity works has

MERCURY-VAPOR LAMPS OUTSIDE TRIBUNE OFFICES, LONDON.

caused an extraordinary amount of discussion, but unanimity of view is still far away.

The report upon advanced technical education, issued by Mr. Haldane's committee, has not been given practical effect, the new government having confined its attention so far mainly to the amelioration of the condition of the working classes. A royal commission on the canals of the country is still sitting, and here is a scope for electrical development. No information has yet been given concerning the proceedings of the International Commission on Units, but our own standards committee has ready for publication some new incandescent-lamp standards, which have an importance quite exceptional. G.

Various Types of Electric Cars to be Gathered in Indianapolis.

The first annual meeting and dinner of the Central Electric Railway Association will be held January 24th at the Claypool Hotel, Indianapolis, Ind. The business meeting and election of officers of the association will take place at the morning session at 10:30 o'clock, also the following subjects will be discussed at the afternoon session: Cost of power for rental purposes; developing a demand for renting power; the model car for long travel; car lighting; handling of accidents and claims. As this is the first annual meeting and dinner of the association a large attendance is desired.

One of the features of the day will be the massing at Indianapolis for exhibition of the various types of interurban cars now in service; it is also desired that all private cars in the Middle West be centered at Indianapolis for this date. Ample arrangements have been made by the Indianapolis Traction and Terminal Company under the supervision of Mr. J. J. Mahoney, superintendent of the company, to have all the cars massed in the center of the city on one of the side streets opposite the Claypool Hotel. This is intended as an object lesson to the public of what is being accomplished at the present time by the interurban systems. All who can operate their cars into Indianapolis should make traffic arrangements at once over whatever route they desire to go and notify Mr. Mahoney.

ELECTRICAL PROGRESS OF 1906 ON THE CONTINENT.

By A. De Courcy.

CONSIDERING the progress of the electrical industries in the different countries of Continental Europe during the last year a very satisfactory advance is to be noted. In France the greatest progress is to be found in hydraulic work and in surface traction. Construction of power plants has been specially active in the two principal Alpine regions, the first of these lying in the district of Grenoble, where the existing stations have been increased in capacity, with some new ones added not long ago. In the Mediterranean Alps region the large company known as the Énergie Electrique is carrying on extensive operations, and its overhead lines cover a wide extent of country. This company, of which the French Thomson-Houston Company forms a part, lately erected the Entraygues plant for the supply of Toulon, and the new St. Cezaire station has also started up. Power is transmitted as far as Marseilles. An important undertaking on the Mediterranean coast is the electric-railway line which runs for over 30 miles length along the coast, taking in the towns of Nice, Monte Carlo and Cannes. I may also mention the construction of the new St. Denis steam-turbine plant near Paris, and the opening up of the south branch of the Paris Metropolitan road.

Germany has been among the leading nations in electrical enterprise this year. Electric traction on railroad lines of greater or less length is one of the features. The Cologne-Bonn railroad follows along the Rhine, connecting the two cities; another line runs from Heidelberg to Wiesloch. Trackless trolleys are coming into use on four different systems in the country; one of these runs near Gravenbruck. A number of the leading companies have gone into the manufacture of steam turbines, among these being the Siemens & Halske and the Augsburg-Nüremberg Company. The Brown-Boveri Company has put in a number of steam-turbine plants in Germany, including two 500-horsepower units at Frankfort and others at Pforzheim. In the Rheno-Westphalian plant at Essen, it erected a large 10,000-horsepower unit, coupled to a three-phase alternator. Electric traction on the Teltow Canal, carried out with success by the Siemens & Halske firm, is one of the features to be noted; also the radio-telegraph work done by the Telefunken Company, which is erecting several large stations. It is also in Germany that the new tantalum and other metallic-filament lamps seem to be making the greatest progress.

Switzerland still continues to draw upon its natural resources for a large amount of power, and, owing to the great success of the hydraulic plants, it is now proposed to operate the main railroad lines from large power plants. Among the shorter electric lines I may note the La Gruyère and the Lausanne-Moudon roads, both operating on the 500-volt direct-current system. The three-phase traction system, which has been applied by the Brown-Boveri Company in the Simplon Tunnel section, is one of the principal undertakings of the year, and the locomotives are now taking most of the trains which run between Switzerland and Italy. Mountain-climbing roads continue to operate with success, and take a large local and tourist traffic from the railroad stations up to elevated points in the mountains. A good example is the Brunnen-Morschach line, which uses electric locomotives on a rack-rail.

The Alpine region in the north of Italy is constantly giving new sources of power, which are utilized in Milan, Turin, Venice and other cities. Among these is the Mont Cenis plant, which gives a supply to Turin. On the Lessin River is a large station sending current to Milan, while Venice secures a good amount from the Celina River. A new hydraulic station is giving current for the region around Viterbo. Rome and Naples are to be connected by a 120-mile electric railroad, and the concession for the line is already granted. Power will be obtained from the Volturno stream. Steam turbines of the Brown-Boveri type are now erected in the Porta Volta plant at Milan. In relation to electro-metallurgy, the Stassano iron furnace has been well developed recently, and may be soon of commercial value, while the electrochemical industries are on the increase.

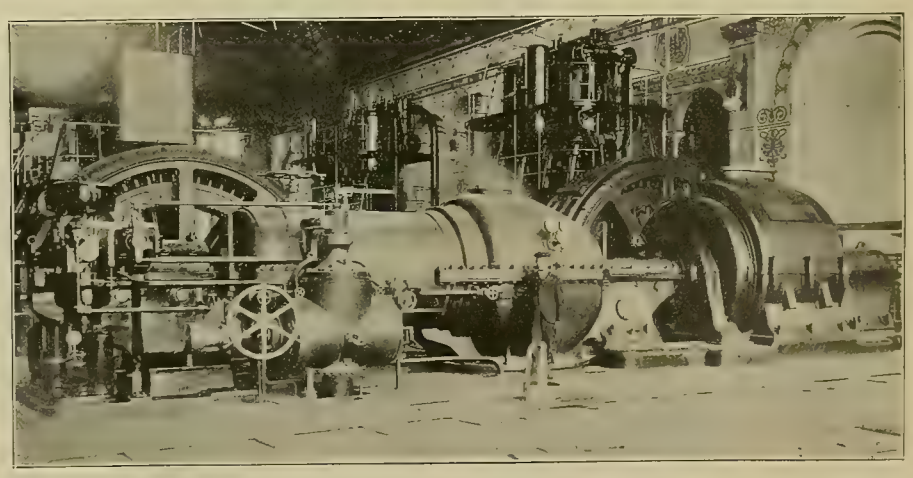
One of the principal undertakings in Austria is the transformation of the Vienna Metropolitan street railways to the electric system. This will soon take place, and the recently built Krizik locomotives are to be tried first on a stretch of track. As to surface traction, the lines of Budapest are being greatly extended, both in the city and the suburbs; also the Prague lines. The Rienz hydro-electric plant in the Tyrol is now supplying an extended district. On the coast of the Adriatic the government is experimenting with radio-telegraph stations.

Spain has been coming to the front in electrical enterprises, and during the year a number of power plants and electric-traction lines have been installed, especially in the regions of Madrid and Salamanca. The Barcena hydraulic plant now operates a large electrolytic works, while the projected Zamora plant will be one of the largest in the country.

Electric Railroading.

Considering electric traction on standard-gauge railroads, the Simplon Tunnel equipment is to be considered the most important undertaking of the year, and brings great credit upon the Brown-Boveri concern, which put in the electrical outfit. At last accounts the three-phase electric locomotives were taking 120 trains a week over the electric line extending from Briguè to Iselle, and the trip can be made in 20 minutes. Since the first of August, when the electric trains were started for passenger service, everything has been working satisfactorily. One of the main difficulties was to install the three-phase 3,000-volt wiring for the overhead-trolley system within the 12-mile tunnel, but by the use of copper-covered steel cross-wires, held upon bronze fixtures, and specially insulated hangers for the two trolley lines, this has been well carried out. The two hydro-electric plants at the ends of the line at Briguè, on the Swiss side, and Iselle at the Italian end, can be worked singly or in parallel upon it.

The Vienna city railway lines will no doubt be changed over to the electric system soon, seeing that electric locomotives have already been built

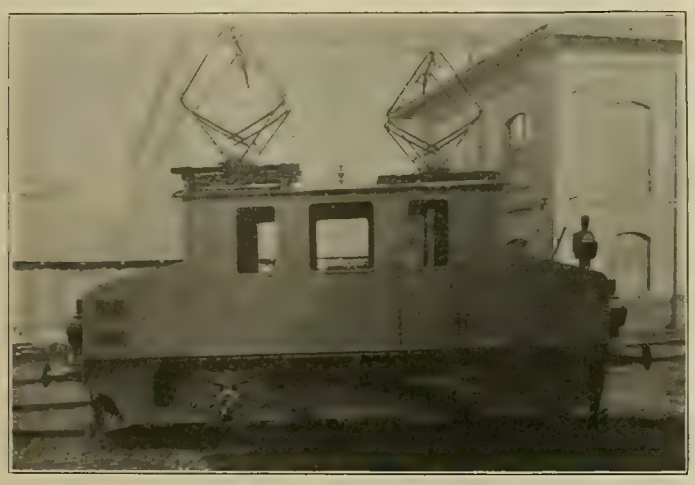


In the foreground is shown a 10,000-horsepower steam turbine direct-coupled to a 5,000-kilowatt three-phase alternator and a 1,500 kilowatt direct-current generator. With the exciter, the whole group is 65 feet long.

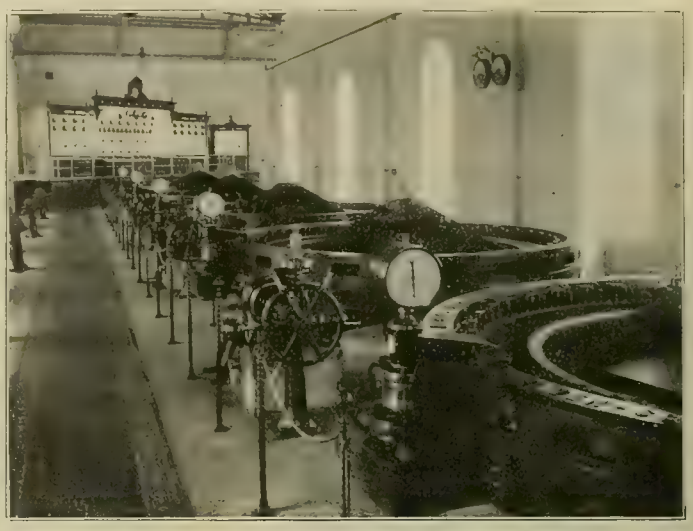
RHENO-WESTPHALIAN STATION AT ESSEN, GERMANY.

for trial upon a part of the line by the Krizik firm. Much dissatisfaction is expressed as to the use of the present steam trains in the tunnels which make up a good part of the line, and when electric trains are used there is no doubt that the public will use the road more largely than heretofore. The new Krizik locomotive is fitted with 130-horsepower direct-current motors, with two of them geared to each axle. What is unusual here is that the four motors will be run in series upon 3000 volts total, or 750 volts per motor. When complete, the new locomotive weighs about 30 tons.

At St. Petersburg, experiments are being carried out with a gasoline electric train which has some novel points. Each of the six cars is fitted with a double truck, carrying an ironclad motor on each. Current is supplied to all the motors by an electric plant which is installed in the special front car, consisting of a 40-horsepower hydro-carbon engine, coupled to a railway generator. Passing by the controller, the circuits are run by cable to the motors, and the speed is regulated by the series-parallel coupling.



KRIZIK ELECTRIC LOCOMOTIVE FOR TUNNELS IN VIENNA.



INTERIOR VIEW OF HYDRO-ELECTRIC PLANT OF RÄTHAUSEN, SWITZERLAND.

An important piece of work which has been completed during the year is the south branch of the Paris Metropolitan, which makes a semi-circular path through this part of the city, running partly in underground and the rest of the way on an elevated structure. Instead of using a single-truck car, the company now employs a double-truck car equipped with two 175-horsepower motors. The Thomson-Houston system has been used to a large extent. On the new line which is to run north and south across town a difficult piece of tunnel work is the metallic caisson construction, laid under the Seine, and near the river. The caisson on the left bank consists of a tunnel section and a circular caisson for the underground station, and the whole is now being sunk below the surface to a depth of 75 feet.

Among the Swiss electric railroads is to be noted the Lausanne-Moudon line, which is 15 miles long, having also a branch line between Savigny and Tumerin. It operates with an overhead trolley at 750 volts. Current is taken for the road from a number of sub-stations which supply direct current. Rotary sets in the sub-stations receive three-phase current from the hydraulic plant installed by the Alioth Company at Montbovon, the high-tension line running at 8,000 volts. Motor cars, either singly or with trailers, are used here.

What is noteworthy about the new Bonn-Cologne line in Germany is that it uses direct current at 600 volts. The road is laid for the most part along the bank of the Rhine, and it has been lately opened for traffic. It is about 10 miles long. Trains are made up of four motor cars in general, carrying 250 passengers. Two 130-horsepower motors run on each car. Current is taken from a double overhead-trolley wire, with rail return. As the road is to handle a large amount of freight, two freight depots are built at the terminals for this purpose.

The La Gruyère electric railroad in Switzerland is 25 miles long and has many heavy grades and a number of curves, so that the trains have a hard wear. On this line is used a type of motor car having four axles, each one carrying a 35-horsepower motor. For the heavier trains there is built a car carrying four 80-horsepower motors. The line runs from Palezieux to Montbovon, through a well-populated region, and has a number of stations. The sub-stations of the line contain rotary groups, consisting of Alioth three-phase motors, coupled to 750-volt railway generators.

From Heidelberg to Wiesloch runs a short electric road which is designed to carry freight especially. Electric locomotives haul material to a large cement factory from the quarries, and they are fitted with two 50-horsepower motors. An overhead-trolley wire brings the current. Generally a 30-ton train runs on the line, made up of a locomotive and three freight cars. On this line not less than 50,000 tons is carried yearly.

A project is on foot to adopt the electric system on all the suburban railroad lines of Berlin, and according to reports it seems that funds are already being secured for the purpose. No less than $45,000,000 will be needed for the whole equipment, including three large power plants, which will supply 60,000 horsepower. The present steam system is working at a disadvantage as regards handling the suburban passenger traffic, and it is recognized that the electric trains will be far superior. It is proposed to begin on the portions of road within the city limits and to finish this part within seven years, while the suburban part will take five years more to complete.

TRAMWAYS.

First among the electric-tramway systems as to importance may be mentioned the extensive series of lines which are now running along the Mediterranean coast, with suburban lines connecting with the city systems of large towns, such as Nice, Monte Carlo, Cannes and Menton. At present there is a continuous line of tramway which begins at Cagnes on one side and runs along the coast for about 30 miles, ending at Menton, and from there it may be run farther. The large cities taken in by the coast line are Cagnes, Nice, Monte Carlo and Menton, each of which has also an extensive system of urban lines. The whole undertaking, which has gone forward by degrees within the last few years, is carried out with Thomson-Houston Paris-built apparatus. It is only within a recent period that the entire 30 miles of coast line has been finished, and in many places this was difficult, owing to the nature of the roadbed, which had to be often cut in the precipitous cliffs of the coast. The usual form of motor car and trailer is used on the coast line, with but few transfers, and the road has proved very popular. Sub-stations along the route furnish the current at 500 volts, while the overhead lines run to these from hydraulic plants at 10,000 volts, working on synchronous motors.

ARMORED CEMENT CONDUIT FOR ENTRAYGUES HYDRO-ELECTRIC PLANT IN SOUTH OF FRANCE.

One of the largest tramway systems to be developed in France is that which is now running in Marseilles, and with the recent extensions a total length of 125 miles is figured for all the city lines. The trolley is used in all cases here, and the cars are fitted with apparatus supplied by the French Thomson-Houston Company. Counting 1.5 miles per 1,000 inhabitants, this seems to be about the largest figure in Europe. The latest reports show an annual traffic of 70,000,000 passengers. A large central station is now running in the city for the tramway current.

The Lucca-Montsumano suburban tramway line in Italy is about 20 miles long and it is supplied with current by a station equipped with low-carbon gas engines, located midway along the course. Direct current at a somewhat higher voltage than usual, 900 volts, is used on the overhead-trolley line. The motor cars carry two 40-horsepower motors each. In the central station are erected three 200-horsepower gas-engine and dynamo sets, which work in parallel upon a large storage battery.

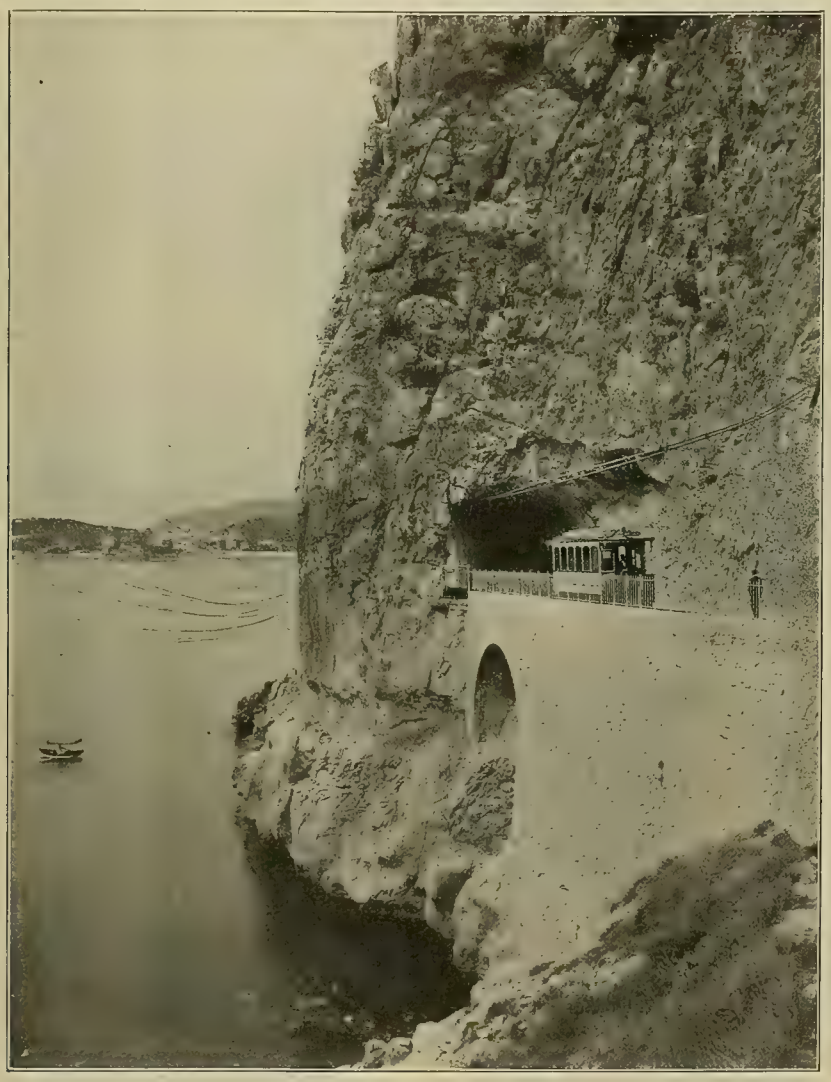
It is proposed to extend the Budapest city tramway lines upon many of the sections, and a connection will no doubt be made by the Budapest Electric Railway Company between its system and the Budapest-Szentlorinczer narrow-gauge electric road leading to the suburbs. Among other undertakings in Austria I may mention the proposed extension of the municipal tramway lines of Prague, which has an increased interest from the fact that steam turbines will no doubt be erected in the station to give the additional current, using the three-phase system leading to a set of sub-stations. The first turbine set will be of 4,500-horsepower.

Turning to surface traction in Paris, the electric tramways are carrying a large amount of traffic and form a great proportion of the city lines. As the use of the trolley is not allowed (except in a few special cases), it was difficult to introduce electric tramways. Examples of the surface-contact, conduit and storage-battery systems are to be seen, including many different systems. The suburban part of the lines is in most cases run by trolley. A road which is much favored by the public is the conduit system installed by the Thomson-Houston Company, which runs cars at very frequent intervals over a long course. This has lately been extended toward the southern suburbs of the city. At the suburb of Malakoff the same company is running a short trial section to experiment with a single-phase trolley line on the Latour system.

Florence now possesses an extensive system of city tramways, which have been installed by the

French Thomson-Houston Company. The generating station contains steam-engine groups, two of which give 700 horsepower, and a third of 400 horsepower, on the direct-coupled system, using multipolar railway generators, which operate at 550 volts. Within the city and also in the suburban lines, the trolley wire is suspended from cross-wires, bracket poles or rosettes. Closed and open cars are run, using two 25-horsepower motors. The lines are operated by the Florence Tramway Company.

Owing to the success of the Elberfeld-Barmen (Germany) suspended road, it is proposed to use the same system for Berlin over a considerable length. As some objections were made to the building of the suspended road, owing to its unsightly appearance, steps are taken to modifying the design so as to comply with esthetic requirements as far as possible. It appears that a trial section of the road will be erected before long, as the municipality has granted permission, and the plans for the structure are now being drawn up by engineers and architects.



MEDITERRANEAN COAST LINE (NICE-MONTE CARLO) ELECTRIC RAILWAY, SHOWING A CLIFF TUNNEL.

The "trackless-trolley" system appears to be coming into favor on the Continent. In France there are a number of such lines already operating at present. Among the newer ones is a recently built line running from Spezzia, Italy, to the suburb of Portovenere, over a route some two miles in length. A double overhead-trolley line is used, with a special form of trolley of the Cantono pattern. On the rear wheels of the omnibus are placed two six-horsepower motors, using 500-volt current. In Germany, what is known as the Schiemann system is used on four different lines. A road car has a special form of trolley pole, mounted so as to give a large swing to the car on the road, some 10 feet on either side of the wire. One of the lines is used for hauling material from the Grevenbruck stone quarries to the railroad station, and has a good traffic, at much less expense than with horses.

Turbo-generator Plants.

The largest steam-turbine plant in Europe is the one which is erected in the suburbs of Paris at St. Denis. Erected in several sections, when fully completed according to the present limits, the plant will afford a total of 150,000 horsepower. Brown-Boveri steam turbines, coupled to three-phase alternators, form a 12,000-horsepower unit, which is the standard adopted. At present four of these groups are erected, and some of them are already running. A well-designed boiler plant is erected, and the entire plant is laid out so that the machines are placed in a long and continuous building. Back of these are erected at intervals a series of boiler houses, each of which is laid out for supplying the four machines which belong to it. When completed, there will be three separate boiler houses and 12 steam-turbine sets, besides some smaller turbine groups. Each boiler room has 24 Babcock & Wilcox boilers, using automatic stokers for the furnaces. Coal is fed from bunkers above the furnaces by means of chutes. The steam-turbine groups operate at 750 revolutions per minute and are coupled to generators wound for 10,250 volts.

In Germany, one of the recently built stations is the Essen plant, which is operated by the Rheno-Westphalian Company, and supplies a large amount of current. Not long since the company decided to use a steam-turbine group, in order to make the necessary extension of the plant, and accordingly installed a Brown-Boveri-Parsons turbine alternator unit, which is rated at 10,000 horsepower and is one of the largest in Germany. The turbine is mounted on the same shaft with a three-phase alternator, and it is entirely enclosed in an iron casing. The alternator is designed to give 5,000 kilowatts at the standard rate, running at 5,000 volts and 50 cycles. Connected on the same shaft is a direct-current generator, rated at 1,500 kilowatts and working at 600 volts. The speed of the turbine in the present case is 1,000 revolutions per minute. Such a turbine has a total length of about 30 feet and measures 10 feet in width, and the weight of the turbine is under 12 tons. The entire length of the group, including turbine, alternator, generator and exciter, is about 65 feet, with a total weight of 210 tons.

The French Thomson-Houston Company is going extensively into the manufacture of the Curtis turbine, for which it has received orders for 32,000 kilowatts, according to the last reports. Accordingly it expects to erect an annex factory for this purpose at Paris. Among the first Curtis turbines which have been installed may be mentioned the two 800-kilowatt units in the Nice Gas Company's plant, a 500-kilowatt group for the Rheims tramways, and a 650-kilowatt set for the tramways of Nancy, France.

In Germany the United Augsburg-Nüremberg Machine Company has taken up the manufacture of the Zoelly turbine, and is meeting with success.

Hydro-electric Plants.

In the north of Italy, where the development of hydraulic power is active and always increasing, one of the largest plants to be erected lately belongs to the Mont Cenis Hydraulic Power Company, and uses a large amount of power from the Cenischia, a mountain torrent. Most of the current is sent over a pole line to the city of Turin. The Mediterranean Thomson-Houston Company secured the contract for the outfit. A high fall of 2,600 feet is secured here, but the plans provide for two separate stations, each one using half the water head. The first plant, already running, has three main 1,600-horsepower turbine-alternator sets, giving 3,000 volts, which is raised to 30,000 volts for a 40-mile pole line.

Milan also takes current to a large extent from a plant erected on the Lessin River. The same plant runs a pole line supplying other towns, such at Pavia and Novara. A 60-foot water head is used. At present there are five turbine sets put in, each giving 1,400 horsepower, and running single-phase 2,700-volt alternators. Step-up transformers give a line voltage of 2,500 volts, and about 18 high-tension lines branch out from the plant to the different localities, covering a large extent of country. The line going to Milan is 18 miles long.

On the Aar River in Germany is erected a 10,000-horsepower plant, which runs on a 30-foot water head and distributes current over the surrounding region for lighting and power in many towns and villages. Designed for seven main waterwheel groups of 1,500 horsepower each, the power house has three of them running at present, using 1,000-kilowatt Lahmeyer alternators, working on 10,000-volt three-phase current. This is sent at once into the pole lines without raising the voltage, but on some of the lines there are transformer stations which raise the voltage to 25,000 volts for some of the longer lines. One of the pole lines is to run as far as Basle.

In the Isère region of France the Livet plant, on the Romanche River, is one of the newest, and it sends current over a pole line to the city of Grenoble, where it is received in a large sub-station. At present there are installed three main sets of 2,000 kilowatts each. The city of Grenoble is one of the best supplied in France, so far as power is concerned, as it also has a line coming from the large Fure and Morge hydraulic plant. About 70 transformer cabins are erected in the town, and a large amount of current is used for public and private lighting or motors.

At Viterbo, Italy, is a hydro-electric station erected not long ago on the Marta River. It is laid out to receive three turbine-alternator sets of 700 horsepower each. This is one of the few plants to use Italian apparatus throughout. It is intended to use some of the power for the new electric road which will run from Rome to Civita Castellana. At present there are two three-phase lines running from the plant to a sub-station in Viterbo, working on 10,000 volts.

Venice receives current from a hydraulic station erected on the Cellina River and equipped with Brown-Boveri apparatus. A 190-foot head of water is used, and it is supply two different plants. The one erected at present at Montereale is in working order, and the second plant will be built later on. Each of them is designed for 15,000 horsepower, containing six principal turbine-alternator sets. Allowing for line losses, Venice has a supply of 10,000 horsepower from this source at present. The overhead line uses 36,000 volts and is 55 miles in length.

In the Coast Alps region in the south of France the Compagnie Enérgie Electrique is operating a number of plants and is erecting new ones which form an extensive system, as they are connected together by the pole lines. Current is furnished to Nice, Monte Carlo, Toulon and other places, and Marseilles will soon have a supply. Erected mainly for sending current to Toulon, the new Entraygues plant now delivers 3,000 horsepower.

The Argens stream gives the power, and it is used on a 40-mile line. One of the points about the hydraulic work is an armed cement conduit, 10 feet in diameter, laid underground for 1,600 feet.

Current from the Freyung (Bavaria) plant is used mainly for carbide manufacture, and gives about 2,500 horsepower for this purpose. It is situated below the confluence of the Saussbach and Rechbach rivers and contains three groups of 800 horsepower each, using Allgemeine machines. An annual production of 4,000 tons of carbide is expected from the plant. At Barcena, Spain, electrolytic works for soda manufacture are run from a hydro-electric plant which contains three groups of 500 horsepower, with turbines coupled to 1,400-ampere 120-volt electrolytic machines.

To supply the city of Lucerne, Switzerland, a 1,500-horsepower hydro-electric plant has been erected at Rathausen. The alternators here are of the horizontal type, the turbines having vertical shaft. There are five of them, each of 300 horsepower, turning at 60 revolutions per minute.

Electric Lamps.

The present year has brought out many methods of making metallic filaments of tantalum and allied metals. A Berlin company brings out what it calls the osram filament, which no doubt contains osmium and tungsten. It is declared that the new lamp has a thousand-hour life and takes one watt per candle, and it is made in 32 and 50-candlepower sizes, running on 100 volts. From Germany comes also the Kuzel filament, whose chief novelty lies in the fact that the inventor succeeds in obtaining titanium, tantalum and other metals in the colloidal state, so that the resulting plastic mass can be easily made into filaments. Driving off all but the metal by heat, he lays claim to a superior filament.

Quite another method is used by Just and Hanaman, who take a carbon filament as the base, and by placing it in tungsten chloride gas they bring a coat of the metal on the filament by flashing; then the carbon is burned out by the current, leaving only the metal. In Paris, tantalum lamps are now to be seen on the market in many places. They are mostly of the 50-candlepower type and are guaranteed at 1.6 watts per candle. A patent for a new zirconium lamp has been purchased by the Lacarrière Company, and it is stated that it is to put up a factory for making the lamps.

Mercury-vapor lamps are commencing to meet with favor in some of the large cities on the Continent. In Paris many of them are used for lighting the exterior or the inside of shops, especially on the boulevard and the main streets. This year [I am writing under date of December 10, 1906] it is expected to make use of them to a great extent in the ornamental lighting of the Grand Palace, on the occasion of the December Automobile Show. Here are to be used about 80,000 incandescent lamps.

The Allgemeine Gesellschaft of Berlin is bringing out a mercury-vapor lamp in connection with the Heraeus firm. Its novelty lies in the fact that it is made entirely of quartz. However, the cost is said to be low, and it can replace arc lamps in many cases. The voltage runs as high as 500 volts at present. What is known as the Hahn lamp is a combination of a mercury-vapor lamp and several incandescent lamps, which are run below voltage, so as to give an orange-colored light. This adds the rays which are absent in the mercury-vapor lamp, and is quite an improvement.

Telegraphy and Telephony.

This is the first year in which the French Army made an extensive use of field telephones during the annual maneuvers. Special field apparatus had been constructed, and ground lines were run between the general's headquarters to many posts. During the maneuvers the telephone played an important part, so that the War Department is convinced of its value and will bring it forward still further in the future. Since then a new feature is the use of motor-cycles for laying the wire, and it can be run along three or four times as fast as by the usual methods.

Not long ago the French government decided to transfer the postal and telegraphic department (including telephones) from the supervision of the minister of commerce to that of the minister of public works, and it is thought that the change will bring about an improvement, at least in the telephone system, which is certainly much needed.

Reports come from Germany about a tele-photographic system invented by Dr. Korn, who, it is claimed, succeeds in transmitting photographic images at a distance of several hundred miles of line.

The Spanish government, which controls the telephone and telegraph lines, is taking measures to improve the existing systems and bring them up to date, and will no doubt purchase new instruments on a large scale. A higher school of telegraphy is to be established. To carry out the needed reforms a special commission is appointed. On the other hand, the Italian government is endeavoring to secure control of telephone systems which are now in the hands of private companies, and at the same time wishes to extend the lines considerably. It is proposed to reimburse the companies by means of annual payments. Two of the leading telephone companies are willing to consent to this plan, and they would turn over to the government 24 city systems, including those of Rome, Naples, Florence, Milan, etc., besides 15 long-distance lines.

Berlin will be one of the first cities on the Continent to adopt the general use of public telephone cabins placed in the streets. These are to replace a formerly used type of kiosk, and in order to have a good appearance they will be selected after a competitive test of designs. Carrying a four-dial clock at the top, on the inside they are to be fitted with automatic telephone apparatus.

Radio-telegraphy.

Some of the most important results on the Continent with "wireless" have been obtained during the year in Germany, and the Nauen station is now one of the largest. It lies some 25 miles from Berlin. Using an iron tower over 600 feet high, with a network of 770 wires running down from it, the plant is run in connection with a battery of 360 Leyden jars. Messages were sent to the steamship Bremen at 1,500 miles distance and also to St. Petersburg, 820 miles. The Berlin Space Telegraphy Company, which operates the above plant, also installed two mountain stations in Switzerland upon elevated points. One of these is placed upon the Righi-Scheidegg, and the second is at Fort Stöckli, with 25 miles between them. Signals can be also received at these stations from the station at Nauen, which is about 500 miles off. Another of the large German stations is located near Emden, at Norddeich. Not long ago the cruiser München made a trip through the North Sea to make experiments, and it was found that messages could be sent at 1,150 miles distance, but the mast carried by the vessel was not high enough to go further, and the Vineta, which is better equipped, will continue the work.

The French Space Telegraphy Company of Paris is operating the Popp-Branly system, and one of the largest outfits is installed in Roumania, at Costanza, where the coast station is to send signals to other points on the Mediterranean and to ships. Some of the vessels have been equipped for the purpose, and they take signals at 300 or 400 miles, but one of them having a 90-foot mast can receive them as far as Constantinople.

Using the Eiffel Tower as a station, the French government is making experiments to send signals to fortified points on the coast or the islands or else to war vessels. Some of the tests made upon the Mediterranean seem to have met with success, and they are being carried further at present, with expectations of working to Algeria or Tunis. The French Thomson-Houston Company is going into space telegraphy on the Continent and has already put in a number of stations in Austria, Germany, Spain and Holland.

In Austria-Hungary the government is commencing to carry out operations on the Adriatic coast under the direction of the minister of commerce. The first stations will be placed at Fiume and Ancona, and, if successful, they will be definitely installed and increased. It is expected to signal to the islands in the Adriatic, which have not had any telegraphic connection hitherto.

VIEW IN FLORENCE, ITALY, SHOWING TROLLEY LINES.

Rubber Importations.

The popularity of the bicycle and automobile, coupled with the increased use of electricity in the daily affairs of the people, has increased enormously the importation of rubber. That article shows now a larger value in the import list than almost any other single product. The value of rubber imported in the crude state in the year about to end will aggregate nearly or quite $50,000,000, and if to this is added the value of old and scrap rubber intended for remanufacture, the total for the calendar year 1906 will considerably exceed $50,000,000. The value of rubber imported in the calendar year 1896 was but $15,500,000, or less than one-third of the prospective total for the year 1906, thus indicating that the value of rubber imported has increased more than 200 per cent. in a decade.

This increase in the value of rubber imported is due, in part, however, to the advance in price caused by the great increase in demand in various parts of the world, and especially in the United States, which now consumes more than one-half of the rubber crop of the world.

These figures of rubber imported, supplied by the Bureau of Statistics, Department of Commerce and Labor, include only that brought in in the crude state. In addition to this, there were brought into the United States during the 10 months ending with October more than 18,000,000 pounds of old and scrap rubber for remanufacturing, and 12,500,000 pounds of gutta joolatong, an article somewhat similar to rubber, which is mixed with india rubber for use in the various industries. In addition to this, there was imported 326,053 pounds of gutta-percha, which is used chiefly in the manufacture of submarine cables. Brazil is the chief contributor to the rubber supply of the United States.

This growing demand for rubber and the reduction of the natural supply, owing to the crude and often reckless manner in which the supplies are gathered from the rubber forests of South America and Africa, have resulted in the establishment of rubber plantations in India, Ceylon, the Malayan Peninsula and Java, and these have already given such assurance of success as to justify the assumption that rubber cultivation is to become an important industry in the tropical world. Data collected by Philippine botanists and collectors show that the climate, soil and other conditions of the Philippine Islands are favorable to rubber and gutta-percha, and government nurseries have been already established in the islands for the distribution of rubber plants for use of rubber plantations.

American Association for the Advancement of Science.

The American Association for the Advancement of Science held its annual meeting at Columbia University, New York city, the session commencing December 27, 1906, and lasting for a week. Practically every branch of scientific progress was represented at the meeting, as 20 of the leading scientific societies of America are affiliated with this association.

At the opening session on Thursday Dr. Nicholas M. Butler, president of Columbia University, delivered an address of welcome, which was responded to by the new president of the association, Dr. W. H. Welsh of Johns Hopkins University.

In an address declaring strongly for all-around education, Dr. C. M. Woodward, president of Washington University of St. Louis, summed up the whole matter by saying that it would be beneficial if the American association could establish two things. First, that usefulness does not impair educational values, and, second, that a so-called culture study, like Latin, may properly stand side by side with manual training in the curriculum. "I see nowhere," he said, "a people whose youth have been trained as our Americans should be trained. No narrow, selfish aim, no prejudice of caste, no false claim of high culture, which scorns service, must mislead the growing, expanding minds. Give them a generous, symmetrical training, open wide the avenue to usefulness, to happiness, to power, and this age of scientific progress and material wealth shall be also an age of high intellectual and social achievement."

The different sections of the society proceeded with the consideration of papers on matters connected with their own particular fields.

On Friday an important discovery in connection with radium was announced. A paper read by Dr. Bertram B. Boltwood and confirmed by another, read by Professor Rutherford, announced that it was now established that radium could be obtained from actinium, which was itself a derivative of uranium.

Professor Rutherford is said to have stated afterward that his contention is confirmed that radium is in its present condition only for a temporary period. "It is derived from something else," said the professor, "and in time will become something else."

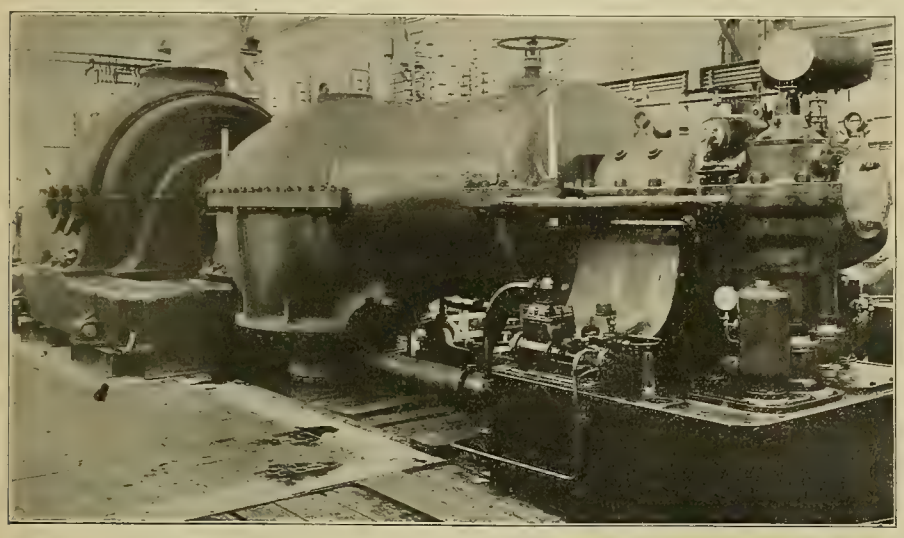
On Saturday an unusual incident occurred when a paper on "A Characteristic of the Most Masterful Nations," which had not been approved, was presented. The author, after an elaborate apology for his lack of scientific eminence, said: "A characteristic of masterful nations is that they touch the earth with their feet, as little as possible with the rest of their bodies, and hardly ever with their heads. By this means they get the benefit of a mysterious current passing up from the earth through their feet to their bodies." But it turned out that the paper had not been passed upon in due course, and the interloper was informed that he could not be heard.

Before the Economic Section it was announced that steps have been taken to promote the formation of a national department of health. Among those invited to form a general committee is Thomas A. Edison.

The members of the association were entertained at luncheon on Saturday afternoon by the College of the City of New York in its new buildings at One-hundred-and-thirty-eighth Street. Two papers were read upon Niagara, in the first of which Dr. John M. Clark put forward a vigorous plea for the preservation of the Falls.

In the evening there was a reception to the association at the Natural History Museum by the trustees of the museum and the New York Academy of Sciences.

Among the other social features was the reception at Earl Hall, which was followed by a smoker at the Columbia Faculty Club. Other informal dinners and gatherings occurred and at the American Museum of Natural History an evening exhibition on scientific lines was given.



VIEW IN ST. DENIS POWER HOUSE NEAR PARIS, SHOWING 12,000-HORSEPOWER TURBO-ALTERNATOR.

Street-railway Subway for Spokane.

A subway project costing nearly a million dollars to connect the freight and passenger terminals of the Spokane and Inland Railroad Company will be submitted to the City Council of Spokane, Wash., and a franchise asked. The proposed tunnel would be nearly a mile long, would follow beneath Front Avenue for nearly the entire distance, and the floor of the tunnel would be about 30 feet from the surface of the street.

The franchise asked for provides for a double-track tunnel from the passenger station at Main Avenue to Front Avenue, under Lincoln Street, thence under Front to about Center Street, between Bernard and Browne, thence diagonally from Front Avenue, coming out into the freight grounds of the company at some point between Division and Sheridan streets, with the right to carry power lines for the operation of its electric-railway system.

Jay P. Graves, president of the company's says the company has found in the operation of its trains to Cœur d'Alene and the Palouse country that it takes 10 minutes to pass a train over the city streets from the passenger station to Erie Street, which means a loss of time to all through passengers who wish to reach their destination either in city or country. Also it is more or less dangerous to operate such heavy trains through the city, and the company desires to remove this by taking the heavy traffic off the streets. The company has been giving consideration for the last year to in some manner overcome this. After a good deal of thought on the part of the engineers the proposed subway has been suggested.

Indiana Public Utilities Association.

The Indiana Public Utilities Association, composed of the managers of electric-light and power plants in the state, was organized in Indianapolis on December 27th. The object of the association is to bring into closer touch the managers of electrical plants in a social way, and more particularly to promote discussion on the general management of the business of generating and distributing electricity for light and power purposes. During the meeting of the association, it was stated that the electric-light companies of Indiana were experiencing serious trouble in obtaining fuel supplies for their plants, and it is the purpose of the association to appeal to the railroad commission for a remedy. A constitution and by-laws were adopted and provision made for the annual meeting of the new association.

The following officers were elected: President, B. W. Hubbard, Mooresville; vice-president, Wm. S. Meade, Spencer; secretary, J. A. Shank, Peru; treasurer, Dr. J. A. Craig, Greenwood. The board of directors includes, besides these officers: W. B. McDonald, Evansville; S. B. Harting, Elwood; W. S. Draper, Ligonier; Geo. N. Lidd, Marion; F. A. Bryan, South Bend; Geo. G. Bryson, Brazil; C. E. Layton, Noblesville.

Storm Indicator Intercepts Wireless Message.

In response to a request from the Western Electrician, Rev. F. L. Odenbach, S. J., director of the meteorological observatory at St. Ignatius College, Cleveland, Ohio, sends the following account of the interception of wireless messages by the ceraunograph or thunderstorm indicator. This instrument, used in the St. Ignatius observatory, is a device similar to the receivers used in wireless or radio-telegraphy, and was described in the Western Electrician of November 30, 1901.

Father Odenbach writes:

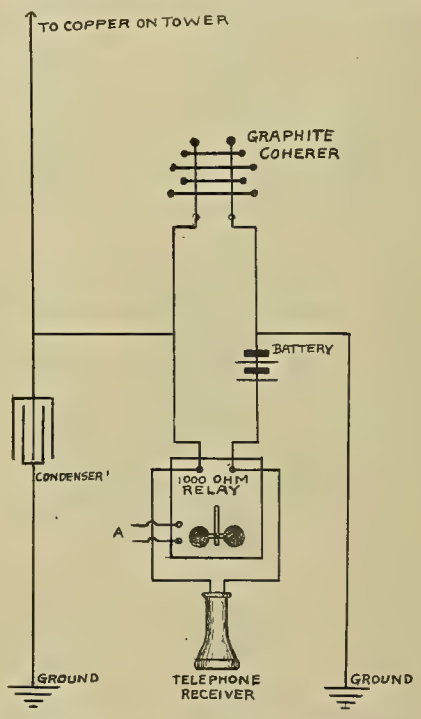
"The ceraunograph, as described in the Western Electrician some years ago, has been in use all along and has recorded every thunderstorm which passed over Cleveland without a single exception. Its range as set now is about Chicago, St. Louis, etc.

"I have suspected for a long time that the instrument was affected by something else than thunderstorms. The sound of the decoherer reminds me very much of the rhythm of a telegraph instrument. I have tried at different times to catch the code by means of a telephone, but never succeeded.

"Some time ago I acquired a very good receiver to be used in testing different lines and instruments in the observatory, and I used it also to see if enough electricity got over my coherer in the ceraunograph to necessitate a frequent change or charging of the battery.

"In making the test I bridged the 1,000-ohm relay and was at once aware of the fact that I was listening to a message in Morse code. I am not an expert myself at telegraphy, so I called in one, and he pronounced it Morse code.

"We found that we were getting the dispatches between the Clark stations of Detroit and Cleveland.



The secondary at (A) goes to the electromagnet of the registering device, which in the present form acts as decoherer.

CERAUNOGRAPH OR THUNDERSTORM INDICATOR AS USED TO RECEIVE WIRELESS MESSAGES.

"Now, in all my experiments in former times, I never thought of short-circuiting the relay; it is, however, the only way in which I can catch the messages. The accompanying sketch will give an idea of the combination.

"The wireless messages do not interfere with the work of the ceraunograph, since I am able to cut it out by tension of the relay spring.

"The relay does not seem to be quick enough to render the Morse signals, but in the telephone they are heard as clearly as any ordinary conversation.

"I have tried every other combination in the system, but find that this is the only one which will give the effect."

The Consumers' Electric Light and Power Company turned on its current for the first time for public lighting in New Orleans, La., on December 18th. The company has erected an extensive plant, and the first tests were satisfactory.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

FUNDAMENTALS *are important and always important. It is the fundamental, underlying principles of the art which will be treated in the serial on "Elements of Electrical Engineering," by Mr. George R. Metcalfe, which will be begun in the Western Electrician of February 2, 1907, and run through thirty issues or more. The author is a technical writer of wide experience, and in his series of "practical talks" he purposes to "discuss and explain in as simple language as possible some of the important features of electrical engineering practice, together with descriptions of the construction and design of the machinery and instruments in common use." All beginners, all practical men seeking help, all engineers who want to "brush up" will find this series of real assistance. It will be begun in the issue dated February 2d.*

ELSEWHERE in this issue are reviews of the electrical engineering progress of the year 1906 in the United States, in Great Britain and its colonies and in the Continent of Europe. There are also presented the annual estimates of the Western Electrician to show the value of machinery and apparatus manufactured in the United States during the year for electrical use. In addition there is a table showing the value of electrical exports from this country by months and an interesting Business Review of the year.

In this mass of material the electrical history of the year just closed is pretty well expressed. It is shown that 1906 was a year of extraordinary prosperity in the United States, electrical and otherwise, while from Europe the reports indicate a good year on the Continent, but an unsatisfactory one in Great Britain.

The altogether remarkable swelling of the tide of electrical business in this country during the year is shown by the Western Electrician's New Years estimates, which indicate that the value of electrical and strictly allied manufactures in the United States increased from $268,000,000 in 1905—the banner year up to that time—to $351,000,000 in 1906, showing the unprecedented rate of growth of 31 per cent. While this increase is largely due to the rise in prices, it also demonstrates a greater volume of business; and the figures, which are given in detail on the opposite page, indicate in a striking manner the size and importance which the electrical industry has now attained.

In electrical exports, too, the total is larger than ever before in the history of the country. With the month of December estimated, the amount of such exports, expressed in dollars, is $16,747,790. This is to be compared with $13,057,677 in 1905, showing an increase of 28 per cent., or almost as great an expansion as in the case of the domestic trade. Electrical exports are almost equally divided between electrical machinery and electrical appliances (including telephone and telegraph instruments).

One conspicuous feature of the year has been the increasing strength and importance of the "co-operative electrical development" movement in this country, which was set on foot in 1905. This movement has for its object the zealous promotion of a more extended use of electricity for light, heat and power on the most modern lines of intelligent, enterprising salesmanship. It is intended to benefit, and has in fact benefited, the sellers of electric current and the sellers of electrical appliances—in fact, all engaged in the electrical industry. Started by the makers of incandescent lamps and placed in the charge of a man of singular energy and enthusiasm, this movement has been taken up by other branches of the industry, and there seems to be no doubt that the formal incorporation of the Co-operative Electrical Development Association will follow early this year.

Electric lighting has been marked by the great attention paid to metallic filaments for incandescent lamps, such as those of tantalum, tungsten and osmium. These lamps are of higher efficiency than those now employed; that is, for a fixed amount of light they require less current; and there are not wanting those who declare that the carbon filament is doomed. However, there are difficulties in the manufacture and use of these newer lighting units, and their widespread use, while probable, is not certain. Flame arc lamps are used in increasing numbers, and the same may be said of Nernst lamps and mercury-vapor lamps. The vacuum-tube lighting system is also attracting increased attention.

Although organized late in 1905, the Illuminating Engineering Society is practically a creature of 1906. It promotes the scientific study of problems of illumination—a subject of much importance which has not had the attention it deserves. This new society is doing good work and has waxed in size and influence in most encouraging fashion. Its formation is another evidence of the modern tendency toward specialization, observable among electrical engineers as well as other professional men.

The electric railway continues to exhibit the most vigorous development. The New York Central terminal electric-railway service in and near New York city is partially in operation, and other installations of great magnitude are under way in or near that city, notably the improvements in the Pennsylvania and Erie railroad systems. In many other parts of the country—in fact, one might say in all other parts of the country—new electric railways or electric-railway extensions are building. In Chicago the long-drawn-out traction controversy bids fair to be settled within a few months, and then will be begun the work of rehabilitating the street-railway lines, which will involve a large expenditure, perhaps $40,000,000. Single-phase apparatus is used to an increasing extent on interurban railways.

Municipal-ownership sentiment seems to be less rampant; the fever has abated somewhat. In its place there is a tendency to entrust the work of conducting public utilities to private interests, provided prescribed regulations as to compensation and service are carried out. This plan also reserves to the municipality the right to take over the enterprise if it finds such a course desirable or if the private concern is derelict. Thus the newer municipal ownership is potential rather than actual.

Long-distance power transmission plants continue to increase in number, with higher voltages of transmission and longer distances covered. At the present time possibly 100,000 volts for the one and 200 miles for the other seem to be limits of practice in this direction, but in a few years these indefinite metes and bounds may be considerably exceeded.

Steam turbines seem finally to have triumphed completely over reciprocating engines for large electric power houses. Turbo-alternators are now made in very large sizes, up to 10,000 kilowatts, or perhaps of even greater capacity. Indeed, this is a day of large things—transformers of 7,500 kilowatts capacity, high-tension insulators that are measured in feet rather than inches, and so on.

There was a greatly increased demand for telephonic apparatus during the year, both of the Bell and Independent types. The Western Electrician's table shows a jump in value of nearly 50 per cent. over last year, and this is probably a conservative estimate. In the manufacture of telephones, as indeed in other electrical manufactures, an increased effort to standardize all apparatus is manifest. During the year the tendency has been toward a better grade of apparatus. As a well-known telephone engineer remarks, specification requirements are continually becoming higher; the limits of allowable variation in manufactured parts are narrower, and the inspection to which all apparatus is submitted is more rigid. The increased demand is due both to new exchanges and extensions in cities and towns and to the great extension of telephone service among the farmers.

In "wireless" the event of the year was the Berlin International Wireless Conference of last October. All of the large progressive nations of the world were represented at this conference, and an agreement was drawn up by which coast stations and ship stations are bound to exchange wireless messages reciprocally without regard to the particular system adopted by these stations. The United States, with France, Germany and many other nations, but without Great Britain, adopted an additional undertaking for compulsory ship-to-ship communication. But these conventions have not been ratified as yet, at least not by Great Britain and the United States, and in the case of the former nation there is some doubt whether even the main agreement will be, for the government has given notice that it will appoint a parliamentary commission to examine the question first. The conference agreed that "radio-telegraphy" should be adopted as the name of the art.

The death-roll of the year contains some well-known names, as those of Professor Curie of France, Professor Popoff and Carl von Siemens of Russia, Professor Drude of Germany, Theophilus Varley and James Dredge of England, and Henry Rustin, Lemuel Bannister, Dr. Otto A. Moses, Philip F. Kobbe, B. H. Warren, Arthur Vaughan Abbott and Wallace C. Johnson of the United States.

STATISTICS OF ELECTRICAL MANUFACTURES.

As shown by the annual New Years estimates of the Western Electrician, given below, the value of electrical and closely allied manufactures in the United States in the year 1906 amounted to the great sum of $351,010,000, by far the largest in the history of the industry. Compared with the corresponding figure of $268,075,000 for 1905, the increase is seen to be $82,935,000, or 31 per cent. This is a tremendous increase, especially as 1905 was itself a very prosperous year, advancing 16 per cent. over the preceding year.

It was known before these estimates were made up that the year just closed had been one of unparalleled prosperity in all lines of industrial activity in this country, and an average increase of 20 per cent. would have been accepted as gratifying but not surprising. But when the total was reached, and the increase was shown to be 31 per cent., it was at first suspected that there must be some error, as it was doubted whether the jump had been so great. Going over the various items again, however (and these estimates are based on underlying estimates supplied by a large number of the best-informed men in the various lines represented), there was every reason to believe that the figures were just and reasonable, and the conclusion was reached that the total was an approximately accurate one.

Of course no pretense is made that these figures are of minute accuracy. They are just what they pretend to be, estimates based on information kindly furnished by experts as the year is closing. But they are very far from being guesswork; they are founded on the shrewd estimates of many men actually engaged in the business and having expert knowledge. The Western Electrician has been publishing these estimates annually for eight years, and just as the figures faithfully revealed the setback of 1904, they show with equal fidelity the truly marvelous advance of 1906.

The figures given are intended to show the value of the machinery and apparatus manufactured in the United States for electrical use. Some of the items are not "purely electrical," if, indeed, there can be any tangible object which can be so termed. But when a hydro-electric plant is built which depends entirely for its existence on the fact that power may be electrically transmitted, the waterwheels, generators, transformers, switchboard, poles, wires, rotaries, etc., are all, surely, to be counted as a part of the electrical development—machinery and apparatus that would not be needed if there was no such thing as electrical power transmission. But the buildings, foundations, real estate, etc., are not included, for the inquiry is limited to manufactures. A similar rule may apply to electric railways and forms the general principle on which the classification is made. The idea is to survey in a broad, statistical way the whole activity of electrical development and to show its yearly advances or reverses.

In accounting for the increase it is to be remembered that it is due not only to increased volume of business but also to a great extent to higher prices. Thus, the value of bare wire sold for electrical use as such is shown to have increased from $20,000,000 in 1905 to $33,000,000 in 1906. This is due not alone to increased poundage, but also to the greatly increased price of copper. And similarly, through the whole list, both price and volume of business have their effect.

Nearly all the items constituting the table show a large increase. An exception is the case of reciprocating steam engines for electrical plants, valued at substantially the same as last year. Steam turbines and gas engines, however, show large gains. Belting shows a decrease, which is not surprising, but the decrease in underground conduit is explained by the fact that the valuation for 1905 was perhaps too high.

Grouping the figures given below on broader lines, the result is as follows: Wires and cables, $88,625,000; dynamos and motors, $74,000,000; telephone apparatus, $28,500,000; prime movers of all kinds, $27,750,000; cars and trucks and distinctively railway apparatus, $15,700,000; boilers and auxiliary power-house plant, $14,425,000; lamps of all kinds, $13,125,000; batteries, primary and secondary, $8,775,000; poles, $7,500,000; all other, $72,610,000; total, $351,010,000.

To the large number of friends who assisted in the preparation of the estimates herewith submitted to the electrical public the Western Electrician returns its cordial thanks.

WESTERN ELECTRICIAN'S ESTIMATES OF THE VALUE OF THE ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

Articles.	For the Year— 1903.	1904.	1905.	1906.
Arc lamps and appurtenances	$ 2,025,000	$ 2,200,000	$ 2,600,000	$ 3,225,000
Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc.	1,950,000	2,300,000	2,725,000	3,275,000
Bells, buzzers, push-buttons, call-boxes, annunciators	800,000	900,000	1,000,000	1,250,000
Belting used in electrical plants	575,000	500,000	550,000	450,000
Boilers for electrical plants (water-tube)	4,500,000	5,600,000	6,750,000	7,500,000
Boilers for electrical plants (other than water-tube)	2,000,000	2,800,000	2,850,000	2,750,000
Cables, underground, aerial and submarine	19,700,000	16,500,000	17,750,000	22,000,000
Carbons for lamps, batteries, brushes or other electrical purposes	2,600,000	3,100,000	3,000,000	3,500,000
Cars and trucks for electric railways	7,500,000	7,500,000	8,000,000	11,750,000
Circuit-breakers	1,200,000	1,350,000	1,450,000	1,700,000
Conduits (underground) and similar material	2,350,000	2,650,000	3,300,000	2,900,000
Conveyors, coal and ash, used in electrical plants	750 000	800,000	900,000	900,000
Cranes and hoists, electrically operated	4,750,000	3,875,000	5,250,000	6,750,000
Dynamos and motors, including parts of machines, boosters, rotary converters, motor-generators, etc., and all motor applications, such as automobiles, not specifically enumerated in this list	52,000,000	51,000,000	60,000,000	74,000,000
Electroplating and other electrolytic apparatus not elsewhere specified	300,000	250,000	800,000	1,000,000
Electrostatic machines, induction coils, medical sets, etc.	425,000	550,000	575,000	550,000
Elevators, electric (mechanism only)	2,000,000	2,000,000	4,350,000	5,500,000
Engines, gas, gasoline or oil, used to drive electrical machinery	1,500,000	1,800,000	2,500,000	3,500,000
Engines, steam (reciprocating), used to drive electrical machinery	16,500,000	14,500,000	13,350,000	13,500,000
Fans, electrically operated and direct-connected	1,450,000	1,200,000	1,375,000	1,575,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc.	950,000	1,100,000	1,400,000	1,850,000
Fixtures for electric lighting	4,250,000	4,125,000	4,750,000	5,300,000
Fuses	250,000	300,000	650,000	900,000
Glassware, electrical	450,000	600,000	700,000	900,000
Heating and cooking apparatus, electrical	325,000	425,000	650,000	850,000
Incandescent lamps	5,400,000	5,750,000	6,625,000	8,600,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc.	3,850,000	3,850,000	4,200,000	5,000,000
Insulating material, fibre, tape, etc.	1,400,000	1,600,000	1,800,000	2,300,000
Insulators (glass and porcelain)	1,900,000	1,550,000	1,700,000	2,100,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc.	1,950,000	1,975,000	2,250,000	3,000,000
Lightning arresters	470,000	450,000	500,000	525,000
Mercury-vapor lamps	30,000	60,000	125,000	350,000
Nernst lamps	450,000	425,000	880,000	950,000
Poles, cross-arms, brackets and pins	4,700,000	4,850,000	5,400,000	7,500,000
Primary batteries	775,000	800,000	1,200,000	1,825,000
Radio-telegraph apparatus	250,000	380,000	400,000	475,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc.	2,150,000	1,900,000	2,200,000	3,000,000
Rheostats, car controllers, motor starters, etc.	3,400,000	2,850,000	3,250,000	4,600,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	400,000	285,000	750,000	800,000
Sockets, switches, cut-outs	3,675,000	3,800,000	4,150,000	5,500,000
Steam turbines used to drive electrical machinery	1,200,000	2,500,000	4,000,000	8,000,000
Storage batteries, including those used on automobiles	5,000,000	5,000,000	6,200,000	6,950,000
Telegraph instruments and apparatus	200,000	265,000	300,000	375,000
Telephones, telephone switchboards and distinctively telephonic apparatus	19,500,000	17,200,000	19,200,000	28,500,000
Third rail for electric railways	500,000	715,000	750,000	950,000
Transformers, stationary	4,500,000	4,450,000	5,175,000	6,850,000
Waterwheels, used to drive electrical machinery	1,500,000	1,230,000	1,700,000	2,750,000
Welding apparatus, electric	.....	.....	95,000	110,000
Wire, bare	18,350,000	18,000,000	20,000,000	33,000,000
Wire, rubber covered	8,250,000	8,200,000	11,000,000	14,000,000
Wire, weatherproof	9,000,000	8,500,000	9,500,000	15,000,000
Wire, all other electrical	2,700,000	2,500,000	3,500,000	4,625,000
Miscellaneous, including switchboard frames and panels, signs and flashers, automatic stokers for electrical plants, wire guards, electrical tools and toys, projectors, solenoids, igniters for gas engines, waterwheel governors for hydro-electric plants, voltage regulators, electric drills, commutator compounds, lamp adjusters, etc.	2,150,000	3,500,000	4,000,000	6,000,000
Total	$234,750,000	$230,510,000	$268,075,000	$351,010,000

BUSINESS OF THE YEAR 1906 IN REVIEW.

There appears [illegible] no dissent to the opinion that the year [illegible] was an exceedingly prosperous one for the electrical and allied industries of the United States. Indeed, the only complaints are such as are distinctly due to good times—high prices of labor and material and the possible danger of over-rapidity and overproduction. The year has been a remarkable one in the large volume of business and the high level of prices which it has witnessed. Therefore the following condensed letters, reviewing the electrical trade of 1906 in various branches, are of quite exceptional interest.

Batteries, Primary and Secondary.

Electric Storage Battery Company, Philadelphia (Charles Blood, third vice-president): Our business during the year has been satisfactory. There have been developed many new methods for the profitable use of storage batteries, and, with the regulation of alternating-current systems, [illegible] with the numerous use of batteries along standard lines, insures a satisfactory business for the coming year.

Helios Manufacturing Company, Philadelphia (G. H. Rettew, general manager): We manufacture storage batteries for electric vehicles, and the rapid increase in the number of automobiles which are being used, and the rapid strides made in electrical vehicles particularly, has resulted in a tremendous demand for storage batteries for this purpose. Until a few months ago the radius of electric vehicles on one charge was limited approximately to fifty miles. We, however, are now supplying one grade of battery on which some record-breaking runs have been made, and 100 miles for this battery have already been made. As this has greatly increased the active radius of electric machines, it, of course, has had a tendency to greatly increase the sales of vehicles of this description. Having personally seen several of the largest manufacturers of electric vehicles during the past two months, I feel that I can safely say that all of the vehicles which can be manufactured of this description will find a very ready sale during the year 1907—in fact, I believe the demand will far exceed the maximum output of our factories. Several new factories have sprung up and several high-grade machines are now on the market, and as they possess some advantages over the internal combustion engine machines, they, I think, will become more and more in demand, particularly for city service.

Rock Island Battery Company, Cincinnati (M. A. Loeb, secretary and treasurer): We are pleased to say that our business for the last twelve months has been very satisfactory. We, of course, were a little bit knocked out the first few months on account of our fire. However, notwithstanding this unfortunate occurrence, our business for the year 1906 will show a very marked advance over the year previous. Besides doing a very satisfactory business in our regular course of trade, we have shipped a great many of our batteries to foreign countries, with the very best results, and from all indications we look for a very large and satisfactory business during the coming year. The only bad feature in our business is the very marked advance in the cost of all raw materials which we use and which, we are afraid, will oblige us to raise the price of our product to our customers. We shall, however, not do so unless we are absolutely compelled to.

Conduit, Underground.

McRoy Clay Works, Brazil, Ind. (E. F. Kirkpatrick, sales manager, Chicago): The manufacturers of conduit for underground electrical wire subways enjoyed a very splendid business in 1906. The amount of conduit made and sold in the last twelve months was greater than in any previous year in the history of the business. All telephone wires between New York city and Philadelphia were "subwayed," as were also all telephone wires between New York city and Boston and between New York city and Providence. The New York City Railway subway used millions of feet of conduit, as did also the Pennsylvania Railroad and the New York Central Railway in the great tunnel construction now nearing completion by those corporations. All telephone wires between Chicago and Milwaukee were also put "under the sod" during 1906, while telephone, electric-light and street-railway companies in various cities extended their subways. The "deadly overhead wire" has become one of the most stupendous factors in municipal life, and not only the insistent demand for public safety, but economy of operation, are factors which argue well for the placing of all wires underground. Notwithstanding the great volume of conduit business in the last few years, the original manufacturers thereof have not made as much money as in the earlier period of underground subway construction, due to low prices brought about by inferior conduits made by sewer-pipe and brick-making plants in various parts of the country, where poor clay, poor workmanship and inexperience have produced a conduit which, to sell at all, must be "cheap." We believe that not only the conduit business, but also that of every branch of the electrical industry, as well as all other trades, corporate and private, will enjoy another year of unprecedented prosperity.

Dynamos, Motors, Electrical Machinery.

Aaron Electric Company, Chicago: We have found the year 1906 one of the most prosperous years of our business. We have found steadily increasing demand for motors and dynamos of all sizes, and have been pushed hard to keep up with the demand. We believe that the present activity in the electrical field will continue for some time to come.

Fairbanks, Morse & Co., Chicago (A. G. Langworthy): The year of 1906, which has just drawn to a close, has been one of great activity and development in the electrical department of Fairbanks, Morse & Co. Early in the spring it was evident that our manufacturing facilities would be taxed to the utmost by the constantly increasing demand for our standard direct-current motors and generators, and in addition it was deemed advisable to provide for the supply of alternating-current apparatus for which we were receiving a great many inquiries. This was done by the acquisition of the plant and business of the Commercial Electric Company of Indianapolis, which plant has been greatly enlarged and improved and is devoted principally to the production of alternating-current induction motors and generators and to the larger sizes of direct-current apparatus. We look forward to an unusually prosperous year in 1907, and think that all branches of the electrical business will share in this happy condition.

Electro-Dynamic Company, New York City (Thomas B. Peck): The year 1906, in our opinion, has been a banner year for the electrical manufacturing business, which probably will show the best results of any consecutive twelve months in the last decade, with the possible exception of the year 1907. Our own factory has been working under very high pressure, a good deal of overtime having been necessary in order to enable us to fulfill our orders. The demand for variable speed motors has increased so far beyond our expectations that we were caught somewhat unawares, but, notwithstanding this fact, have been able to meet our deliveries in the majority of cases, while at the same time we were preparing for the business that was constantly coming in by the addition of new machinery and the manufacturing of special machinery. We believe, from present indications, that the electrical manufacturers of the country will be very hard pressed within the next twelve months to meet the urgent calls of their customers in the matter of deliveries. From all sides come the reports of extensions, additions and new plants. All of these are being equipped with the most up-to-date labor-saving machinery, the output in most cases being the main factor, and in order to keep this output up to its normal it is necessary that the machinery be of the most approved design. All this is good for every branch of trade, but for none better than for the electrical manufacturing industry. Nine-tenths of the new machinery added to manufacturing establishments is motor driven, either by individual motors or from subdivided line shafting. Smaller machines are group driven, but the group itself is driven by a motor. The furnishing of current to drive these motors and the necessary demand existing for generator apparatus, from present indications, as well as for the year 1907, will be unprecedented in the history of the country. The extraordinary and able response which the United States has made to the demand for electrical machinery has centered the eyes of other nationalities upon our factories and we anticipate an increase of export. The usual deliberation in the placing of orders, characteristic of December, is noticeable at this time, but judging by past experience, the estimates being placed this month will receive attention after the first of the year, and we hope January will be a record-breaker.

General Electric Company, Schenectady, N. Y. (B. E. Sunny, western manager, Chicago): The sales of electrical apparatus and appliances for the year 1906 have been the largest in the history of the business. The same can no doubt be said regarding almost all lines of manufacture. If it were not for the unsatisfactory situation regarding financial matters, it would be safe to predict that 1907 would outstrip 1906, but with the scarcity of money, which promises to continue for some time—for the reason that there is not enough of it to go around—many new enterprises will have to be abandoned for the time. Including the financial situation, there is no reason why the business for 1907 will not be as large as for 1906. The steam turbine, which came to the front with such a rush last year and the year before, has been living up to its reputation as a revolutionist during the current year, with the result that no one is buying a reciprocating engine where a steam turbine can be had to do the same class of work.

Gregory Electric Company, Chicago (A. O. Kuchmsted, vice-president): Business with us during the last year has been extremely satisfactory, particularly since we moved into our new works, the sales this year being by far the largest in our history. The prospects for 1907 appear fully as good.

Jeffrey Manufacturing Company, Columbus, Ohio (R. Grosvenor Hutchins, vice-president): In volume 1906 has been the largest year in the history of our company, but we feel very certain that the net results for the year will not be what the volume would indicate we were entitled to. Unfortunately, or perhaps fortunately, early in the year orders came to us in such tremendous quantities that our output was, practically taken for the entire year, but the cost of raw materials entering into the manufacture of our material advanced at such a tremendous rate that a very large portion of our output for the latter part of the year has been supplied at prices that verge on a loss. We cannot see why the year 1907 is not going to be a greater year in volume than 1906. Orders are already booked for a tremendous volume and new inquiries are unusually numerous. We do have considerable anxiety, however, due to the tremendously inflated prices of materials, such as pig iron, copper and other articles that enter into our manufacture. When one compares the capacity for the production of pig iron in the United States in the year 1896 and prices at which pig iron was sold at that time with the present tonnage capacity and the present prices, one is inclined to shiver and wonder who is paying for this fearful increase. We are not pessimists, but we certainly feel that it behooves every manufacturer in planning his work for 1907 to be careful not to be carried away by the demand for all lines of manufactured goods at the present time, but to keep at all times in sight of land.

Mechanical Appliance Company, Milwaukee, Wis. (F. H. Petrie, secretary): The last year has been an exceedingly busy one for manufacturers of electrical apparatus, and a reasonably profitable one. The molders' strike, the remarkable advance in raw materials and the tardy advance in price on manufactured products have, however, prevented profits from being what they should. Electrical machinery is to-day selling on a smaller margin than any other line of machinery on the market, and the trade has never had the opportunity to buy so near cost which it is now enjoying. We believe that the present large demand is independent of the low price at which electrical machinery is being sold, and that, while higher prices are warranted and will come, the demand will continue unabated. This, we feel, will be particularly true of electric motors in the smaller sizes. One of the most striking characteristics of the electrical situation for the last few years has been the increased use of the individual motor drive and the consequent demand for smaller units of power. This tendency has been particularly marked during the last year, and there is every reason to believe that it will continue with increased force during the coming one. While we feel that there is great reason for conservatism, we are looking forward to the new year very hopefully.

Robbins & Myers Company, Springfield, Ohio (W. W. Mumma, sales manager): The fiscal year 1906 was a very successful one for this company, the business done showing an increase of over 50 per cent over any previous year, and on a healthy basis. We believe that most of the electrical or allied industries have seen a marked increase in the output. The outlook for 1907 looks prosperous, and we would not be surprised if it will end with as favorable a record as the year just closing, as the demand has been keeping up steadily, even during what are considered the dullest months of the season. It is rather a difficult matter to foretell what the future will bring about, but we feel that there is no cause to fear a depression in the business for an indefinite time.

Sterling Electric Motor Company, Dayton, Ohio (J. A. Gauthier, president): We had nothing to complain of during the last year, as business has been plentiful and the Lord has treated us kindly and generously. The year 1907 has all the earmarks of a good proposition. The only thing in sight that might depress, and will undoubtedly do so to some extent, is the high price of copper and iron. While we cannot blame anybody for getting all he can, we believe it is a short-sighted policy to try to choke the goose that lays the golden eggs to make it lay faster. There is a limit to all profits. With the possible cost of copper at nine cents and the selling price at 23 cents, somebody is making more than what he is legitimately entitled to—that is, morally entitled to—to say the least. The price of pig iron also denotes a tendency on the part of somebody to get a little more than his share of this world's yellow metal.

Fuses.

American Electric Fuse Company, Muskegon, Mich. (Frank G. Jones, president): The year 1906 has been the best in volume of sales which we have experienced in our history. The only cloud in the sky has been the increased cost of raw material and the difficulty of securing prompt shipments of material necessary for the manufacture of our goods, and our sale prices have necessarily been somewhat higher than they otherwise would have been. The extraordinary demand for goods by our trade, however, has exceeded any previous year. We believe that 1907 will be as good or better than 1906, although the scarcity of material and the difficulty of purchasing machinery hamper business operations along normal lines. These two difficulties, however, simply emphasize the great prosperity of the industry. We believe that the rising markets are natural and are caused by the extraordinary demand, while the fact that all machinery houses are from three months to two years behind on their orders shows the enormous preparations being made for future business. The only danger is over-confidence and overproduction. The telephone and electrical trade is now so largely expanded that the conservative business man should prepare for some shrinkage, although there is no present indication of any such shrinkage taking place.

Chicago Fuse Wire and Manufacturing Company, Chicago (W. W. Merrill, secretary): We are confident that 1907 will show a substantial increase over the year 1906 in the production and sale of electrical goods and apparatus. We found it necessary during 1906 to increase our manufacturing facilities in Chicago, in order to take better care of our customers, and our business during 1906 has been very satisfactory.

Lamps, Electric.

Cooper Hewitt Electric Company, New York (Alfred D. Childs): During 1906 the amount of Cooper Hewitt business has more than doubled the amount of business done in 1905. The Cooper Hewitt lamps have surpassed our most sanguine expectations in every way, and in most instances have far exceeded in commercial installations our guarantees for light and length of life. Customers have found by experience that with Cooper Hewitt lamps they can light greater areas with less cost for current and obtain a better quality of light than they can obtain with any other form of electric lamp. The maintenance cost of the Cooper Hewitt mercury-vapor lamp is extremely low. The Cooper Hewitt lamp is particularly adapted to all kinds of industrial lighting where a good illumination is required and where a close distinction of the color values under the light is not important. We do not recommend the lamp for dry-goods stores, public halls, residences, etc., where the changes in the colors caused by the light might be objectionable. During the past year we have placed about 10,000 lamps, both with new customers and with customers who have been using Cooper Hewitt lamps for the last two or three years. These lamps are used for the lighting of machine shops, foundries, freight piers, etc. In 1906 we further developed and perfected an alternating-current lamp, which gives a steady light and has the same efficiency as the direct-current lamps. The demand for both direct and alternating-current lamps is steadily increasing and there is every indication that the business for 1907 will be two to three times as great as it has been during the last year.

Franklin Electric Manufacturing Company, Hartford, Conn. (J. Camp, manager): Conditions prevailing in the incandescent-lamp business during the year 1906 have been very satisfactory. Our volume of trade has increased somewhat over the previous twelve months, and we look for still greater improvement during the coming year.

Helios Manufacturing Company, Philadelphia (G. H. Rettew, general manager): We manufacture arc lamps, and the business as a whole has been very satisfactory, with a number of inquiries for export goods, but the business has suffered to a certain extent by the necessary increase in the price of lamps, due to the increase in the cost of all raw materials and labor. The outlook for 1907 is very good, and I think that it will be the banner year in all electrical lines.

Standard Electrical Manufacturing Company, Niles, Ohio (H. H. Albert, sales manager): The business of the last year has shown a remarkable gain over the year preceding. We attribute this not only to the quality of the "light that's right," but to the wonderful activity in all lines of elecrical construction. Some time ago it was estimated that 20,000 sockets were installed daily, for which, of course, an equal number of lamps was required. To-day the installation will greatly exceed this amount, and the general growth of the lamp business all over the country has given the lamp industry a decided stimulus. As no new factories have been built to handle this increase in business, the manufacturers of high-grade lamps are experiencing the largest volume of business since the inception of the art. In anticipation of a corresponding increase in 1907 we have completed a new addition to our factory which will practically double our output. As all high-grade lamps are sold for practically the same price, central station buyers are more discriminating in regard to quality and selection than heretofore, and we have made it a point to cater to this discrimination. It may interest lamp buyers to know the cost of lamp construction has advanced nearly 100 per cent during the past year. As Russia is the platinum market, the recent war in that country has disorganized that industry and the price of this commodity has been advanced, the present market quotation being $38 an ounce. It is thought an additional increase in the cost of this material would necessitate the advance in lamp prices. We think, however, that platinum has about reached its highest point.

Poles.

W. C. Sterling & Son Company, Monroe, Mich.: We have had a very successful year, having sold more poles than any former year since we have been in business, which has been over 26 years. During this last season we organized the Sterling Cedar and Lumber Company and purchased 4,000 acres of timber land which contains considerable cedar. We are also interested in the Michigan Cedar Company, which has been operating heavily in the last four years and is getting out a large number of poles and ties this winter. We are now operating in the lower part of the Upper Peninsula and expect to have during the winter more men working in our camps than in any previous years, and, unless the weather is unfavorable, expect to have a larger stock in our yards than we have ever had before. We expect a better price on poles and ties next year than we received this last season. In looking over the last year's business of all the different firms that we know of, we think they have all been very prosperous and have received prices in excess of those charged in previous years. The demand is gradually increasing. The number of poles used each year for maintenance will soon run up into the millions, at least three millions a year, and a great deal larger number of ties. Of course, it is costing considerably more to get this stock ready for the market. Labor in the woods is twice as high as it was a few years ago. Men are scarce and timber has to be hauled a greater distance each year. The output will depend entirely on the winter, and prices will depend on the demand and amount of stock gotten out.

Western Lumber and Pole Company, Denver, Colo. (B. H. Vreeland, president): We have had a fairly

satisfactory business this year, but have been handicaped nearly the entire season for want of equipment. This lack has prevented us from taking on a larger volume of business than we otherwise would. However, trade held up pretty well all through the year, and inquiries are still coming in quite freely, a good many for spring shipments, but these we have quoted on only with the understanding that we would ship as soon as we could secure cars, provided we were favored with the order. We have, however, a considerable volume of business on our books that will take us some little time to clean up, provided equipment is not furnished in future in any better shape than it has been in the past. We have good stocks, especially in Idaho, and, while prices have advanced considerably, we believe they will still be higher for spring shipments. The outlook for next year's business we consider very promising.

Signs, Electric.

Haller Machine Company Sign Works, Chicago (William Goltz, secretary): A few years ago a man who wanted an electric sign went to a sign painter, and he in turn called upon an electrician, and between them they got up something that cost a fortune to operate, that could not be read at one-half a block away, and that the first rainstorm put out of business, to the great relief of the unhappy purchaser. To-day electric sign-making is an established business in the hands of people who know what they are about. The electric-light central stations, which usually know a good thing when they see it, find that electric signs are business getters, not only for their clients but also for themselves, and therefore are willing to assist the manufacturers in placing their goods. The prospects for 1907 are exceedingly bright.

Specialties.

Ajax Line Material Company, Chicago (Albert Scheible, president): One characteristic of 1906 (which promises also to hold good for the coming year) was the demand for up-to-date devices and the readiness to pay a fair price for the same. Mere first cost seems to have been less than ever a criterion in the choice of goods, and instead of seeking cut prices, experienced buyers have been looking more and more for devices that will save time in erection, look well when up and prove extra durable. Of course, the resulting economies will prove of lasting benefit to both the lighting plants and their customers.

Appleton Electric Company, Chicago (A. I. Appleton, manager): We are pleased to state that during the year 1906 our business increased steadily, particularly in telephone supplies and specialties. The outlook for 1907 seems to be very bright, and we cannot see any reason why the coming year will not prove to be one of the most prosperous and best years in the electrical and telephone industries.

Blake Signal and Manufacturing Company, Boston (E. J. Burke, president): In our specialties, such as staples and cleats for low-voltage wiring supports, which are sold principally to the telephone and telegraph companies, our business for 1906 has been larger than ever before. In our signals, which are a comparatively new thing and are sold to high-speed interurban electric roads, the increase in business during 1906 has been most gratifying. So far as the year 1907 is concerned, there is every promise that of all lines which we handle the business will be very considerably better than in 1906. We have unfilled orders on our books now which would indicate that 1907 will be an exceptionally good year for us.

W. S. Hill Electric Company, New Bedford, Mass. (Charles S. Mendell, treasurer): Our business has far exceeded that of any other year, and we look for next year to be still better.

Vulcan Electric Heating Company, Chicago (F. J. Holmes, president): We are approaching the close of 1906 with satisfaction in this year's business and great confidence in the year to come. Having made a specialty of high-temperature, electrically heated devices, particularly electric soldering and branding tools, and having introduced these appliances with practical and economical results in a number of large establishments, we feel that the year 1907 will witness the installation of thousands of electrically heated tools in place of those now heated by gas, gasoline and charcoal. We have demonstrated that the logical way to heat these tools is by electricity. The exhibit which we now have under preparation, showing these tools in full operation at the Chicago Electrical Trades Exposition, January 14th to 26th, will be both interesting and convincing, and will, we believe, establish our claims on a firm basis. We do not know what progress is being made by our competitors or what business they are securing, but we have great confidence in the success of electric heating devices and are of the opinion that this class of apparatus will be completely vindicated during the coming year.

Steam Heating, Central Station.

W. H. Schott, Chicago: During the last year business has kept up in volume, with some increase, but on account of the advancing market and the slow delivery of material a great deal of work under contract has not been completed. The outlook for business for 1907 is good, but high prices are bound to prevail, as well as delays in the delivery of material, as the material market is in a very congested state.

Supplies.

Central Electric Company, Chicago (George A. McKinlock, president): The year 1906, which, as this is written, is now drawing to a close, is one in which the commercial and industrial affairs of the world reached a volume greater than the anticipations of the most optimistic forecast. In this development steel and copper are conspicuous because of their entering so largely into the products of the world's work. A close examination of the conditions seems to show that the industrial movement or development is a natural one and belongs particularly to the progress of the evolution of civilization. The period that we are now in may be called the industrial or transportation building age. Nothing, apparently, but an unforeseen calamity will interfere with or retard a continuation of present activities, as there is so much more to be done before modern life is adjusted to modern thought. Of course, there may be periods where a halt may occur, but on the whole the movement seems to be irresistibly upward. The electrical industries are among the leading factors in this progressive movement, and as it is generally conceded that electricity enters very largely into the calculations and plans of the progressive movement, the electrical supply business will naturally keep pace with it.

Commercial Electrical Supply Company, St. Louis (J. P. Casey, sales manager): The electrical supply trade for the last twelve months has been most gratifying in proportion and stability. We believe that in no other business has prosperity been more manifest than in railway, lighting and latter-day improvements in electrical equipment. This, we believe, is due to the fact that the average American requires the greatest amount of comfort obtainable and is willing to pay for the required results. This point can be more clearly made in reviewing and contemplating the great number of desk and ceiling fans which have been sold in the past few years. This is just a single instance of the many modern devices now dependent upon a central station. We attribute also, to a considerable extent, the recent advance in our trade to the awakening of the central-station manager and electrical contractor and engineer to the great field that lies undeveloped before them. This latter awakening is due in considerable part to the Co-operative Electrical Development Association, the organization which has done so much in working with the operator to enlighten the consumer on the possibilities of electricity. We look back on an increase of 130 per cent over the same period in previous years and feel that we are just at the starting point at the foot of the ladder for future developments.

J. Allen Haines, Chicago: It seems to me that the year 1907 promises to be a banner year in the electrical industry, notwithstanding the fact that the prices of raw materials are still bound to increase. In the beginning of the year 1906, after a careful survey of the electrical field and its possibilities in connection with a sales agency proposition, I determined that an electrical sales agency for the West, if properly handled and with large capital, would be a most paying investment. The result was that J. Allen Haines, Inc., was organized and the agencies which I formerly handled as an individual were taken over by this company. We have been successful from the start, and all business, particularly in the finer grades of insulated wire, has been very satisfying. We believe that in 1907 our business will be triple or quadruple. Of course, the only thing which may interfere with the electrical line as a whole is the extremely high price of copper and the unsettled condition of the copper market. I believe, however, that after copper has attained a certain figure, although high, it will probably remain and the conditions will become more stable.

Telephone Apparatus.

Automatic Electric Company, Chicago: The Automatic Electric Company has enjoyed the busiest and most prosperous year of its existence. At present there are nearly $7,000,000 worth of orders on hand to be filled. These include some large plants, Denver, Omaha, San Francisco and Chicago being among the number. So enormous has been the growth of the business that the factory has been more than doubled in size and trebled in capacity. The new addition will be available shortly after New Year's, and the enlargement will enable the company to cope with the constantly increasing demands for automatic equipment. There is no doubt that the automatic telephone system has "arrived." The public is awake to the merits of the system, the operating companies are fast becoming aroused to the necessity of adopting it if they are to supply the public demand for first-class telephone service at reasonable rates and at the same time make their plants paying ones; and the investing public is learning that the securities of the telephone companies operating automatic equipment are the most valuable, stable and profitable. Perhaps the most important contract which the company will handle this coming year will be for the 100,000-line exchange to be built in Chicago by the Independent Telephone Company of Chicago, a $10,000,000 corporation which has been formed by some of the leading financiers in the Independent movement. This company has taken over the telephone rights of the Illinois Tunnel Company, the growth of whose automatic plant, serving the loop district only, has been retarded by reason of the fact that the latter company has devoted its entire capital and energy to the completion and perfection of its tunnel system for freight and mail service. In line with the new Independent company's advent into Chicago are the arrangements for the entrance of the Independent toll lines. The South Bend Home Telephone Company of South Bend, Ind., has been purchased by a company of Independents, who will make that city the clearing point for the Independent toll-line business of that half of the United States lying east of that meridian of longitude. Similar arrangements will be made for the western and northern territory, and the completion of the work laid out will mark a great advance in the Independent movement, both local and long-distance. The greatest development of the automatic business the past year has been on the Pacific Coast, where the system has been adopted by practically every city of importance from San Diego on the southern end of California to Bellingham, Wash., on Puget Sound.

Central Telephone and Electric Company, St. Louis, Mo. (S. G. Le Bourveau, sales manager): The year just closed has been the most prosperous one in our eleven years' manufacturing experience. Our increase in sales has been most gratifying, and we look forward to a larger use of telephone apparatus during the year of 1907. We are preparing to secure our share of the business, both domestic and foreign.

Frank B. Cook, Chicago (F. W. Pardee, general manager): I firmly believe that the volume of telephone business during the year 1906 exceeded the wildest expectations of every single manufacturer in the country. By this I do not mean any one manufacturer, to the exclusion of others, but every manufacturer, large or small, seems to have had more business than he could handle. This is true apparently of general business as well as with the telephone business and its allied industries, and the most gratifying part of it is that from the present outlook this same state of affairs is booked for a continual performance, at least during the year 1907. Four of the largest cities in the country have recently voted or given Independent telephone company franchises. This means that there will be a tremendous amount of construction and that it probably will not be given to any one telephone manufacturer. Aside from these four large cities, literally hundreds of smaller places have granted franchises, and exchanges will have to be built. Another particularly gratifying point is that in spite of the fact that almost every manufacturer and every telephone exchange was doing more business than it had any right to, considering its capital, and that the growth of the business, both from an operating and a manufacturing standpoint has been almost appalling, there have been very few failures. Collections have been slow at times, and money has been exceedingly tight, but most of the difficult financial situations seem to have been passed over happily, and the profit-and-loss accounts on the ledgers will show very few items on the wrong side.

Farr Telephone and Construction Supply Company, Chicago (C. W. Farr, president): The year 1906 has been a banner year for the telephone business. The demand has been enormous. The bulk of the business is now in the rural districts. Farmers' lines are being built through nearly every county where the settlements are large enough to warrant eight or 10 subscribers. This farmers' line branch of the telephone business is only in its infancy, and we estimate that for the year of 1907 there will be much more than 500,000 farmers' telephones installed in the United States, making a heavy demand for construction material. The Independents have secured franchises in Omaha, Milwaukee, Kansas City and St. Louis, and are assured of connection with Chicago very soon. Being able to get connections with these cities, from which they have heretofore been shut out, will stimulate the rural district telephone industry very much and make the service twice as valuable as it has been heretofore. A bright prospect is certainly ahead for the year 1907.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. (J. O. Oliver): We are pleased to state that the year 1906 has yielded to us of its riches the largest volume of trade we have ever known, exceeding to a very large extent the business of any previous year. During September last our company completed the installation of the largest telephone switchboard in the world. This, in addition to the completion of many other large and important contracts, has kept our plant exceedingly busy, and the ever-increasing demand for our product in the various activities of life, both at home and abroad, leads us to believe that the coming year will yield even larger returns. Our plant also has been largely increased during the past twelve months. The power house has been doubled in size, new boilers and engines installed and additional electrical machinery. A large building has been erected for the use of our cable and wire insulating departments, which will greatly relieve the strain in this direction, as our product in this department has been sold for many months ahead. The telephone industry as a whole has been most prosperous. Many new and important telephone exchanges have been established, thousands of miles of new toll lines have been erected and old ones improved and rebuilt. The rural movement, that of building country exchanges and party lines, has continued with unabated zeal. Judging from the general interest in Independent telephony and from the large number of important contracts soon to be let, it would seem that the coming year will be equally and in all probability more progressive.

Swedish-American Telephone Company, Chicago (W. A. Taylor): From present indications it would seem that the year 1907 will bring in more telephone business than any other previous year. The business during the past year, to express it mildly, has far exceeded our most sanguine expectations. The Independent telephone exchanges during the past year seem to have been doing more rural business than local or city business. The farmer seems to be realizing more and more each year that the telephone is indispensable to his business, and the exchanges are kept busy most of the time building lines for connecting the rural districts. Judging from the inquiries we have received and from observations made by our sales force, the coming year will show as great an increase in the business as the past year. We are making arrangements to transact fully 50 per cent more business during the year 1907 than we have done during any previous year. With an Independent company in Milwaukee and another in Chicago there should be a great boom in the growth of exchanges throughout the whole of the central states. Our past year has been the best in our history and the future will, no doubt, be just as satisfactory as the past.

Transformers.

Kuhlman Electric Company, Elkhart, Ind. (E. Kuhlman, president): Our business for 1906 shows the largest increase in any one year since 1895. The outlook for 1907 indicates a still larger increase. A review of this year's work is interesting to the central-station manager. The average capacity of transformers sold has more than doubled; the demand for 125-cycle transformers is practically nil; 60-cycle and 25-cycle transformers show a large increase. The primary voltage is fast changing to 4,400 and 6,600, with a large increase for transformers for long-distance transmission from 10,000 to 30,000 volts, with a few at 50,000 and the rest at even 100,000. Our high-voltage transformers have proven as reliable as the old standard. Electrical engineers want to know how good you can build, and demand quality first.

Pittsburgh Transformer Company, Pittsburg, Pa. (F. C. Sutter): This company's business for the year 1906 is 80 per cent. greater than for the year 1905, notwithstanding the fact that 1905 showed an increase of practically the same amount over the preceding year. The outlook appears to indicate an exceedingly prosperous year so far as volume is concerned. These brilliant prospects are greatly marred, however, by the exceedingly high cost of raw materials, especially that of copper, and also the difficulty of securing same even at the high prices in effect. It will be noted that the prices of finished electrical machinery have in no way increased correspondingly, and the benefit derived by the manufacturers from their greatly increased sales is largely offset by the increased cost of their product. But, of course, this is always one of the drawbacks of a period of unusual prosperity.

Wires and Cables.

Standard Underground Cable Company, Pittsburg (J. W. Marsh, vice-president): Business for the year 1906 in the branches of electrical industries with which we are immediately concerned has been larger than ever before in the history of the business, notwithstanding the comparatively high prices of all raw material. The outlook for the year 1907 seems to us to be very good in general. The only clouds on the horizon are the extremely high level of prices recently reached by the metals, copper and lead, which may result in serious curtailment or postponement of purchases, for a time at least, and the fact that the recent abnormal demand has resulted in increased manufacturing facilities, which will tend to demoralize the market when demand returns to the normal figure, as it is bound to do sooner or later.

Miscellaneous.

Aiton Machine Company, New York (Thos. A. Aiton, vice-president): The year 1906 has proved the biggest business year that this company has yet enjoyed, but the prospects for the coming year are of such magnitude that we are at present increasing our facilities in every branch.

Samson Cordage Works, Boston (H. G. Pratt, treasurer): The year 1906 has been the largest in our records, though the increasing cost of material and labor is a serious drawback on profits. We see no reason why 1907 should not be a continuation of the last twelve months' prosperity, though there must evidently be an end to the seesaw between higher wages and higher cost of goods.

Servian Trade.

M. K. Moorhead, consul at Belgrade, reporting on the trade of Servia for the last year for which figures were available, lays stress upon the fact that an opportunity is being offered to American makers of agricultural implements, stoves, electrical appliances and general hardware. Farming is the chief industry of Servia. Belgrade and many of the smaller towns are lighted by electricity. As in most other things, the chief source of supply is Austria-Hungary. The city of Valjevo, situated in the interior of Servia, 100 miles from the nearest railroad, has an electric plant fitted out with American machinery. The owner of the plant says that American electrical goods give entire satisfaction and are much better than German or Austrian apparatus. Mr. Moorhead says there should be, during the next year, a good market for all sorts of mining machinery, as many new mines are about to be opened up. Several Englishmen are now in Belgrade looking after mining concessions.

Representative Sims has introduced a bill to provide that, after January 1, 1908, the present District regulations for the prevention of smoke would be extended so as to apply to all steam locomotive engines of any description used on any steam railroad within the District of Columbia.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The Co-operative Development Movement in the Electrical Field.

Conspicuous success has attended the "forward movement" for the increased use of electricity and electrical appliances begun by the Co-operative Electrical Development Association under the able and enthusiastic direction of Mr. J. Robert Crouse. Up to this time the finances for conducting the work of the association have been supplied by the lamp manufacturers, but the benefits have been general. It is now hoped to broaden the plans and form a strong organization, to the support of which all branches of the industry—manufacturers of all kinds, dealers, contractors and central stations—can contribute and in which all will co-operate.

To consider the objects and plans and the results of the work of this association, on the basis of which a correct conclusion could be arrived at as to the desirability of putting it in position for continued and more aggressive operation, a meeting of representatives of the joint electrical trades was held in New York on December 13th, attended by some of the leading men in the industry. A report of the meeting, with the names of those in attendance, was given in the Western Electrician of December 22d, page 504.

At this meeting a very interesting paper reviewing the work and results of the association and laying down plans and suggestions for the future was presented by Mr. Crouse. Following its reading there was a discussion by prominent men in the various branches of the industry. The paper and discussion brought out some interesting points relative to the commercial activity of the past and a general forecast of what may be expected for the coming year.

Central-station managers seem to be the loudest in their praise of the work of the association, although all branches have felt good results from the co-operative movement. It is especially interesting to note that in the discussion it was declared that one or two of the large electrical manufacturing companies were not anxious to broaden the scope of the co-operative association just now because they were busy extending their plants and facilities in order to meet the present demands for their products.

The idea of the co-operative movement originated with the incandescent lamp manufacturers in February, 1905, and in May of that year they contributed $10,000 to put the initial plans into effect. Soon after it was realized that the power and heating interests should be included in the movement with the lighting interests, for the reason, in the first place, that there exists a complimentary relation between the lighting end of the business, which is obviously a night load, and the heating and power end of the business, which is obviously a day load. The proper balance of these three elements in electrical service so as to secure as even a load as possible, is a subject in which all should be interested, as it seems to be the effective means to increased profits, and a possible reduction in rates, which, of course, would mean accelerated business of itself alone.

In his paper, while reviewing the work, Mr. Crouse said that the expenses from May, 1905, to November 30, 1906, were $28,256.41, while disbursements for the future, amounting to $9,280.21, have been incurred. He showed that the campaign in the central-station field had resulted in the expenditure by the electric-light companies of about $550,000 in advertising and soliciting new business. Also, 165 display rooms had been opened. The speaker continued:

"On the average it costs central stations 45 cents per 16-candlepower equivalent of new business secured through advertising, soliciting, etc.—30 cents for soliciting expense and 15 cents for advertising expense. Using these figures as the unit, the $551,167.50 noted, could reasonably be expected to result in a total added business of 2,720,050 16-candlepower equivalents. Thirteen 16-candlepower equivalents to the horsepower would aggregate 209,234 horsepower. This at $100 per horsepower would amount to $20,923,400 for the necessary generating and distributing apparatus. This assumes that all business was added to the peak load, which would not be the case. The result should therefore be discounted, but to what extent is difficult to determine."

Mr. Crouse presented an elaborate plan of administrative organization for the future work of the association, with a president at $12,000 a year and many other officers and branches of work. The campaign as outlined for 1907 would cost $151,550. As to ways and means, he said: "We are proposing to get together in this association on the basis of an assessment of approximately one-tenth of one per cent. on the output, a tax which can be in no wise a particular burden to those who co-operate in the movement; but while it is small in the case of any individual company, it is readily seen that it makes a very large sum in the aggregate, and will render possible the prosecution of extensive plans for increasing the business."

Proposed Certificate of Incorporation.

The paper of Mr. Crouse concluded with a proposed certificate of incorporation and the tentative by-laws suggested for the Co-operative Electrical Development Association. They were prepared by the legal department of Mr. Henry L. Doherty, whose liberal co-operation in this, as well as in other phases of the development of the entire movement, was gratefully acknowledged by Mr. Crouse.

A few of the features are given:

The name of the proposed corporation is Co-operative Electrical Development Association.

The objects and purposes for which the corporation is formed are for the promotion of the increased and more extended use of electric current by the public for light, heat and power, as an end in itself, and a means to increased demand for apparatus and supplies, and the co-operative planning and execution of various means and methods effective to this end; the establishment of co-operative relations, both moral and financial, among the different electrical interests, from the manufacturer to the consumer, to the end that each may contribute in some measure toward bringing about the above results desired in common by all, and the mutual co-operation, benefit and protection of its members. In furtherance of its said objects and purposes it shall have power to purchase and acquire in the state of New York and elsewhere such real and personal estate and property as may be necessary or proper, and to mortgage the same to secure the payment of any bonds which may be issued by the corporation, and, generally to do any and all things which may be necessary or proper in connection with its objects and purposes, which may not be contrary to law. The corporation is not to make a profit nor to make or declare dividends, and is not to engage directly in the business of selling electric current or manufacturing or selling electrical machinery or apparatus.

Active Members.—Any individual, firm or corporation engaged in the manufacture, construction or sale of electrical or other apparatus and supplies necessary to the production, distribution or utilization of electric current for light, heat or power, or in the sale of electric current for these purposes, shall be eligible to active membership upon payment to the association at stated periods during a period of three years, of such an amount as may be determined upon and provided for in the by-laws.

Associate Members.—Any individual, firm or corporation, association or society, shall be eligible to associate membership subject to such conditions as may be incorporated in the by-laws relative to eligibility, rights, duties, etc.

Honorary Members.—Any individual shall be eligible for honorary membership whose practical and scientific knowledge of the electrical arts would recommend him to the association.

Membership Assessments.—The membership assessment for active members shall be approximately one-tenth of one per cent. on their sales of electric current, or electrical or other apparatus and supplies necessary to the production, distribution or utilization of electric current for light, heat or power other than in connection with electric traction work, the same to be paid in during a period of three years, subject to the detailed terms of the membership contract.

Discussion by the Joint Electrical Trades.

An interesting discussion followed the reading of Mr. Crouse's paper, in which representatives of nearly all branches of the electrical industry took part. Following are extracts from the report of the discussion:

A representative of one of the lamp manufacturing companies said, in answer to an inquiry: Speaking for the incandescent-lamp people, we can trace many inquiries we have received to Mr. Crouse's work, and we can praise his work fully. The proportion we will be called upon to pay will be very much less than the benefits we have received. We are, therefore, perfectly contented with contributing our share and wish the work continued. We indorse what has been done very heartily, and what can be done with a united support we expect may be very much greater.

A representative of one of the large electrical manufacturing companies: I do not know whether this is the time to offer experiences to the meeting. After all, that is the gist of the whole matter here. I told Mr. Crouse when I first knew anything about this scheme that I was passive and would be a friendly pessimist, and he has never asked anything else from me. I will say that in the past year I followed Mr. Crouse's propaganda and read the literature he has sent out, with the result that I am now able to say that my position to-day is that of a friendly optimist instead of a pessimist. I don't think that this is the proper time to speak for myself. There are other gentlemen here representing manufacturing interests who will be glad to express themselves as to how far their people are prepared to commit themselves. The money participation is the principal thing in the whole matter. I believe we will be able to get a subscription from practically all of the large manufacturers. The amount of that subscription and the question as to whether this association shall inaugurate a full and complete programme for this propaganda is one which is open to discussion, I think. I know that, speaking for my company, neither the officials nor the board of directors have given this thing consideration enough at the present time to enable anybody to speak authoritatively as to their probable action.

I will say that all through the organization those who are familiar with Mr. Crouse's work and his plans have only a very friendly and favorable opinion of the whole thing, and it is only a question of expenditure in relation to the conditions which we find ourselves in as far as factories, facilities, etc., are concerned, which will determine the final action of the company. As a matter of fact, when we ask for an appropriation of a considerable amount of money we have to go to the board of directors or executive committee, and I think a typical programme of the boards of directors of most of the companies for the last six months or a year has been: First, money for extending factory facilities, and, second, trying to adjust for the commercial departments better plans, enabling these departments to handle their orders. This has resulted in our own case in a large extension of factories, an increase in the number of men employed, the installation of new tools and machinery, and the purchase of materials, etc., and every nerve has been strained to meet that condition. So that when we bring this thing up in the course of a few weeks to our board of directors or executive committee and we ask them to appropriate a substantial sum at the present time, I do not know how they will receive it. I think they may say that the thing is not consistent at the moment with the conditions of affairs as we find them.

In conversation with Mr. Crouse I had suggested a possible programme by which the work of the association could be kept going on the basis on which it has been going during the last year, so that the work already done might not be lost and the association will not lose power, and we could keep things in that condition until such time as business conditions that are now full of plenty have passed, keeping the whole thing agoing until we are ready to start the three years' programme, which may be at any time. This is my own idea, although I have not discussed it at any great length and the company has not endorsed any of the ideas which I am setting forth.

With our present facilities it will be impossible for us to catch up with our orders within six or 12 months, and this probably would give Mr. Crouse time enough to get in his stride, and we would then receive more favorable consideration from the people to whom we would have to eventually go to get the sinews of war. We have assumed that the condition of business was such that unless we gave some very good reason we could not at this time secure the attention of the board of directors.

Another representative of the same company: Perhaps the knowledge of the progress business has made since the inauguration of this association is as good a barometer of the situation as you can get. The total increase in the incandescent-lamp business will not be less than 20 per cent. The total of all manufacturers (quoting from the figures of the past 16 years) is less than the figures of last year. I quote you these figures, which have been carefully compiled, and I find that the percentage stated is the greatest increase in all that period. My impression is that nearly all of this increase is on lines such as are advocated and being pushed by the Co-operative Electrical Development Association. From a selfish standpoint, the next question would be whether the business men might not say that they are fairly started and will adopt these methods without the expense of the association, or whether the association can get every station in the country to adopt this method and aid the association is what we have to consider. The work, considering what has been done toward the success which the stations are having, by the use of certain methods in keeping before the central stations the advanced methods of getting business is worth the expense Mr. Crouse is advocating; it seems to me that there can be no doubt of that.

A specialty manufacturer: I think to-day, in discussing what is to be brought about in a year or a year and a half from now, it would seem that the pressure should not be taken off. We will have a wedge for business in the future, and whether we are confronted later on with the embarrassment of unfilled orders this will not work to the disadvantage of any of us. It is our idea that it is well to bring such a condition about.

A representative of a big light and power com-

pany in Western New York said: I think the central stations agree to a man that this work is helping them tremendously in our part of the country particularly. I feel what has been done has helped us tremendously. Salesmen have been coming into my office for the last few months, as many as two or three a week dropped in. After bidding the time of day they then flash on me the pamphlets of the Co-operative Electrical Development Association. "It is a great thing; have you read it?" "I have," I say. "I have a little slip and I would like to get some information. It is sent out by the association; we are all co-operating on this thing. I want to find out the methods that you are using for increasing business." He would give me the list as sent out by Mr. Crouse. If we are getting two or three salesmen giving us that right along, other salesmen must be doing the same thing.

I think it is having the same effect on others. At Batavia and Dunkirk the central-station managers said things in that part of the country had stood still for many years. The Batavia manager is now getting the business there. He has sent solicitors out for it. It has now become one of the liveliest towns in Western New York. They are advertising in the newspapers and making use of advertising bureaus for a regular campaign. I think I have spoken to nearly all of the central-station managers in my section of the country, and they admit that this association has been a help to them. I think they should come in, and our company, for one, would be glad to subscribe to this association the same as the lamp manufacturers do.

A lamp manufacturer: I believe that all the lamp manufacturers certainly must be very much in favor of this proposition. Business has increased generally along the central stations this year, and especially with the central stations in the smaller towns. This is not the time to rest, but, on the contrary, we should push ahead harder than ever. It is going to take some time to work it out in the proper way, and I imagine that we will find in a year, or two years, or three years from now that the business we are handling and the orders we are taking in will not be as great as they are to-day. Instead of letting it go along as it is, or suspend the work, we should push hard. I think it is going to take some time for us under any circumstances to accomplish the best results.

A representative of the jobbers: Personally, our observations have confirmed our belief in this work. But a few days ago I was very much surprised to get the information from a gentleman who is very widely traveled in this business and who has gone to the bottom of it, and for whom I have a very high regard. He was rather inclined to think that this work was not what I think it is, but I am still convinced that we are right; that the work is right, and if anyone had told me 12 months ago that you could not get incandescent lamps when you wanted them I would not have believed it. At a previous time when me met together I made a suggestion of the work which the jobber could do in furthering the aims of the association. I think he is doing it, and whenever I have had an opportunity I have always asked the other jobbers to aid, and have yet to find the man who was not interested.

The various salesmen get right close to these people, calling in a great many cases on the small companies and doing a great deal of good. Not more than 50 miles from me at this session are men who have not done a thing in the past and who have been awakened. The future is hard to tell, and I have not a suggestion for the betterment of the work. I have watched it very carefully, and the point that has impressed me most is the awakening of the men in the business in the smaller towns, and that is where we are going to sell our stuff very largely, and they are the people who should be awakened, and we are the people who can do it. If this is done by the association, I have no fear of our business dropping off in two or three years.

One speaker said that the figures of his company show that 85 per cent. of the central stations are located in comparatively small cities. In a great proportion of these towns the central-station manager had some other business and he gave his surplus time to the central-station affairs casually. He did the best he could, but the electric-light company was an extra, and he waited for the public to come to him. In the beginning he probably had a row over his franchise and has been fighting the town ever since. I met an old friend of mine the other day in a town of 3,000 people and I asked him about this work. I said, "Do you get the literature that is sent out by the association?" He said, "Certainly; do you know that I have made a mistake in the last 10 years? I never knew how to get at this thing until now. I learn something every time these things come to me." He is up-to-date and he is busy. They now have display signs, have advocated electricity for illuminating, heating, etc. He is getting down to the same truths that we have been convinced of for some time. While I admit that the man on the further end of the line is doing his work, it is because we are giving him the ammunition. He would not get any by staying at home. The number of central stations who attend the national convention are a very small proportion of the whole number. I do not expect the association would aid in the work of the large stations, but I expect it to reach the small stations, which, I believe, it has been doing.

A central-station man from New York city: I feel that it is a usual thing to advise your friends to spend money freely when you expect the profit from it. But I want to tell you that I believe this association has accomplished a great deal during the past year. They have been helping the electric companies, especially the small ones, and I am satisfied that the large companies, too, have been helped considerably during the past year through the association. I appreciate the difficulties that the manufacturers have met with from time to time. I know from experience that what they say is true, and I could understand the remarks that possibly it might not be wise to put on too much steam just now. Of course, the manufacturer's problems are different from those of the distributers of electric current. As far as our company is concerned, we are going to push as hard as we can irrespective of getting the goods, and then we will pound the manufacturer to get the goods.

I believe the most desirable advertisement of electric current would be a long waiting list for the manufacturer. While I should growl with the manufacturer and tell him that he was placing me in an embarrassing position, I would keep right on buying his things. Nevertheless, he should have my business. From the central-station standpoint the sooner the matter is taken up, the broader the scope of the plan, the more effectually caried out, the better it will please the central stations. I also agree, but not speaking for my associates, I believe that the central stations can well afford to and ought to be willing to co-operate in the matter of expense if we are to benefit from those whose assistance we are seeking, and I believe we are willing to share the charges, and there should be no trouble in arranging a satisfactory basis for contribution on the part of the manufacturer. My company would do so, and I think other companies would do likewise. Mr. Chairman, so far as we are concerned, we are more than grateful for what has been accomplished through the work of the association. We know it has helped us and it is worth while to go ahead and spend all the money you can raise and our support will be forthcoming.

My acquaintance with the work is so limited that it has not yet gotten to the consumer. The communications from Mr. Crouse have been able to start up central-station people, the campaign to reach the consumer must be on broad lines and will probably cost considerable money. I believe the consumer can be reached, but not by any such plans as have been heretofore employed. It must be done by newspaper or magazine advertising. The money spent thus far has been with the purpose of interesting the central stations. I believe the consumer ought to be and can be reached by your plan, but it will take a larger campaign along a broader scope to obtain results from that source.

Speaking from the central-station viewpoint, a Chicago man said in part: I think Mr. Crouse's campaign has done a great deal of good. There is no question but that his frequent communications have stirred up interest and inquiry. I believe the central stations should be included in this movement. They are going to be great factors, probably greater than the manufacturers. I can speak from the standpoint of both, and as a manufacturer I have often been annoyed to find that it was so difficult to get central-station men to make a move which would mean a provision against a rainy day. I think the central stations would join. I think the quicker you get into a magazine campaign the better. I think that it is going to be the feature which would be the most productive of results. The magazines are very widely read by the class of people who can afford to use and pay for electrical devices and electrical conveniences, and through the magazines you can reach a very large element of that kind of people, and there is no doubt but that the public would be awakened by an enthusiastic magazine campaign. On the subject of electrical devices, I noticed when I attended the electrical show that was held in Chicago the people showed how densely ignorant they were in regard to electrical devices. Therefore, if you advertise in the magazines you will reach a very desirable part of the public.

A Boston man: I have had one or two instances lately in our town of pushing for business. We have many medium-sized calls for power, from 100 to 200 a month. We have investigated that class of business in small towns where the electrical companies have been pushing after business. The effect upon them has been good. In those small towns the manufacturers are changing over to electrical power, and that particular line will be worth to us the amount we should plan to contribute if this thing goes through. In other lines it goes the same way, and when a man moves to Boston, where electricity has been pushed, he is far more apt to become a user of electricity than he is if he comes from a city where it has not been pushed. In the long run, it is well worth while to us to have it pushed in other cities. The magazine advertising will be even more valuable.

From Dayton, Ohio: I feel like a great many other central-station men of medium-sized plants, that we are doing fairly well and that we are using as much effort and energy to push things along as we could afford. This co-operative business in the shape it was going at first did not impress us very much. We got into it a little more thoroughly and it grew upon us. We soon discovered that there seemed to be no limit to the field to be developed by the proper management of the company. We are very enthusiastic.

I believe that it has been the means of showing that we were doing the best we could, but did not know how to go about it. There is a task of importance to be accomplished; that idea is fastening itself on all central stations of all sizes. These central stations have learned that this developing scheme is the proper way to take hold, and advertising is the question of the hour. I have learned from central-station men all over the country that they are taking a great interest in this work, and this interest is growing constantly, which will mean that the central station, regardless of its size, will endeavor to push for more business, which means more apparatus, more lamps and more business for everybody concerned; it should be pushed along. As a representative of a medium-sized station, I would say that we would be glad to assume our proportionate part of the expense. We will be very glad if these funds are to be expended in magazine or publicity work.

We have installed in 60 days as many lamps of a certain type as a city twice the size of Dayton had put in in two years. This development business is, in its way, wonderful, and we are going to do all we can to help it along. We sent an order for incandescent lamps to a certain company; their representative asked if it was not a fact that we had added one cipher too many to the order. We told him that we were willing to take the chances—to ship the order. I believe the figure was 6,500 as to 65,000.

A former president of the National Electric Light Association: One of the hardest things we have now to contend with is the finding of the proper man to follow up this method, to continue the work which has been inaugurated. Mr. Crouse, I think, would do well to have a kindergarten department to educate some men along this line, and if we could get hold of these men and solicitors to follow up the work, I think our work would show a material improvement. In this connection I should like to see some kind of movement inaugurated to reach the men higher up than the managers and superintendents; something to appeal to the presidents and boards of directors. The managers appreciate the work. It has been gradual and broad in its scope and it has meant much to the manager, but he has been unable to put it before his board of directors. It is a very important question to interest these men, and some scheme should be developed to get them interested. This, I think, would give the work a new impetus.

One of the electrical manufacturers of St. Louis: Our company's attitude toward the organization and movement is thoroughly friendly and sympathetic so far as it is informed as to its purpose and character; that it has not taken a more active part up to the present time is largely through not having been brought closely in touch with the movement through a personal interview with any actual representative of the organization. It is quite willing to become actively identified with the organization so far as its understanding goes. When its purposes are known and ascertained in every respect the company will be glad, no doubt, to take part in some of the active committee work and subscribe its reasonable share to the funds of the organization on receipt of full information as to the scope of the operations of the organization.

A representative of the electrical contractors said: I had not expected to say anything at this meeting. The electrical contractors at their convention discussed this matter and we heard from Mr. Crouse, and are exceedingly interested in the project of increasing the electrical field and electrical contract work. I think it is proper for me to say in connection with the discussion of this subject that there was brought up at our convention the question of what action we should take with reference to the boards of directors of lighting companies, who in many localities are doing what the contractor considers as his work, that is, they are doing what is known as concessionary wiring. It seems to us and it seemed to our convention that there is a way of increasing the operations of lighting companies which would not injure any persons in the electrical field. If concessions are to be made, it should be possible to make them without doing it so as to make it come out of the pocket of the contractors. Without mentioning particular in-

stances, it is proper to say that it is done in various parts of the country today. The lighting companies are doing what is called concessionary wiring, or free wiring, or partially free wiring, and at the same time to compensate themselves for this outlay they are taking on considerable of what is strictly competitive work—not work that can be considered in the field of development—at prices which through their staff they are able to make less than what is really a fair competitive price. I hesitate to bring any element of discord into this meeting; nothing is further from my thoughts. It is fair to say when asked to speak of this matter from the contractor's standpoint that they have passed a resolution, which you have received, I suppose, in the printed matter which Mr. Crouse has issued, to the effect that they approve of the operations of this co-operative association, but felt that it would work much better to the interests of the contractors if the question of the central stations doing free or concessionary wiring could be taken care of.

Contractors claim as a particular field of theirs the wiring of new buildings and the other things that necessarily go with it. If the lighting company organizes a construction of its own, with the officers of that company housed in the same building, sends out its solicitors at the cost of the construction company, it follows that the prestige the construction company gets through the lighting company takes away work from the jobbers. It must in the end create a feeling of dissatisfaction between the contractors and such an association as this, which, so far at least, has operated solely for the benefit of the lighting companies. It is not proper to say solely, because it certainly has benefited some manufacturers in some lines without question. Primarily, the talk of the printed matter we have received, the books and pamphlets, have in themselves all pointed to the increase of business for the lighting company. Under these conditions it cannot be but that the contractor and the jobber, in a sense, must feel that the whole plan of action of the lighting companies in several places throughout the country is against the interest of the contractor and the jobber. In the East jobbers do not sell to these large lighting companies. They buy the material direct from the manufacturer. I know that jobbers in the East feel the matter quite seriously. They feel that where the construction company is doing a large amount of work, and doing it through the office of the lighting company, the jobber does not have a chance to sell, and there is no money to split up among the contractors operating there.

I want to urge upon this representative body that this matter be given careful consideration; that its influence be used along the lines of endeavoring to persuade the lighting companies to do their advertising and extend their business in a way which will not work to the disadvantage of those whom you wish to have co-operate with you in this movement.

The discussion went into every phase of the situation. Incidentally one of the large lamp manufacturers paid a high compliment to Mr. Crouse for his untiring and efficient work along the line of co-operative development. Up to this time he has worked without compensation. It was evident that all present appreciated the good work which has been done, and while several of the large manufacturing companies did not pledge their support, they left the impression that as soon as the various committees have worked out definite plans for the broader organization they will without a doubt add their financial and moral support.

The following resolution was adopted:

"Resolved, That it is the sense of this meeting that the commercial programme outlined for the Co-operative Electrical Development Association for 1907 and the future is along sound lines, and gives good promise of highly profitable returns to all concerned.

"It is the further sense of this meeting that immediate steps be taken to perfect the organization of the association and to prosecute its commercial plans vigorously, pursuant to which the chair is requested to appoint three committees of five members each, as follows: Committee on constitution and by-laws; committee on membership and assessments; committee on commercial programme."

W. M. McFarland, the chairman, then announced the following committees:

Committee on Constitution and By-laws.—E. E. Jackson, Noble, Jackson & Hubbard; A. D. Page, General Electric Company; Walter Cary, Sawyer-Man Electric Company; F. J. Newbury, John A. Roebling's Sons Company; W. W. Freeman, Brooklyn Edison Company.

Committee on Membership and Assessments.—J. S. Anthony, General Electric Company; Walter Cary, Sawyer-Man Electric Company; W. W. Freeman, Brooklyn Edison Company; Charles B. Price, Pettingell-Andrews Company; James R. Strong, National Electrical Contractors' Association.

Committee on Commercial Programme.—F. S. Terry, National Electric Lamp Company; W. C. Bryant, Bryant Electric Company; R. S. Hale, Boston Edison Company; A. L. Doremus, Crocker-Wheeler Company; E. W. Gillmer, Warren Electric and Specialty Company; F. Bissell, The F. Bissell Company.

The meeting then adjourned until such time (perhaps next month) as the committees are prepared to submit their reports.

Chattahoochee River Power Development at Columbus, Ga.

The Columbus Power Company, under the engineering of Stone & Webster of Boston, will develop on the Chattahoochee River, at Columbus, Ga., one of the largest waterpowers in the South. When the full development is completed, there will be a capacity of over 75,000 horsepower. The proximity to the city of this large amount of power eliminates the necessity of long transmission lines in electrical development. In this respect the company has a distinct advantage over other southern waterpower developments, which have long distances between the source of supply and their markets.

The fall of the Chattahoochee within the distance controlled by the company is 362 feet. Fully to protect the development, the company has purchased the necessary land on both sides of the river north of the city, also the river bed and riparian rights.

The present completed development consists of the so-called "Lover's Leap" plant, located just north of the city limits. The fall at this point is 42 feet. The bed of the river and its banks are solid rock, and the massive stone dam rests on this bottom and is anchored solidly to rock at each end. The length of the dam is approximately a thousand feet, while the spillway is over 700 feet. Many factories are now run by this power, as well as the street-railway and lighting systems of the Columbus Electric Company.

The station equipment at the present time consists of five pairs of waterwheels, each of about 1,500 horsepower, which are direct-connected to 1,080-kilowatt Stanley two-phase 60-cycle alternating-current generators of 5,500 volts. Provision has been made for an additional unit of like capacity. There are also two smaller waterwheels of 125 horsepower, connected to two 60-kilowatt Eddy direct-current 75-volt generators.

Supplementing the water development, the Columbus Power Company has an auxiliary steam plant of some 3,000-horsepower capacity. The largest unit of this plant consists of a 1,500-kilowatt Curtis turbo-alternator, two-phase, 60-cycle, 2,300-volt. There is a direct-current unit, consisting of a 400-horsepower Westinghouse engine 18 by 30 by 16 inches in cylinder dimensions, turning at 250 revolutions per minute and direct-connected to a 250-kilowatt General Electric 550-volt generator.

The exciter equipment consists of one steam-driven unit and one motor-driven unit. The former is a 110-horsepower Porter-Allen engine, 11 by 14 inches, 270 revolutions per minute, direct-connected to a 75-kilowatt Westinghouse 125-volt generator.

The motor-driven exciter is made up of a 60-horsepower General Electric induction motor, two-phase, 60-cycle, 2,200-volt, 720 revolutions per minute, driving a 35-kilowatt General Electric 125-volt generator.

A Westinghouse motor-generator is installed also, which, together with the 250-kilowatt generator mentioned above, furnishes power to the Columbus Railroad Company. This unit is a direct-connected 700-horsepower synchronous motor, two-phase, 60-cycle, 2,200-volt, 514 revolutions per minute, and a 500-kilowatt 600-volt direct-current generator.

The station transformer equipment consists of two 800-kilowatt General Electric water-cooled two-phase-three-phase, 2,200-5,500-volt transformers.

In the boiler room is a battery of three 500-horsepower Stirling boilers of 175 pounds pressure, 150 degrees superheat, and one 320-horsepower horizontal return tubular boiler, 96 by 18 inches, of 120 pounds pressure.

The supplemental plant in the city is used as a distributing center as well as a manufacturing plant.

The capacity of the present plant, both water and steam, is about 12,000 horsepower, but complete surveys are under way, and plans are being prepared for additional developments to be made in the near future.

Columbus has exceptional advantages as a manufacturing center. It lies in the heart of the cotton belt, nearly 1,000,000 bales being grown within the radius of 100 miles from the city. Already it has many large manufactories, ranking second in the textile field in the entire South. With the development of 75,000 water horsepower at its very door, it will have a vast supply of the cheapest motive power known. The city is served by seven railroad lines, while it has a waterway to the Gulf of Mexico, and direct steamship service. These natural and economic conditions place Columbus in a most advantageous position and promise much for its future among the large and prosperous cities of the South. In the tremendous industrial growth of this country, cheap waterpower at the point of production of staples is what will determine the location of the large manufacturing cities of the future.

Improvements Planned at Vladivostok.

Consul Roger S. Greene, referring to his report published in Daily Consular and Trade Reports for September 5th, in regard to the improvements planned at Vladivostok, Siberia, now writes as follows:

"The municipality has determined to undertake by itself the construction of the electric street-railway and light and power plant. No definite project has yet been adopted, but an engineer has been appointed to prepare plans and estimates. The present intention seems to be not to give a contract for the whole to one firm, but to buy the necessary material from a number of different parties. Persons interested in any kind of street-railway and electrical supplies should therefore send at once catalogues to the mayor of Vladivostok, and catalogues, with prices and other pertinent information, either by their own representative or to some local house. The principal German electrical companies have already on the ground experienced representatives who know the local conditions thoroughly, and, of course, American manufacturers cannot expect to compete satisfactorily with them in this business unless they also are prepared to send here trained men speaking Russian, if possible, and, if not, German. Without special effort no orders, except, perhaps a few odds and ends, can possibly be obtained.

"The local American houses which might assist American manufacturers are: Clarkson & Co., and the Vladivostok branch of the Pacific Commercial Company of San Francisco."

BOOK TABLE.

THE GROUPING OF ELECTRIC CELLS. By W. F. Dunton. London: E. & F. N. Spon, Ltd. (Spon & Chamberlain, New York.) 1906. Pp. (4 by 6½ inches), vi., 52, Price, 60 cents.

The chief feature of the book is the demonstration that the rule, hitherto taught as an accurate one for grouping cells so as to get the greatest possible current with a given external restistance, cannot be relied upon to give the best regular group. The author gives a new set of rules for grouping cells, both for maximum-current output and for the minimum number of cells to send a given current through a given resistance. Twenty-eight exercises are also given in the book.

While the subject is not one that is of great interest to all engaged in electrical work, the book is interesting, because the author attempts to upset some of the rules that have been long in use and have apparently proven their value beyond doubt.

City Ownership Comes High.

The Record-Herald publishes an item dated Ithaca, N. Y., December 28th, which says: "The city of Ithaca must pay about $900,000 for the Ithaca waterworks system, which it could have obtained two years ago for about $600,000. The decision of the commissioners in appraisal of the noted suit for municipal ownership of the system was made known to-day. The case has been dragging along since 1904, and the costs to the city will amount to about $57,000. The terms of the decision are that the city pay the old water company $660,000, with interest from January 1, 1905. With the costs and the money expended for improvements since the property was acquired the plant will have cost the city $900,000. The water company offered to sell for $605,000. The city's offer was $450,000."

Census Figures of 1904 Collected in 1905.

A gentleman connected with the collection of census statistics points out that a misconception may easily be caused by the article in the issue of December 8th, entitled "Electrical and Other Manufactures in the United States in 1905." While it is true that these returns are published by the Bureau of the Census under the title "Census of Manufactures, 1905," as a matter of fact the statistics are those of 1904, although collected in the following year, each manufacturing company making its figures up to the end of the year 1904. It should be understood, therefore, that these statistics are to be taken as those of 1904 and not of 1905.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER V. (*Continued*).

Electric Wave Detectors.

Doubtless, the reader has observed that in the different arrangements for accomplishing satisfactory wireless operation, while there is, practically speaking, but one method of generating electric waves, there are many methods of intercepting these waves in space, and that, in fact, the different "systems" differ principally in the manner in which the waves are intercepted. During the last few years scores of investigators have worked diligently, endeavoring to invent a perfect means of wave detection, and while it is true that wireless-telegraph engineers believe that the ideal detector has not yet been discovered, yet a study of the various arrangements which have been developed will at least acquaint the student with the thorough manner in which the subject has been gone into.

In considering this subject, I might refer to a detector invented some years ago by Messrs.

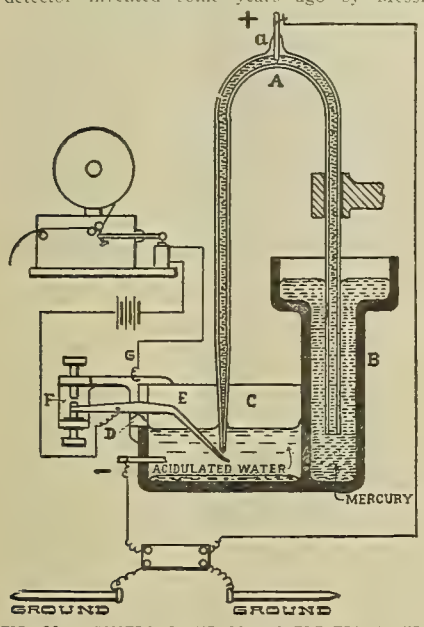


FIG. 33. ARMSTRONG AND ORLING ELECTRIC WAVE DETECTOR

Armstrong and Orling, the former a well-known English engineer, the latter a young Swedish electrician. Their receiver is illustrated in Fig. 33.

In the diagram, (A) is a small glass tube with one leg terminating in a finely drawn point, while each leg is open at its end. At the top of the tube a small neck (a) is fitted with a stopper to which the positive wire is attached. This instrument, which is but four inches in height, works on the principle of the siphon. One leg of the glass tube is inserted in the cell (B), which is filled with mercury, the other end of the tube terminating in the cell (C), which is filled with a solution of acid and water. Upon the outer edge of the cell (C) is fixed an agate pivot (D), and upon this is delicately poised a sensitive balance (E), one end of which descends into the cell (C), immediately below, and almost touches the end of the capillary tube. The other end extends outward to a small contact point (F), almost touching it. To this contact point is attached the wire leading to the Morse register or what other instrument it is desired to operate.

The action of the detector is as follows: Whenever the end of the balance in the cell is depressed it causes the outer extremity to fly upward and come in contact with the point (F). The capillary tube (A) is also filled with mercury. The wire leading from the positive pole of the battery is connected to the stopper (a), while the negative terminal of the battery is connected with a pole in the acidulated solution. As the current enters the capillary tube through the contact (a) it sets up capillary attraction of the mercury within the tube, which results in the precipitation of a certain amount of the mercury, varying according to the intensity and duration of the current, into the cell (C), which falls upon the end of the balance.

This immediately depresses the end of the beam and causes the opposite end to rise until it comes into contact with (F), and the current is conducted along the wire (G) to the electromagnets of the Morse register. As the balance (E) falls by the weight of the deposited mercury, the latter falls upon the floor of the cell. The balance of the beam (E) upon the jeweled point (D) is so delicate that the smallest amount of mercury falling from the tube sets it in motion and closes the local circuit, and as very faint currents will cause precipitation of the mercury, the detector is a very sensitive instrument.

The foregoing descriptions cover pretty thoroughly the various improvements which have been made up to date in the imperfect-contact type of Hertz-wave detector. These improvements, together with the increased height and number of aerial wires used, have made it practicable to receive signals at distances of five or six hundred miles under favorable atmospheric conditions.

In addition to the limited range of action, another serious objection to the coherer type is that the speed of operation is too slow for telegraphic requirements. A speed of but 10 or 12 words a minute could be obtained in practice, on account of the sluggish action of the coherer. The cohering and decohering process, together with the inertia of the apparatus used in connection therewith, requires a rather uneconomical time constant. It became evident, therefore, in the early stages of wireless operation, that a detector would have to be brought out which decohered automatically, that is, a detector which would be extremely sensitive to received oscillations and which would not require the aid of a mechanical tapper to restores the high-resistance state after the wave had ceased.

There are a number of names which come to mind in connection with the production of the modern type of auto-coherer; among them are Solari, Neugschwender, Schaefer, Fessenden, De Forest, Aschkinass and Schloemilch. In 1898-99 Neugschwender and Aschkinass, German physicists, conducted a series of experiments dealing with the effects of Hertz radiation upon circuits in which electrolytic action was taking place. In the latter year Dr. De Forest, in America, experimented along similar lines, which resulted in the development of a detector, or, as it is called, a "responder," which has given very gratifying results over both short and long distances, and has done much to build up confidence in the feasibility of wireless telegraphy for commercial purposes.

In explanation of the underlying principle of this device, it may be best to refer to the original experiments of Neugschwender. The silver plating on the back of a small glass mirror was cut with a keen-edged knife into two sections. Thus, an almost invisible insulating slit separated the two silver sheets. An electric circuit was then made, connecting a dry cell of battery, a telephone receiver and a galvanometer in series through the separated silver sections. Of course, the circuit thus arranged stood open, but when a film of moisture or drop of water was placed on the insulating slit the galvanometer needle was deflected and the telephone receiver gave out a click. This action, however, was gradual, the galvanometer needle being violently agitated for a few moments before coming to rest and the telephone giving a scratching sound for a moment before indicating a closed circuit.

With the circuit still closed, Hertz waves generated within range were found to disrupt the electrolytic path, or bridge, formed between the edges of the silver, and indications of the galvanometer and telephone showed that the circuit was thereby opened. But, upon cessation of the Hertz-wave impulse, the circuit again became closed.

This discovery opened up a new field of research, and the problem of developing a more perfect wave detector was attacked anew by a dozen investigators in as many different countries.

During the latter part of the year 1903 Schloemilch announced the discovery of what he termed "polarization cells." As constructed, the polarization cell consists simply of a small receptacle, into which is placed a small quantity of dilute acid, equipped with platinum electrodes, and connected to a source of electromotive force slightly in excess of that of the cell itself. The passing current decomposes the electrolyte and causes a slight liberation of gas. When exposed to the effects of Hertz waves, the current strength of the cell builds up, and a more pronounced liberation of gas is the result. The positive electrode used was of extremely small section, while the negative electrode could be made of any convenient size. Reversing the electrodes, stops the action entirely, clearly indicating that the gas liberated at the smaller electrode is the prime factor in the operation of the device. Inasmuch as the quantity of gas liberated is dependent upon the current strength, it is evident that the sensitiveness of the cell may be accurately regulated by the employment of a graduated resistance.

No decohering auxiliary is required, as the cell automatically resumes normal state when the action of the wave has ceased. The manner in which the cell is connected in the receiver circuit is shown in Fig. 34. A condenser of large capacity (C) connected in parallel is to minimize the damping influence of the cell.

It developed that the finer the wire used for the anode, the more satisfactory were the results obtained. At first considerable difficulty was experienced in making wires of sufficiently small diameter to satisfy the investigators that the limit of sensitiveness had been reached. One method

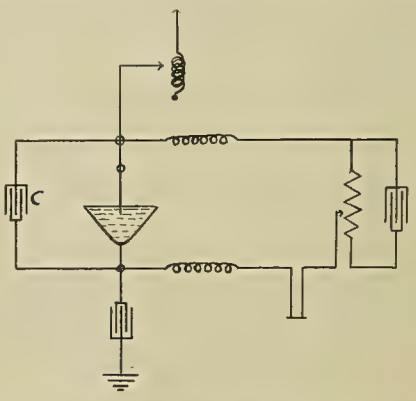


FIG. 34. METHOD OF CONNECTING POLARIZATION CELL.

employed was to have a Wollaston wire with platinum core, sheathed with silver, then drawn out to a fineness of two or three mils, after which the silver sheath was dissolved in acid, leaving the extremely thin platinum wire exposed.

A detector, to be presently described, invented by Professor Fessenden of Washington, D. C., resembles very much the Schloemilch device, both in appearance and in action. Professor Fessenden calls his detector a "liquid barreter." Considerable diversity of opinion exists regarding the theory of action of this device. Professor Fessenden asserts that the action is due to a heat effect, due to the action of the Hertz waves passing from the fine anode into the electrolyte. And if it is true that the thermal coefficient of the electrolyte is negative, the heat effect would naturally lower the resistance of the latter.

Experiments made by the writer with a Fessenden barreter showed that the lowering of resistance of the cell is proportional to the square of the applied alternating electromotive force. As the polarization electromotive force increases, the sensitiveness increases to a certain degree, and then remains constant. The resistance of the cell was found to vary between 800 and 50,000 ohms. The diameter of the anode used depends considerably upon the periodicity of the alternations employed. For slow alternations a wire with a diameter of one mil gave good results, but for oscillations of the higher order a diameter of 0.0003 millimeter gave the best results.

[*To be continued.*]

NOTE.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

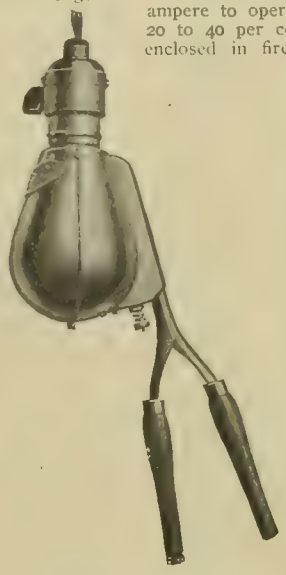
At the recent Empire Club luncheon held at Toronto, Ont., Mr. Cecil B. Smith of the hydro-electric commission of Ontario, in an address on Niagara and hydro-electric power, said that the investigations of the commission showed that from 5,000,000 to 6,000,000 horsepower could be made available to the people of Ontario, even during the dry season. Within six months 150,000 horsepower will be available from the Canadian companies at Niagara Falls, and a provision for greatly increasing this supply has been made. All the power required in the province within 150 miles of Niagara for some years to come is now ready to be employed.

Curling-iron Heater Utilizing Incandescent Lamp.

Among the interesting electrical novelties of the end of 1906 is the Rolfe electric "wireless" curling-iron heater, manufactured by the Rolfe Electric Company of Rochester, N. Y.

It is known that a large portion of the energy consumed by the ordinary incandescent lamp is thrown off in the form of heat and only a portion is radiated as light. This heater, as shown by the self-explanatory cuts, clasps over an ordinary 16-candlepower lamp and prevents the radiation of the heat. The curling iron is inserted alongside of the lamp and is said to be quickly heated to the required temperature.

ROLFE ELECTRIC CURLING-IRON HEATER AS APPLIED.



ROLFE ELECTRIC CURLING-IRON HEATER IN USE.

To ladies who travel this heater should be a special friend, as most modern hotels are lighted with electricity. Many modern residences also have gas in the kitchen alone and electric lights throughout the house, so in these homes this heater will find a place. No matter what the circuit or voltage may be, this heater is always ready and does the work.

Special forms holding two irons are made, if desired, for hair dressers and for use in theatrical dressing rooms.

These electric curling-iron heaters will be on exhibition in section A, division 7, at the Electrical Show at the Coliseum, Chicago, January 14-26, 1907.

The Benjamin "Anti-Night."

A new incandescent cluster, one form of which is here illustrated, has been placed on the market for lighting stores, offices and public buildings. It is called "Anti-Night" and its manufacturer says that for quality of light and for ease and economy of operation it is an epoch-maker in the field of artificial illumination. This fixture is made for clusters of three, four, five or six lamps, 50-watt frosted gem lamps being used. The style here shown is a six-cluster fixture form measuring 25 inches over all. It is highly ornamental, and as regards both first cost and cost of operation is said to be an extremely economical device. It is a National Code standard. The cluster body is finished in polished aluminum and the fixture, from reflector to tip of bottom lamp, is snow white.

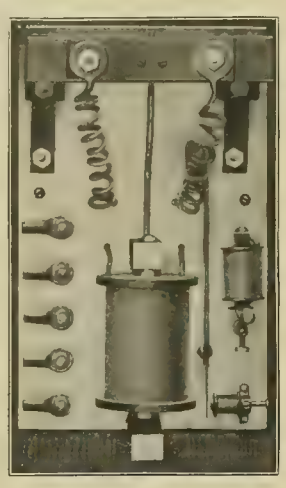
BENJAMIN "ANTI-NIGHT."

The turn-down feature of Anti-Night furnishes three degrees of illumination, being operated by using two single-pole switches, either pendant or wall. The first position lights the center lamp, the second the center and side lights, and the third the side lights only. Anti-Night is made by the Benjamin Electric Manufacturing Company.

Hays Automatic Electric Flasher.

The new Hays automatic electric flasher, illustrated herewith, has some interesting features which will commend its use. It operates on the magnetic principle, requiring no motor, belts, cams, brushes or gear wheels, and its simplicity of construction and operation does away with the constant attention of an electrician.

It is stated that this flasher requires but 0.381 ampere to operate it, thereby actually saving from 20 to 40 per cent. of current. These flashers are enclosed in fire and water-proof iron boxes and are covered by a broad guarantee. The Hays Electric Manufacturing Company of Indianapolis is the manufacturer.



HAYS AUTOMATIC ELECTRIC FLASHER.

250-volt Indicating Plug Fuse.

In electric-lighting installations where wires are exposed to view it is obvious that the fittings used should be as neat and compact in appearance as possible. Believing that the Edison plug cut-out represents the ideal design for this class of work up to 30 amperes, the D & W Fuse Company of Providence, R. I., has recently devised a plug fuse embodying all the merits of its cartridge fuse, including the well-known bullseye indicator. This indicating feature is entirely new with 250-volt plug fuses. Up to this time the construction of the company's plug fuse was such that it was impossible to determine the blown fuse without testing the circuits, but with this new type the blown fuse is detected at a glance, as the indicator is visible at all times, thus eliminating the present practice of testing for trouble.

Fig. 1. Label Before Blowing.

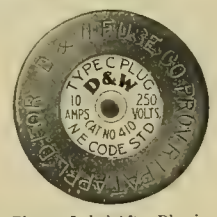


Fig. 2. Label After Blowing.

Fig. 3. Side View of Plug.

250-VOLT INDICATING PLUG FUSE.

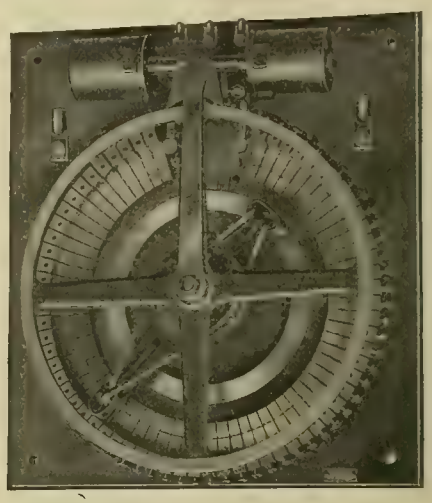
The operation is shown in Figs. 1 and 2, Fig. 1 giving the appearance of the label before the blowing of the fuse, and Fig. 2 showing the same fuse blown as indicated by the appearance of the black spot within the circle. Fig. 3 shows the full-size plug.

Another important factor in the construction of this fuse is that it can be readily renewed by returning to the factory, thereby reducing the cost of maintenance. This fuse has been approved by the National Board of Underwriters and it is now listed among its "Approved Electrical Fittings" of October, 1906.

Remote-control Rheostat Switches.

Modern switchboard engineering tends toward making the controlling board as compact and safe as possible. To this end remote-controlled apparatus with low-tension wiring at the switchboard has been devised. The accompanying illustration shows a simple remote-control field rheostat recently placed on the market by the General Electric Company. This new solenoid-operated rheostat has been developed to take the place of the bulky and expensive motor-driven switch, and, aside from being smaller and simpler than the old type of motor-driven switch, the new switch has the advantage of having no momentum to carry it beyond the desired point of rest.

This automatic rheostat is arranged so as to cut resistance in and out of the circuit by a revolving arm making contact on a series of points corresponding to divisions in the resistance. The switch arm is rotated by means of pawls which engage in the knurled rim of a wheel upon which it is mounted. The pawls are operated by a solenoid plunger to which the necessary reciprocating motion is imparted by alternately making and breaking the energizing circuits of the solenoid magnets. A single-pole double-throw control switch is used to close the circuit in one solenoid or the other, depending upon the direction in which it is desired to turn the switch arm. Limiting switches are provided, so that when the rheostat arm reaches either end of its travel it opens the operating circuit.



REMOTE-CONTROL RHEOSTAT SWITCH.

With the standard switches the operating solenoids are wound for three-fourths of an ampere and 125 volts. Three capacities are made, namely, 50 amperes, with 70 divisions; 100 amperes, with 65 divisions, and 200 amperes, with 46 divisions. The General Electric Company can also furnish special switches with solenoids wound for any standard voltage and with switches for smaller or larger capacities.

While remote-control rheostats of the type described are especially built for varying the field strength of generators, their use is not limited to this service, but they are adapted as well for cutting in and out resistance for any purpose from a distant point, where automatic "no-voltage" and "overload release" features are unnecessary.

GENERAL TELEPHONE NEWS.

The Sacramento Telephone Company has been incorporated at Alamogordo, N. M., with a capital stock of $10,000 by O. M. Lee and others.

The Eldorado Telephone Company of Oklahoma City, Yulsa, Eldorado and Quanah, Texas, has been incorporated with a capital stock of $300,000 for the purposes of building and acquiring lines throughout the state. Duncon G. Smith, J. R. Keaton, J. F. Woolbroight and a number of others are incorporators.

The Fifth District (Ill.) Independent Telephone Association recently held its semi-annual meeting in Peoria, Ill. President Dailey presided, and a committee was appointed to draw up a constitution for the association. A large proportion of the members were in attendance, and much interest was shown in the situation in Chicago and the matter of entrance into that city.

St. Joseph (Mich.) business men who favor the granting of a franchise to the Stromberg-Carlson Telephone Company have prepared a petition of 500 names asking the Council to grant the franchise. Another petition has been circulated opposing the introduction of a competing system by the granting of the franchise. The mayor of Benton Harbor vetoed the franchise which the Council voted to the company in that city and it will again come up for consideration.

CORRESPONDENCE.

Continental Europe.

Paris, December 18.—A combination gasoline and electric outfit is applied by the Compagnie Internationale of Liège to a standard-gauge locomotive for railroads. It is intended to be independent of outside current and can therefore be run on any road. Briefly described, the locomotive contains, first an engine of the 30-horsepower four-cylinder pattern; then, on the same shaft, is mounted a multipolar generator. The shaft is connected with the wheels of the locomotive by reduction gearing and a set of magnetic clutches, which are useful in starting. Mounted on the truck is a storage battery which can be charged by the generator, and the current comes in as an aid during hard pulls. In its general plan, the locomotive runs on the same lines as we are familiar with in the gasoline-electric automobile, but it contains some details which are of interest as applied to a large locomotive. The present type is designed mainly for shifting trains in station yards.

One of the principal German firms, the United Augsburg-Nürnberg Machine Company, has entered the field for the manufacture of steam turbines. It already builds electric cranes, tramway outfits, steam engines, water turbines, etc. The wheels which it is now constructing are of the Zoelly type and consist of a number of steam disk wheels placed in a succession of chambers, forming a compact whole. On the same foundation plate is mounted an alternator or generator. One of the largest groups which the company has installed so far is a 2,200-horsepower set, erected in the Elektrizitätswerk Mulhausen, and the turbine is coupled to a 6,300-volt three-phase alternator. Both turbine and alternator are enclosed in the outer casing and are well protected.

The annual Paris automobile show is a greater success than ever this year and undoubtedly contains the largest number of exhibits which has been brought together on the Continent, consisting of gasoline and electric automobiles and heavy hauling cars, stationary motors, magnetos and various kinds of ignition devices, storage batteries, headlights, pneumatic tires, etc. Seeing that the demand for space was greater this year, it was decided that no exhibits but actual automobile cars should occupy the main floor of the Grand Palace, so that the ensemble has even a better appearance than last year's show. The stands are handsomely decorated, and most of them have very tasteful illuminations by colored incandescent lamps, while in the immense dome are placed lamps arranged in artistic patterns, together with mercury-vapor lamps. It is said that 70,000 or 80,000 lamps are used throughout the building.

Not long ago appeared the annual report of the Compagnie Francaise Thomson-Houston, which has its offices and large factory at Paris. The company pays a dividend this year of five per cent. upon its capital of $8,000,000. As regards the different traction companies in which it has an interest, such as the Compagnie Générale Parisienne de Tramways, the Rouen Company, the Nice and Mediterranean Coast Tramways, also the tramway companies of Bordeaux, Versailles, Algiers and others, all these companies are paying dividends, and some of them are higher than for the preceding year. Another enterprise is the Compagnie Générale de Distribution, which is erecting hydraulic plants at Albi, also at Algiers, and will soon begin building a large station near Paris. Another large company is the Enérgie Electrique du Littoral Méditerranéen. As to the Thomson-Houston Company's shops at Paris, these are working with an increased output. The material needed for manufacturing the Curtis turbines was installed, and the first plant erected for the Compagnie du Gaz et d'Electricité of Nice, gave very satisfactory results. The new orders booked by the company include the equipment of the Marseilles station which the City Gas Company is erecting. The Tunis Tramway Company ordered the outfit for an electric railroad connecting Tunis, Carthage and Marsa. A. De C.

Great Britain.

London, December 19.—Quite the event of the week has been the publication of the prospectus of the Victoria Falls Power Company, and for the first time ordinary outsiders know exactly how matters stand. The engineers in chief to the company are Sir Douglas Fox and partners of London and Sir Charles Metcalfe of Rhodesia. As electrical engineers, the services of Messrs. Ralph D. Mershon of New York and Mr. Arthur Wright of London have been retained, while there is an advisory board of engineers, consisting of Lord Kelvin (London), Prof. André Blondel (Paris), Prof. Dr. G. Klingenberg (Berlin) and Dr. Edward Tissot (Switzerland). The primary object and intention of the company is to acquire a preferent right to develop 250,000 electrical horsepower at the Victoria Falls, and the exclusive right to deliver power from the Falls to the Transvaal Colony. Above this, however, it is recognized that an immediate supply of electric power to the Witwatersrand market is of paramount importance, and the company will, therefore, in the first instance, erect a steam-driven station in the vicinity of Johannesburg having a total generating capacity of 24,000 horsepower, and this plant will be requisitioned to maintain the supply until a transmission line has been erected from Victoria Falls and the necessary works completed. The Allgemeine Elektricitats Gesellschaft of Berlin has been given the contract for this station.

The share capital of the company is put at $15,000,000, and one of the directors will be Herr Rathenau of the Allgemeine Electricitäts Gesellshaft, Berlin. The scheme has received an enormous amount of expert technical criticism, and the strictures of such engineers as Sir A. B. W. Kennedy, Mr. Robert Hammond and Prof. W. E. Ayrton may create a little shyness on the part of investors. One fact much commented upon, by the financial press, is that whereas British investors are asked to subscribe, the company itself is registered in Southern Rhodesia, under the companies' ordinance, 1895, and is thus not liable to English law. The radical press, naturally, is attacking the scheme with extraordinary avidity, presumably from "patriotic" motives. To what extent it will affect the scheme I am not able to say, but a Reuter telegram from Johannesburg states that the government there has refused the application of the African Concessions Syndicate, which eventually will hold all the ordinary capital of the Victoria Falls Power Company, for power to construct an electric power line through the Witwatersrand, on the ground that the syndicate does not comply with the laws of the colony, in that it is not working a mine or carrying on any works. The applications for the shares close tomorrow.

One of the features of the parliamentary session will be the complete way in which the Administrative County of London and District Electric Power Company has given itself up into the hands of the County Council, so to speak. I have just seen an early copy of the company's bill, and it forms a striking contrast to bills of previous sessions. In fact, in face of a strong political opposition, this strong company has to conduct itself in the meekest possible manner. Its bill this year seeks no defined territory within which it may supply; it asks for no compulsory or semi-compulsory powers over existing authorities. It merely asks to be allowed to enter into agreements with the London County Council, and the subsequent clauses are so worded that practically its every action is to be subject to the consent of the London County Council. Opposition is already being organized against the London County Council scheme on the part of many of the borough councils.

On the occasion of the opening of London's latest tube railway, the Great Northern, Piccadilly and Brompton Railway, the new chairman of the London Underground Company, Sir George Gibb (successor to Mr. C. T. Yerkes), pronounced strongly in favor of differential fares in opposition to zone fares. Those who remember the very strong remarks made by the late Mr. Yerkes in favor of zone fares, before a parliamentary committee three years ago, will regard Sir George Gibb's opinion as a further indication that American ideas have not always borne fruit when applied to English conditions. For instance, in London, one of the railway companies' greatest competitors over short distances is the motor-omnibus, the existence of which has not to be reckoned with in the United States.

Hull seems to be experiencing the same difficulty in coming to an amicable settlement with the National Telephone Company on the question of intercommunication between the municipal telephone system and that of the company as was the case at Swansea. The cost, according to the corporation, would be about $1,500 to both parties, but the company has such a complete want of faith in the estimates of the corporation consulting engineer that there will probably be a good deal of negotiation before the matter is settled.

A discussion took place in the House of Commons yesterday on the terms of the Berlin wireless-telegraph convention, and the government has promised to appoint a committee early next session to inquire into the whole question and issue a report.

Just at the moment of posting these notes it is announced that the Victoria Falls Power Company has removed one obstacle to its rapid progress. The Falls Power Company has acquired the undertaking of the Rand Central Electric Works, and this must be regarded as a good stroke of business. G.

Dominion of Canada.

Ottawa, December 29.—The Electrical Development Company of Ontario has bought a right-of-way, 100 feet wide, for a power line to Brantford, Ont., which city will be made a center, whence will radiate extension of the company's line to Paris, Woodstock, Ingersoll and London, Ont., and north to Galt, Preston, Hespeler, Guelph and Berlin.

P. W. Sothman, chief engineer of the hydro-electric power commission of Ontario, reporting to the board of control for Toronto, states that the cost for commercial lighting would be six cents per kilowatt-hour and residential lighting five cents. The light company charges 12 cents for the former and eight cents for the latter.

The Stark Telephone, Power and Light Company has bought the Erindale power concern at Toronto for $47,500. The property consists of a power-basin dam, real estate, chattels, franchises and pole lines.

A striking evidence of the growth of the city of Ottawa is shown in the increase of the passenger traffic on the Ottawa Electric Railway. In comparison with the year previous the result shows a daily average increase of 5,000 passengers in 1906. This improvement in trade enabled the directors of the company, a few days ago, to award the biggest profit of its history. The regular dividend of eight per cent. is forthcoming to the shareholders and an additional bonus of four per cent. This exceeds last year by two per cent. and is the largest dividend ever paid by an electric-railway company in Canada. W.

Winnipeg, Man., December 29.—Application is being made to the Alberta Legislature for an act to incorporate the Lethbridge Radial Railroad Company for the purpose of building an electric-railway system in and about Lethbridge. Kenneth M. Fessenden, Lethbridge, Alberta, is interested.

The British Columbia Electric Street Railroad Company will at once commence construction on a line to connect Eburne and New Westminster. R. H. Sperlin is general manager, Vancouver, B. C.

The town of Portage la Prairie has decided to take over and operate an electric-light plant.

The Beatrice Gas and Power Company of Beatrice, Neb., has made an offer in the city of Brandon to supply light, heat and power. The offer will probably be accepted.

Sealed tenders addressed to the chairman of Fire, Water and Light Committee, Winnipeg, Man., will be received until 2:30 p. m., January 14th, for the supply of one 750-kilowatt electric generating plant. Plans and specifications may be had from M. H. Rattan, city engineer.

Application has been made to incorporate a suburban electric-railway company to build an electric railway from Winnipeg to Lake Manitoba.

Superintendent Jones of the electric-light department, Fort William, Ont., has recommended to the commissioners that a meter system be installed instead of the flat rates now in vogue. The recommendation will likely be adopted. R.

New York.

New York, December 29.—What would be the result of a conflagration in the lower section of New York city, in case it should ever get beyond the immediate control of the Fire Department, has for a long time been a matter of very serious consideration; hence anything that promises improvement in the facilities for fighting fire has an absorbing interest for the New Yorker. Fire Chief Croker has been conducting a series of experiments with a new electric fire engine, equipped with powerful electric pumping apparatus, designed to take the electric current obtained from trolley or other source at a point located at the source of water supply. So far the developments have been highly satisfactory, and if, in Chief Croker's judgment, the new electric engine can do what is claimed for it by its friends, it will not be long before New York city's Fire Department will be equipped with electric fire engines that can instantly produce enormous pumping power and be a great factor in safeguarding the city from the possibility of such a terrible disaster as would inevitably result in case a conflagration once got beyond the control of the Fire Department.

The New York Independent Telephone Company, which is the successor to the Mercantile Electrical Company, has made application to Commissioner O'Brien of the Department of Water Supply and Electricity for permission to lay electrical conductors in subways in Wall Street from an intersection at New Street to a vault at 7 Wall Street. This application is made as a test case. The New York Independent Telephone Company asserts the right to lay electrical conductors under the streets of New York without obtaining a franchise, under the rights granted by an old state charter to the Mercantile company, which it succeeded. Corporation Counsel Delany some months ago held that the charter did not convey this power. It has generally been understood and construed that the charter provided only for the laying of wires for burglar alarms. Mr. O'Brien sought the advice of Corporation Counsel Ellison as to his power to grant such permit, and Mr. Ellison replied: "Permit applied for should be refused. In view of the probable litigation following this refusal, the grounds for the refusal should not be stated." A favorable decision in this matter would be of vast importance to the new telephone company in its fight against the older companies and in the direction of lower local rates for the public.

During the last week the Brooklyn Rapid Transit Company has added a new 12,000-horsepower unit to its plant. This increase in available power has enabled the company to add materially to its facilities. The officials say that the service has been increased from 25 to 33 per cent. On the

elevated roads three-car trains have been increased to four-car trains and two-car trains to three-car trains. There has also been a general increase in the number of cars on many trolley lines where the service was notoriously inefficient. The improvement was greatly appreciated by the traveling public, and while much remains to be done before New York City is provided with adequate means for transportation, still this concession was hailed with delight by the patient strap-hanger, and in the thankfulness of his heart he is quite contented to accept the statement of the company that "all these changes had been decided upon before the State Railroad Commission had suggested them."

The Brooklyn Rapid Transit Company has just placed an order with the Westinghouse company for the largest steam electrical generating units ever built in the world. The contracts call for five steam turbines of 10,000 kilowatts each. As these machines will be able to carry a 50 per cent. overload, the total capacity of each unit is equal to 20,000 indicated horsepower.

The Rapid Transit company has already contracted with the Westinghouse Company for four 7,500-kilowatt turbines of this type, of which two have been in operation for some time. An Allis-Chalmers turbine of 5,500 kilowatts is also installed in the same plant, the Kent Avenue power house. The Westinghouse company will also supply an equal number of electric generators of the same capacity as the turbines. The cost of these five turbines and generators will be about $2,500,000.

Movements in connection with John C. Sheehan's Manhattan-Brooklyn transit deal are becoming interesting. A valuable property has just been obtained on Water Street for tunnel purposes to construct the subway from Broadway, New York, to the City Hall in Brooklyn. This will cost $3,500,000. The important feature of the move is that the tunnel to be built will cross the line of the proposed north and south tunnel on Third Avenue, Manhattan, and complicates the situation to such an extent that the Manhattan Transit Company will have a tremendous advantage over all competitors in bidding for the Third Avenue subway. D. E. P.

Ohio.

Cleveland, December 29.—The street-railway fight in this city became strenuous last week when the Forest City Railway Company undertook to evade the injunction granted by the court a few days ago to prevent the use of the Cleveland Electric tracks between the Superior Street viaduct and the Public Square by the new company. Having obtained a permit from the board of public service at a called meeting after the adjournment of the City Council Wednesday evening, the Forest City people gathered their working force and soon after midnight began the construction of a temporary track to connect the points named. Connecting with the viaduct tracks at West Ninth Street, the rails were laid on the top of the pavement on Superior. The viaduct track belongs to the city, and the company seems to have had a right to connect their track with them. Iron strap ties were used, with five-inch rails, bolted together in a loose manner.

The poles were improvised by nailing scantlings together and placing an arm at the top. This was held in position by a brace. The poles were set in barrels of ashes at the side of wagons heavily loaded with ashes, and were held in position by ropes from the tops to the ends of the wagons. This kind of construction extended from the viaduct to the public square. It excited considerable curiosity among the early arrivals uptown. The trolley wire was fastened to the arms with ordinary small wire and at the square was anchored to the flag pole, while at the other it was fastened to a post.

At three o'clock Thursday morning, just as the tracklayers had reached a point opposite the Rockefeller Building, an injunction was served upon Fred C. Albers, assistant to President Dupont of the Forest City Traction Company, and Mayor Tom L. Johnson, who seemed to be busy superintending the construction. The injunction was issued by Judge Keeler an hour before at the instance of I. C. Cooper, a property owner on Superior Street. It included the Forest City Railway Company, the Municipal Traction Company, the Low Fare Railway Company and Tom L. Johnson. Work was immediately suspended, but the street was left in bad condition.

During the day another injunction was filed with Judge Babcock, asking for the removal of the debris from the street on the allegation that it impeded traffic and was damaging the business of the stores along the street. This was done at the instance of property owners and merchants. On Friday the City Council met and granted the Forest City Railway Company a permit to lay a temporary track on Superior Street, in order that the injunction might be rendered inoperative, but the company did not venture to resume work, preferring to await the hearing which was commenced Saturday before Judge Beacom.

On Sunday the Cleveland Electric Railway Company announced that on Monday morning a trial of their plan of selling seven tickets for a quarter would be begun. The management desires to give people an idea of what the proposition is and for a certain period tickets will be sold at that rate. Possibly the trial will last two months. O. M. C.

Michigan.

Grand Rapids, December 29.—Lansing officials are proposing action to bring the Commonwealth Power Company under a franchise in that city. The company is now supplying one concern in the edge of the city and has not secured a franchise. The company intends later to secure a franchise and go after business in the city, as it will then be supplying the power for the lines of the Michigan United Railways.

The Edison Illuminating Company of Detroit is preparing to make a reduction of one cent per unit in its maximum lighting rate of 16 cents. The minimum rate of four cents is to be left as it is.

The Marquette Light and Power Commission has decided that the city should build a new plant, power house, dam and canal. The approximate cost will be $97,000. The new plant will develop 1,500 horsepower. By extending two pipe lines from the forebay to the power house, installing two waterwheels and generators, 3,000 horsepower can be developed. The present 1,000-horsepower plant will be maintained as it stands. The net earnings of the plant for the fiscal year were $20,000. O'Keefe & Orbison of Appleton, Wis., have prepared plans for the new plant.

Iron River has granted a 10-year franchise for the construction and operation of an electric-lighting and power plant to A. J. Lytle of Norway and associates. An expenditure of $200,000 is contemplated. Power will be secured at Hemlock Rapids, on the Paint River, where it is said 6,000 horsepower can be procured. The maximum rate for incandescent lighting is to be 10 cents per kilowatt-hour and for street lighting $60 per arc lamp on an all-night schedule.

The Detroit United Railways has purchased the Detroit, Ypsilanti, Ann Arbor and Jackson Electric Railway through a holding company. The details of the transfer are not given out. The property acquired is capitalized at $2,600,000.

The Saginaw, Owosso and Lansing Railway Company has been incorporated to build an electric road between the cities named, with branches to Alma and Durand. The company is incorporated under the steam-road act, with a capital of $60,000. The incorporators are J. L. King, Syracuse, N. Y.; F. S. Richards, Cleveland; George P. Morley, Saginaw, and others. L. W. B.

Indiana.

Indianapolis, December 29.—Arrangements have been made for the establishing of through electric-railway service between Detroit and Indianapolis by way of Toledo. The new route, as now planned, will be from Indianapolis via the Indiana Union Traction line to Waterloo, thence to Toledo over the Toledo and Indiana, and from Toledo to Detroit by the Toledo, Lake Shore and Detroit line.

A movement has been started in Evansville for the erection and equipment of a municipal lighting plant. Mayor Boehne says that Evansville is the poorest lighted city in the state, and that the sentiment for municipal lighting is almost unanimous.

As a matter of economy the City Council of Anderson has decided to consolidate the city electric-light plant and the city water plant under one management, naming Henry Dranch as superintendent. The consolidated plants will be improved by the installation of a new set of boilers and other equipment.

The Danville electric-light plant, formerly owned by James H. Wilson, has been sold to James M. Lynch. Mr. Lynch is a practical electrician, having been formerly engaged in erecting and installing electric-light plants. He will remodel and improve the Danville plant.

The City Council of Boonville has taken steps toward the erection and installation of a municipal electric-light plant. Plans and estimates are now being secured. In the meantime the private company is proposing to sell its plant to the city. The City Council is in favor of a new plant.

The Evansville and Southern Indiana Traction Company has filed articles of incorporation. The capital stock is $4,500,000. The company proposes to operate an electric railroad through a number of counties in southwestern Indiana. The company also proposes to engage in supplying electricity for light, heat and power to the cities and to the people along the entire line. H. B. Smith, C. M. Murdock, R. I. Todd, Hugh J. McGowan are directors.

The Ft. Wayne and Wabash Valley Traction Company has put on sale a half-fare ticket for children between the ages of five and twelve.

An increase of one cent per hour has been granted to the employes of the Indianapolis Traction and Terminal Company, beginning January 1st.

The Indiana traction officials are organizing to oppose the proposed bill to limit traction lines to one cent a mile for passenger rates, also a bill to prohibit the merging of interurban lines and a bill to prohibit the taxpayers in any township from voting a subsidy for an electric railroad. The interurban people are also opposing the proposition of the railroad commissioners to bring interurban lines under the power and jurisdiction of the State Railroad Commission.

Limited service will be inaugurated between Indianapolis and Dayton, O., January 1st, the distance is 110 miles and the limited trains are scheduled to make the trip in four hours.

The Travelers' Protective Association of Indiana has prepared a bill for presentation to the Legislature calculated to secure better rates on steam and interurban lines for traveling men's baggage.

The Panama Construction Company, with headquarters in Wolcottsville, Ind., and a branch office at 103 and 105 Washington Street, Chicago, has been incorporated with a capital of $25,000. The declared object of the company is to promote and operate electric railway, light and power plants in the state of Indiana. E. A. Hebberd, D. G. Splane and O. G. Wales are the directors. S. S.

Illinois.

Peoria, December 29.—The mayor of Peoria signed the ordinance passed by the City Council on December 18th granting the Peoria Gas and Electric Company a 40-year lighting franchise. The city gets several valuable concessions by the franchise, the maximum price of gas is 90 cents during the life of the franchise. Electricity is 10 cents per kilowatt with a sliding scale for large consumers. The company is to put its wires underground in the business district.

A plan is on foot by a party of foreign capitalists to buy or lease the Clover Leaf Railroad and make it the main line of a great system of electric roads in the Middle West to be headed by Congressman McKinley.

President W. B. McKinley, in company with the directors of the syndicate, will make a tour of inspection of the Illinois properties early in January. Among other things to be considered will be the appropriation of $600,000 for the building of the Peoria-Canton line. The contract for the construction of the line from Springfield to Pana by the Springfield-Southeastern has been let to the Turner Construction Company of New Orleans. The work is to be started soon as the weather permits and to be finished by September 21, 1907. The price agreed upon is $33,000 per mile.

The new line between Springfield and Lincoln which was opened this week promises to be one of the best paying of the Illinois Traction Company's lines.

The new Wabash shops at Decatur are electrically equipped and the machines are now being tested preparatory to opening January 1st.

The Lena Electric Light and Power Company of Lena has been incorporated to furnish light and power; capital, $12,000. Incorporators, G. W. Benfer, J. D. Hinds and A. J. Clarity.

The Green Engineering Company of Chicago has increased its capital stock from $75,000 to $200,000.

The Elgin Merchants' Light Company of Elgin has increased its capital stock from $2,500 to $50,000.

The Peoria Railway has installed on 60 days' trial a new electric track switch that is operated by the trolley. The car desiring to make the curve must take power when passing the overhead switch, which is located one pole ahead of the track switch, while those that take the straight track coast along without power. If they prove satisfactory 10 more will be ordered and installed.

The proposed Indianapolis, Crawfordsville and Danville line will connect at Danville with the McKinley lines and place Peoria in connection with over 3,000 miles of interurban roads in Indiana and Ohio. V. N.

Pacific Slope.

San Francisco, December 27.—The United Railroads is improving its service as rapidly as it can while hampered by a shortage of power, lack of sufficient cars and the bad condition of the streets since the rains began. The frequent stalling of heavily loaded wagons on or near the tracks causes many vexatious delays to car traffic.

The business men of Van Ness Avenue have installed and are now maintaining a row of somewhat ornamental poles extending almost the entire length of that broad thoroughfare, each carrying two 1,000-candlepower arc-lamps at a height of about 20 feet from the ground.

Representatives of 70 local electrical contracting firms recently held a meeting and formed the Electrical Employers' Association. It is understood that the new organization will consider the feasibility of opposing the demand for a minimum wage scale of $6 a day, which the members of the Independent Brotherhood of Electrical Workers will attempt to put into effect January 1st. In view of the great amount of building construction under way, a strike or a lockout, if prolonged, would cause a serious check to the rebuilding of the city.

The San Rafael Gas and Electric Company has planned the remodeling and extension of its system so as to supply gas to San Anselmo, Ross, Larkspur, Corte Madera, Belvedere, Tiburon, Sausalito

and Mill Valley, Cal. The company's gas and electric plant will be moved from its present location at San Rafael to a point on tidewater, where fuel oil can be conveniently supplied.

A transfer of the control of the electric railway and lighting system serving Monterey and Pacific Grove, which was pending for some time, has taken place.

The recent fire in the Sixth and Palmetto Street plant of the Los Angeles Electric Company, which caused damage estimated at $50,000 to the switchboard and station equipment, is said by the management to have not damaged more than two of the generators seriously.

The Town Trustees of Berkeley, Cal., have granted the Home Telephone Company a franchise to operate in Berkeley, the price of the privilege being $47,000. The money is to be expended on the fire department, it is understood. An underground conduit telephone system will be installed through the greater part of the city and the exchange switchboards are to be of the automatic type.

The Los Angeles Pacific Railroad Company has announced that it will at once begin the construction of a branch line from Beverly Station, half way between Los Angeles and the ocean, to an intersection with Sunset Boulevard.

Articles of incorporation have been filed at Riverside, Cal., by the San Bernardino Interurban Railway Company, which is capitalized at $1,000,000. Four electric lines with branches are to be built by the company according to its objects as set forth.

J. A. Whitehead recently incorporated the Pacific Power Company. It is planned to divert 20,000 inches of water at the Long Ranch on Battle Creek. It will be carried six miles down the creek to the proposed power plant, and 12,000 horsepower can be generated, according to the promoter's estimates.

S. H. Sauve, president of the Suave Electric Company of Spokane, Wash., inventor of the Sauve coil, is trying to arrange for a manufactory in Cœur d'Alene, Idaho.

Articles of incorporation have been filed for the Hydro-electric Mines and Power Company of Salmon, Lemhi County, Idaho. The capital stock is placed at $250,000 and the incorporators are G. B. Quaries, George W. Meitzier and others, all of Salmon.

The City Council of San Diego will receive bids for the purchase of a new street-railway franchise in that city up to January 7, 1907, each bid to be accompanied by a check.

A shipment of 120 tons of steel rails has been received in Guadalajara, Mexico, for the electric street-railway line of the Compania Industrial de Guadalajara. Construction work has been commenced.

The Central California Traction Company's electric-railway line, extending from Stockton to Lodi, Woodbridge, and other suburban points, is being rushed to completion. It is a modern third-rail system. Electric power will be supplied from the American River Electric Company's transmission line via the necessary sub-stations. A.

PERSONAL.

William H. G. Butler, manager of the Citizens' Telephone Company of Columbus, Ind., retired with the close of the year, having resigned from his position. He will be succeeded by J. W. King of Indianapolis.

P. E. Yeatman, manager of the Southern Bell Telephone Company at Norfolk, Va., has resigned his position. The duties of the office will devolve upon J. R. A. Hobson, who goes to Norfolk as state manager of the Bell Company.

The board of directors of the United Railways and Electric Company of Baltimore has selected Second Vice-president William A. House to fill the position of president of the company, taking the place of the late president, Gen. John M. Hood, until a permanent election is held.

Mr. Nathaniel P. Yeatman, secretary and treasurer of the Nashville Railway and Light Company of Nashville, Tenn., died very suddenly on December 18th. He had been secretary of the company for 15 years and was one of the well-known and well-liked citizens of Nashville.

Amos A. Lawrence, president of the Cohasset (Mass.) Electric Light Company, died at his Cohasset home on December 23d. He was born in that town on November 3, 1847. He was one of the incorporators of the Cohasset Electric Light Company and had been its president since it was organized.

W. H. Johnston, chief engineer of the Consolidated Telephone Company of Buffalo, and to be chief engineer of the Milwaukee Independent Telephone Company, has arrived in Milwaukee to begin at once the construction of the new system. He expects to have the telephone system in operation within 16 or 18 months.

Samuel Little, president of the West End Street Railway Company from 1893 until 1900, died at Hotel Lenox, in Boston, on December 21st. He was born in Hingham, Mass., on August 15, 1827, and became interested in the Highland Street Railway Company upon its organization in 1872. When all the Boston companies consolidated under the name of the West End Street Railway Company Mr. Little became a director. He succeeded Henry M. Whitney as president.

Harry S. Conover, son of George W. Conover, the well-known "buyer and seller," is expected in Chicago early in January after a two months' European trip. Mr. H. S. Conover is associated with his father in business. Early last November, through Armour & Co., the opportunity presented itself to make a trip to Europe for that company. While abroad Mr. Conover visited London, Paris, Edinburgh, Berlin and Rome.

Mr. Ludger Trudeau, superintendent of the Montreal (Canada) Street Railway Company, died December 11th, at his home. While quite a young man, Mr. Trudeau entered the employment of the Montreal street railway. His ability was quickly recognized, and, after many promotions, he reached the position of inspector when the electric cars were introduced. Later, Mr. Trudeau went to Bordeaux, France, and was connected with the management of the electrical system in that city. From there he went to Alexandria, Egypt, and assumed the management of the street-car system there. In 1904 he returned to Montreal and since that time has occupied the position of superintendent of the Montreal systems.

In an article on "The University of Glasgow" in the London Times Engineering Supplement, "A Graduate" says: "In the natural philosophy department the most honored name is that of Lord Kelvin, who for 67 years had his home within the gates of the university and for 53 years out of that total occupied the chair of natural philosophy. He was the first to introduce laboratory work as part of the student's course, and his first laboratory work was situated in a deserted wine cellar of an old professorial house, enlarged a few years later by the annexation of an abandoned examination room. When the new college was built on Gilmorehill in 1870, provision was made for a proper teaching laboratory, and it would be superfluous to set out here a list of the important original investigations which have been carried out there by professor and students, for Lord Kelvin's work is known to all the world."

ELECTRIC LIGHTING.

The electric-light plant at Shannon Falls, Minn., has recently been destroyed by fire.

The city of Marshfield, Wis., has purchased an entirely new equipment for the municipal electric-lighting plant in that city.

The Hubbard City Light and Power Company of Hubbard, Texas, has sold its plant to the Union Central Light and Ice Company.

H. M. Byllesby & Co., engineers, Chicago, have purchased the business of the Muskogee Ice and Power Company of Muskogee, I. T.

R. G. and E. M. Kerlin of Toledo, Ohio, have purchased the local plant of the Kenton Gas and Electric Company of Kenton, Ohio, for $100,000.

J. L. Spurlin and associates have organized an electric-light company in Hamilton, Texas. They have incorporated with a capital stock of $10,000.

The Rockwall Electric Light Company of Rockwall, Texas, has been incorporated with a capital stock of $5,000 by W. C. Bishop, L. J. Austin and others.

A. J. Lytle has received a franchise to build and equip an electric plant for the purpose of lighting the village of Iron Mountain, Mich., and vicinity.

The Lena (Mo.) Electric Light and Power Company has been incorporated with a capital of $12,000. The incorporators are G. W. Benfer, J. D. Hinds and a number of others.

The City Council of El Reno, Okla., has given a 21-year franchise to the Electric Light and Gas Company. The council granted the franchise over the veto of the mayor of the city.

Both branches of the City Council of St. Paul, Minn., have passed the ordinance granting a franchise to the Northern Heating and Electric Company and the mayor's signature has been affixed, so that construction work can be commenced without further delay.

The Hearne Light and Power Company of Hearne, Texas, has been incorporated with a capital of $20,000 to furnish light and power to the public. C. H. Alberts, W. T. Bartholomew and others are incorporators.

A 30-year franchise for the public and private lighting in Mt. Clemens, Mich., was granted to the Detroit Edison Company by the City Council of that city on December 17th. The company will light churches and municipal buildings at half rates. The full rate is 12½ cents per unit.

The town of Brookhaven, Miss., has recently awarded a contract for a new municipal lighting plant, consisting of one 200-kilowatt and a 100-kilowatt alternating-current generator, to furnish light and power for the street lights, etc. The contract for the generators was secured by the Crocker-Wheeler Company of Ampere, N. J. The 200-kilowatt generator is of the engine-type, alternating-current, three-phase, 60 cycle, 2,300 volts, and the 100-kilowatt machine is belt driven, alternating-current, three-phase, 60 cycle, 2,300 volts. A 13-kilowatt generator is to be furnished as exciter for the 200-kilowatt unit and a 2½-kilowatt generator for the belt-type generator.

ELECTRIC RAILWAYS.

R. W. Clark is seeking a franchise to operate an electric street railway in Huron, S. D.

W. J. Hall has been granted a franchise for an electric street-railway system in Wallace, Idaho.

Henry W. Dorman has asked the city of Caldwell, Idaho, for a franchise for an electric street railway.

The Roanoke Railway Company of Roanoke, Va., is preparing to extend its lines. About $100,000 will be expended in improvements.

The Chicago and Milwaukee Railroad Company has been granted a franchise to operate an electric railway on the city streets of Kenosha, Wis.

The Iowa Railway, Light and Power Company has been organized at Marshalltown, Iowa, and will succeed to the business of the local light and railway system.

The Amarillo Street Railway Company of Amarillo, Texas, has been incorporated with a capital stock of $250,000 by J. C. Paul, W. E. Kirk and a number of others.

The Atlantic (Iowa) Northern and Southern Railway has been organized with a capital of $150,000 and with J. H. Simmons president and J. Stier secretary. It is the intention to build an electric road from Manning to Villisca via Atlantic and Elkhorn, Iowa.

Traction officials and representatives of the city of Chicago are concluding the terms of a franchise ordinance for the Chicago Union Traction Company at this writing. The meetings are being held in Atlantic City, and it is understood that a satisfactory agreement will be reached. New internal troubles have arisen between the Union Traction and its underlying companies, but these, it is said, will not be permitted to interfere with the concluding of franchise negotiations with the city.

PUBLICATIONS.

Bulletin and price-list No. 79½ of the Cutler-Hammer Manufacturing Company, dated May, 1906, covering drum-type machine-tool controllers with automatic release, was sent out in error, and notice of cancellation of same is given. Copies of this bulletin should be destroyed, as a superseding bulletin will be mailed at an early date.

W. H. Schott, engineer, Chicago, is remembering his friends and patrons with a handsome wall card. The picture, entitled "The Signal," is done in relief and is that of an Indian chief stationed in a rocky mountain gorge giving a signal to other warriors in the valley beneath. He holds in his hand a burning brand with which the signal is given. ....

A number of interesting bulletins have recently been issued by the Rockwell Engineering Company, 26 Cortlandt Street, New York. These relate to the Rockwell fuel oil-burning appliances, annealing, welding and hardening furnaces, furnaces for tempering, coloring, annealing and hardening with oil or gas fuel, brazing furnaces, rivet-heating furnaces, pot furnaces for lead and cyanide hardening and for melting soft metals, and double-chamber furnaces for metal melting. The bulletins are all well illustrated and contain much information that will be useful to those engaged in work which requires this class of appliances.

The Buckeye Electric Company of Cleveland will issue at short intervals a series of 12 "lamp talks," the first of which is about regular lamps, by which is meant carbon-filament lamps, which are made in hundreds of different classifications and patterns. Buckeye lamps have been made for the last 17 years. The first ones were crude-looking things called "goose eggs," because of their awkward look, but they brought 75 cents apiece and more. The shape has given way to something more graceful, the price has gone away down, and the lamp itself has gone through development after development, until today when the company offers the Buckeye lamp it says that it is offering something that is without a peer.

The Allis-Chalmers Company has issued bulletins Nos. 1419, 1501 and 1503. The bulletins are all of the standard size, so that they may be bound with the other publications that the company sends out. Bulletin No. 1419 describes the Allis-Chalmers crushing rolls for coal, rock salt, etc. Bulletin No. 1501 describes the Allis-Chalmers belted Corliss engines, Reliance pattern, and contains illustrations of various details of the engines. Bulletin No. 1503 describes the company's direct-connected Reynolds-Corliss engines, Reliance pattern, and also contains

illustrations of the details and complete machines connected direct to dynamos. The bulletins are effectively arranged and the illustrations are excellent. The company is also sending out an illustrated leaflet, No. 4001, describing the Reliance friction clutch.

The Crocker-Wheeler Company of Ampere, N. J., is publishing a 1907 calendar showing a view, printed in colors, of the main office and works of the company, where its electric motors, generators, transformers, etc., are designed and built. The calendar is an excellent example of lithographic work and gives an impression of the magnitude and attractive surroundings of the Crocker-Wheeler works.

The Electric Storage Battery Company of Philadelphia has recently issued a folder describing the application of Chloride accumulators and Exide batteries to railway signal and interlocking systems. The folder contains an interesting table, showing the rapid increase in the use of these batteries for this class of work, and gives illustrations of several of the types usually employed in signal service. Illustrations are also shown of batteries of Chloride accumulators in place in semaphore towers.

SOCIETIES AND SCHOOLS.

The Technical Publicity Association devoted its meeting of December 20th in New York city to the subject of "The Value of Circulars and Printed Matter." Mr. Frank Vreeland, art editor of the American Printer, spoke of the commercial value of beauty in typography, and Walter Gilliss, president of the Gilliss Press, New York, made some remarks about limited editions.

The Northwestern Electrical Association meets in Chicago in the Coliseum, January 16th, 17th and 18th. An attractive programme is prepared. The electrical show will be in full swing. Members are urged to be present and to extend a cordial invitation to their friends. For information address, Harold Almert, president, 704 Royal Insurance Building, Chicago; B. C. Adams, secretary and treasurer, Lincoln, Neb.

On the occasion of the annual meeting of the managers, salesmen and heads of departments of the Salt Lake Electric Supply Company and the Capital Electric Company of Salt Lake City, a theater party for 162, followed by a banquet, was tendered by Mr. R. W. Nicol, president of the companies. The banquet was held in the Wilson Hotel on Christmas day. The menu was neatly designed, some appropriate electrical terms being used to designate the courses.

Lewis Institute, Chicago, announces its evening course of instruction in electrical engineering, beginning Monday, January 7, 1907. There are three courses: The first-year course covers engineering principles of electricity; the second year direct-current motor and generator testing, and the third-year course alternating-current transformers and transmission. The winter term begins January 7th and continues 10 weeks. The Institute, corner Madison and Robey streets, is open from six to 10 four evenings a week—Monday, Tuesday, Wednesday and Thursday.

The subject of central-station accounting is again being actively taken up by the National Electric Light Association, and a strong committee has been appointed by President Williams to report at the 1907 convention of the association. The members of this committee are H. M. Edwards of the New York Edison Company (chairman), A. S. Knight of Boston, G. W. Curran of the United Gas Improvement Company of Philadelphia, C. N. Jelliffe of the American Light and Traction Company of New York, and Paul R. Jones of Henry L. Doherty & Co. These gentlemen have a very thorough knowledge of the subject, and a very valuable addition to the work already done in this line by the association may be looked for.

TRADE NEWS.

A stockholder has asked the court to appoint a receiver for the Finsen Light Institute of America—a Chicago concern which has attracted attention from its use of the therapeutic electric-light treatment of the late Dr. N. R. Finsen of Denmark.

The Kilbourne & Clarke Company of Seattle has been appointed Northern Pacific agent for the Ajax Line Material Company of Chicago. This will add to the Seattle company's large supply stock an assortment of the Ajax mast arms, arc-lamp pulleys, arc insulators, toggle-bolts and incandescent street hoods.

The Phœnix Glass Company's Chicago office was moved on January 1st into the new and commodious salesrooms in the Heyworth Building, Madison Street and Wabash Avenue, where complete lines of their quality glassware for all lighting systems will be shown. The display of new designs for the coming season will please dealers in the lines represented, and a cordial invitation is extended to them.

The Lindsley Brothers Company of Spokane, Wash., producer and shipper of western cedar poles and manufacturer of red-fir cross-arms, has found it necessary, owing to its constantly increasing business, to open a more eastern sales office. This office will be located in the Marquette Building, Chicago, and will be in charge of Vice-president George L. Lindsley, one of the oldest and most prominent men in the pole industry. Mr. Lindsley was until recently in Portland, Ore., in charge of the company's business there. The Lindsley company is one of the oldest concerns in the cedar-pole industry. It claims to be the first to ship Idaho poles east, making its first shipment in 1897.

The American Insulated Wire and Cable Company is to be incorporated under the laws of Massachusetts with a capital of $200,000. The factory buildings, five in number, are located at Hyde Park, Mass., and are to be in running order by February 1st. Hon. John H. H. McNamee of Cambridge is to be president and general manager, and associated with him will be Mr. Andrew J. Conlin, for the last 18 years connected with the Simplex Electrical Company. The output, as planned, will be cables, submarine, aerial and lead-covered, wires for inside, telephone, telegraph, fire-alarm and kindred work, annunciator wires, incandescent, flexible and battery cords, railroad signal and weatherproof and flameproof wires.

The new Richmond in the field of dry-battery production, the Stackpole Battery Company of St. Marys, Pa., has now about finished at its home city one of the most complete and scientifically equipped factories in the United States for the production of various grades of dry-battery cells. The Stackpole Battery Company is officered as follows: President, J. K. P. Hall; vice-president, B. F. Wallendorf; secretary and treasurer, H. C. Stackpole; assistant sales manager, G. W. Mills; superintendent, William J. Mills. Hon. J. K. P. Hall is a banker and capitalist well known in Central Pennsylvania and also in Congress. B. F. Wallendorf is a retired contractor. H. C. Stackpole is also a well-known Pennsylvania banker and capitalist. Mr. Stackpole and Superintendent G. W. Mills are in active charge of the business. Assistant Sales Manager Mills is one of the best-known and best-liked carbon men in the country, but of late years his particular field has been in the East. Mr. Stackpole will look after the general business of the company and particularly the financial end of the institution. Superintendent Mills will devote himself particularly to the manufacture of the company's product. The Stackpole Battery Company will make the highest grade of dry cells, and is now putting on the market the following brands: The Elk, Autocrat, Wizard, Radium, Hello and Sun. Not only will the Stackpole Battery Company make dry cells, but it will likewise make other carbon products, and is prepared to undertake experimental work in the line of carbon goods for battery or other service.

BUSINESS.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, whose return from his twenty-first trip to England and the Continent was noted last week, reports the pneumatic-tool business on the increase at all points abroad, and is much gratified over the fact that the current year has shown an increase of between 25 and 30 per cent. over any previous year. The popularity of the Chicago company's product is attested through the fact that practically all foreign railways have installed these tools in their shops, as well as a great many of the larger industrial institutions and government ship yards. In the market abroad, as in the United States, Canada and Mexico, it is said that 90 per cent. of the pneumatic tools used are of the Chicago company's make.

Among the recent large generator sales of the Crocker-Wheeler Company of Ampere, N. J., are the names of firms who have used electric power for a number of years, as follows: Waynesboro Electric Light and Power Company, Waynesboro, Pa., one 300-kilowatt engine-type alternating-current generator; Republic Iron and Steel Company, Youngstown, O., one 300-kilowatt engine-type direct-current generator; Interstate Iron and Steel Company, East Chicago, one 225-kilowatt engine-type direct-current generator; Charles C. Morse & Co., San Francisco, Cal., one 200-kilowatt alternating-current generator and exciter; Williams Construction Company, Corinth, Miss., two 150-kilowatt engine-type alternating-current generators; Crown Seal and Cork Company, Highlandtown, Baltimore, Md., one 150-kilowatt direct-current generator; Trimont Manufacturing Company, Roxbury, Mass., one 100-kilowatt belt-type alternating-current generator.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 25, 1906.

835,095. Automatic Exchange for Double-wire Telephone Systems. G. A. Betulander, Stockholm, Sweden.

The switching mechanism consists of a movable part operated by a pawl which is actuated by an electromagnet called the connecting magnet. Another movable part is operated by a pawl actuated by an electromagnet called the disconnecting magnet.

839,096. Apparatus for Cooling Electric Motors and Generators. Benson Bidwell, Chicago, Ill. Application filed May 28, 1906.

A condenser and compresser supply a cooling agent to an air-tight casing surrounding the dynamo or motor.

839,113. Electrical Converter. William B. Churcher, Cincinnati, Ohio, assignor to Kennon Dunham, Cincinnati, Ohio. Application filed June 29, 1903.

A number of electrodes are adapted to receive a current in one direction. An electrode is adapted to transmit the current so passed, and a number of coils are respectively traversed by alternating currents of different phase.

839,127. Telephone Direction Plate. Gabriel Felsenthal, Chicago, Ill. Application filed January 18, 1906.

A printed sheet provided with an opening has a removable printed sheet behind the opening. A transparent sheet is permanently united to the surface of the first-printed sheet and covers the opening.

839,151. Composite Pole for Electric Wires and Other Purposes. Eugene M. Johnson, Allston, Mass. Application filed November 15, 1905.

A hollow sheet-metal frame, the walls of which are perforated, is provided with lateral, integral projections combined with an interior filling. An outer covering of plastic material is anchored to the frame through the holes and about the projections. The frame has lengthwise-extending, projecting ribs on its outer side.

839,186. Air-brake System. Jay Noble, St. Louis, Mo. Application filed July 10, 1905.

The engineer's valve comprises a fixed contact member, a movable contact member and a means for maintaining an open circuit during the movement in one direction of the movable contact member.

839,210. Composite System of Telegraphy and Telephony. Harry O. Rugh, Sandwich, Ill. Application filed October 20, 1906.

The transmission conductor normally permanently extends to a number of telephone and a number of telegraph stations. An arrangement of impedance devices permits current to pass for telegraphy and condensers permit the telephone current to pass.

839,216. Circuit-closing Mechanism. Thomas W. Small, Cleveland, Ohio, assignor of one-half to George H. Worthington and one-half to Charles W. Johnson, Cleveland, Ohio. Application filed May 17, 1905.

A circuit-closing plate is provided with a yielding contact prong and a supporting-plate so constructed that the parts may be securely attached to the insulating-spool supporting a main-current wire.

839,224. Coupling Device for Electric Conductors. Harold Stokes, London, England. Application filed February 5, 1906.

Two casings are provided with means for attaching them together and with the insulating-blocks in the casings. Split plugs are fixed in one coupling part and plug-sockets are fixed in the other coupling part, the plug-sockets including pins adapted to spread the split plugs against the walls of the plug-sockets when the parts are forced together.

839,250. Controller. Thorsten von Zweigbergk, Preston, England. Application filed May 21, 1906.

A double set of contact segments are combined with two sets of contact fingers. The segments on one side are in the same circumferential plane with the corresponding segments of the other side, so that the segments may each co-operate with the corresponding fingers independently to close circuits or form a bridge from the fingers of one set to those of the other. (See cut.)

839,255. Circuit-opening Device for Electric Heaters. James I. Ayer, Cambridge, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed May 5, 1905.

A fusible circuit-opener is located adjacent to but out of contact with the heated device, whereby upon the overheating of the device the circuit will be opened and the device protected from injury.

839,256. Conductor Support for Movable Tools. James I. Ayer, Cambridge, and George T. Gilbert, Northampton, Mass., assignors to the Simplex Electric Heating Company, Boston, Mass. Application filed December 22, 1905.

A supporting arm adapted to support a flexible electric conductor is mounted on a supporting standard for universal movement. Means act to move the end of the arm in a direction opposite to the pull upon the flexible conductor.

839,257. Electrical Resistance Material. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed January 5, 1906.

A long, flexible metallic ribbon has an insulating covering, and a high-resistance wire is wound over the covering throughout the entire length of the ribbon. An insulating covering is placed over the whole.

839,259. Rheostat. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed April 9, 1906.

A disk is mounted on a rotatable shaft. A number of alternately disposed conducting and insulating peripheral segments are secured to the disk, and contact-springs are mounted to bear upon opposite faces of the peripheral segments. A resistance-coil is adjacent to the disk, and means are provided for connecting up the parts in an electrical circuit. (See cut.)

839,268. Support for Surgical Needles. William R. Burch, Chicago, Ill. Application filed July 14, 1905.

A cross-head is mounted on a swinging carrier. The carrier and cross-head are adapted for supporting a main conductor and a number of transmitting conductors for an electric current and has the transmitting conductors free to swing in suspension from the cross-head.

839,291. Electric Signaling Apparatus and Circuit. Felix B. Herzog, New York, N. Y. Application filed January 24, 1900.

The base of an annunciator carries electrodes. The connecting wires are protected from the solution. A vessel containing solution is arranged and adapted to have the base immersed therein below the level of the wires.

839,306. Electric Cigar Lighter. David Misell, New York, N. Y. Application filed January 22, 1906.

An igniting tip has two electric terminals connected within the tip by an igniting filament, one of the terminals being normally connected to one electrode of the battery. Means support the tip so as to permit movement thereof to bring its remaining terminal into connection with the second electrode of a battery.

839,340. Thermostat for Journal Bearing, etc. Frank A. Vath, Chicago, Ill. Application filed September 19, 1904.

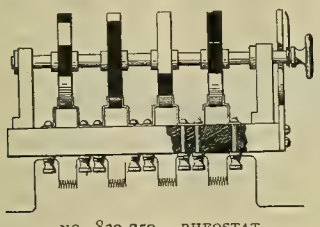
A tube is engaged in a seat in the journal bearing. A screw plug is fitted in and closes the inner end of the tube. An insulator in the tube is provided with a core at each end of its central bore. Means are provided connected with a conductor, extending into the bore to produce an alarm.

839,343. Heating Device. Frederick M. Vogel, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 22, 1905.

In an electric flatiron, an electric resistance unit is located within the container (which is the body of the iron) and a layer of mica closely surrounds the unit and is held from expansion in the direction of cleavage.

839,346. Line-test Connector. Aubrey Wardman, Whittier, Cal. Application filed December 18, 1905.

Springs are secured at the opposite ends of the plate and project toward each other. They have the free ends bent upwardly above the plate and projecting toward each other, and just back of the free ends they are bent to form a wire-receiving section.



NO. 839,259.—RHEOSTAT.

839,348. Automatic Electric Reverse Switch. Isaac A. Watrous, West Haven, Conn., assignor of one-half to Frank F. Burton, New Haven, Conn. Application filed May 7, 1906.

An automatic electric reverse switch for internal-combustion engines. A trigger co-acts with a circuit-breaker to hold the circuit-breaker in its open position, and a spring-controlled stripper is applied to the flywheel of the engine and is adapted to coact with the trigger to release the circuit-breaker for the closing of the circuit at a predetermined time and place.

839,358. Alternating-current Generator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 5, 1905.

A field-winding is provided with a rectifying-commutator and brushes. An armature-winding is arranged in sections. Means are provided for connecting the sections in verying relations to the work circuit, and an auxiliary exciting winding is carried by the armature and connected to the brushes. (See cut.)

839,361. Electric Time Switch. Ira S. Callender, Galesburg, and Elmo J. Johnson, Chicago, Ill. Application filed March 7, 1904.

An electric switch is mounted on a base. Two casings are also mounted on the base. Plates inclosed by the casings are connected by an intervening switch-operating bail. Spiral springs are attached to the casings and to the plates for operating the plates and bail. A trigger is provided for holding the plates in operative position, and means actuated by a clock mechanism move the trigger out of the path of the spring-actuated plates so as to cause the bail to engage and shift the switch. (See cut on next page.)

839,365. Protective Device for Signal Systems. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1904.

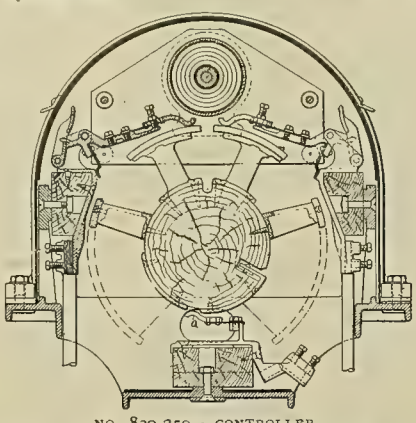
For block-signal systems for electrically operated railways, a signal device is connected to the rails, and an overload relay is adapted and arranged to short-circuit the device upon an abnormal rise of potential between the rails.

839,368. Spring Support for Measuring Instruments. John T. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1903.

A torsion spring yieldingly suspends a rotatable element and relieves the bearings of its weight. A socket receives one end of the spring, and means are provided for clamping the spring against the wall of the socket.

839,374. Insulated Electric Conductor. William L. R. Emmet and Wallace S. Clark, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed November 9, 1901.

An insulated electric conductor is covered with a number of layers of preliminary varnished and hardened fabric. A homogeneous layer of permanently viscous insulating material forms a continuous covering for the layers of fabric.



NO. 839,250 — CONTROLLER.

839,376. Electrical Station-indicating System. Josef Esser, München-Gladbach, Germany. Application filed December 27, 1904.

Drums, carrying signs, are operated by electromagnetic means.

839,384. Parallel-feeder Protection. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 21, 1904.

An electroresponsive device at the receiving station is connected to both transformers and arranged to open the circuit of the feeder upon a relative reversal of current in the transformers.

839,401. Alternating-current Motor. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 17, 1904.

The armature winding is provided with a commutator and brushes. Short-circuiting connections are placed between equipotential points on the field winding, the connections being utilized and connected as the terminals of the field winding.

839,404. Safety Appliance. Harry W. Morris, Oak Park, Ill., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed May 19, 1904.

Evidently for theaters a vertically movable curtain is adapted to close an opening. Movable means support the curtain, and means are provided for controlling the supports so as to positively raise and lower the curtain, in combination with electrical means operated from a distant point, for disconnecting the controlling means and causing the curtain to close the opening.

839,413. Switch-stand and Connection Therefor. Harry C. Odenkirk, Cleveland, Ohio. Application filed October 15, 1906.

A cam member has a spiral groove in it. Means are provided for turning it, and a slide bar has a part projecting into the groove of the cam, whereby, when the member is turned the slide bar will be moved longitudinally. A tie rod for the switch rails lies substantially in line with the slide bar, and a connecting rod is pivoted at one end to the tie rod. There is an easily breakable connection between the slide bar and connecting rod.

839,430. Interlocking Plug Switch. Arthur R. Smith, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 21, 1904.

A contact plug is formed so as to intersect the axes of other switch sockets when inserted in one of them.

839,436. Curve-drawing Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 30, 1903.

Means are provided for moving a record surface parallel to a marking element which swings about an axis. Electromagnetic means move the surface into and out of engagement with the marking element at regular intervals.

839,455. Electric Sign Apparatus. Frank B. Cook, Chicago, Ill. Application filed January 30, 1904.

A series of electrothermal switches have a translating device for each switch and are connected to be operated thereby. A normally closed contact at one switch is in the thermal circuit of the preceding switch in the series and is arranged to be opened by the operation of the one switch. A normally open contact at the one switch is in the thermal circuit of the succeeding switch in the series and is arranged to be closed by the operation of the one switch.

839,462. Ceiling Switch. Frank L. Fenn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 13, 1903.

Stationary contacts are secured to an insulating base. A U-shaped bearing frame is mounted on the base and provided with stop shoulders. A shaft is mounted in the side arms of the frame parallel to the face of the base. Means co-operating with the stop-shoulders for producing snap movement of a rotary switch blade are mounted on the shaft, and ratchet means actuate the shaft.

839,482. Electric Arc Lamp. Charles E. Jones, New York, N. Y. Application filed February 16, 1905.

The following is a claim: A compact electric headlight whereof the back plate and reflector are disposed in close proximity and the actuating electromagnet placed in inclined position in the space between the plate and the outer part of the reflector, the magnet being provided with an armature which is in elbow form to adapt it to its function when the magnet is in position. (See cut on next page.)

839,492. Typewriting Machine. Andrew T. MacCoy, Dover, Mass., assignor to Charles B. Strecker, Brookline, Mass. Application filed December 30, 1904.

An electric motor rotates and selectively positions the rotary type wheel. Connections are made between the motor and the type wheel, and means are provided for pivotally supporting the type wheel and motor on the same axis. Means are also provided for moving the motor and the type wheel about the axis to feed the type wheel relatively to the paper.

839,502. Electric Motor. Eugene W. Myers, Bloomfield, N. J. Application filed March 21, 1905.

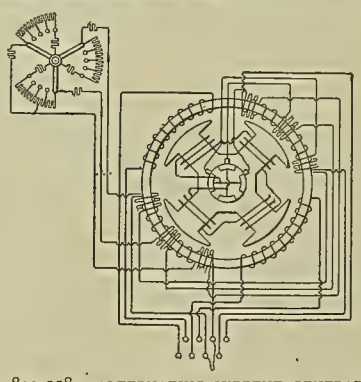
The field comprises two sections having faces adapted to lie flatwise together, each section having in its face a longitudinally disposed trough-like chamber, and in the floor of the chamber a longitudinal groove or recess with outwardly flaring side walls.

839,505. Engineer's Alarm. Edward McClintock, Merriam Park, Minn., assignor to the McClintock Manufacturing Company, St. Paul, Minn. Application filed September 20, 1905.

Good-order and alarm circuits having signals are combined with a track circuit having a pole changer. The good-order circuit is normally closed and the alarm circuit is normally open. A number of relays having different windings are provided in the track circuit, and sources of electrical energy are provided for the circuits.

839,513. Electric Circuit Protector. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed December 3, 1900.

An outer shell encloses an inner shell. A layer of material susceptible to a moderate degree of heat is arranged between the shells or casings and is adapted to secure them together. A heat-concentrating device is confined within the inner shell.



NO. 839,358.—ALTERNATING-CURRENT GENERATOR.

839,519. Electrical Switch and Socket Key. Herbert L. Smith, Bridgeport, Conn., assignor to the Siemon Hard Rubber Corporation, Bridgeport, Conn. Application filed February 15, 1906.

The mandrel has the key end split and the parts thereof bent outward in opposite directions in the plane of the cut. The key is formed from a suitable compound and molded upon the mandrel. The separated parts of the end of the mandrel extend well outward into the wings of the key.

839,522. Holder for Commutator Brushes. Oscar M. Stiegler, Boston, Mass. Application filed July 14, 1905.

A guideway having a carbon exterior is secured to a head, and a shoe is secured to the carbon and received within the guideway. A tongue projecting from the shoe carries a rest, and an arm, fulcrumed between its ends, bears at one end on the rest. A resilient member engages the other end of the arm.

839,525. Railway Signaling System. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 4, 1904.

The trackway of the railway is divided by insulations to form block sections and is included in the return circuit for the car-propulsion current. A generator is provided for the car-propulsion current. A conductor is connected with the rails around insulation points and traversed by the propulsion current. A core is provided for the conductor, and a second conductor for the core is also traversed by the propulsion current to prevent saturation of the core by the propulsion current flowing through the first conductor. The signaling system for the block sections comprises the track circuits, relays and railway signals controlled by the relays.

839,526. Trolley-pole Head. William J. Wagner, East Bradford, Pa. Application filed October 28, 1905.

The pole has a wheel mounted at its upper end, and brackets are arranged upon opposite sides. There is a connection between the ends of the axis of the trolley wheel and the brackets. A semi-cylindrical member is secured at each end of the brackets to form co-operating pairs of members to embrace the trolley wire. Means

connect the brackets whereby the pairs of wire embracing members may be separated with relation, one member with its companion member.

839,530. Panel Board. Joseph J. Wesley, New York, N. Y. Application filed January 29, 1906.

The panel board comprises a main base or support, a supplemental support held in spaced relation therefrom, potential and neutral bus-bars on opposite sides of the supplemental support, fixtures connected to the bus-bars, and switch arms for controlling circuits branch circuits with the fixtures.

839,540. Railway Signal. Aricola L. Carpenter, Mount Vernon, N. Y. Application filed September 19, 1905.

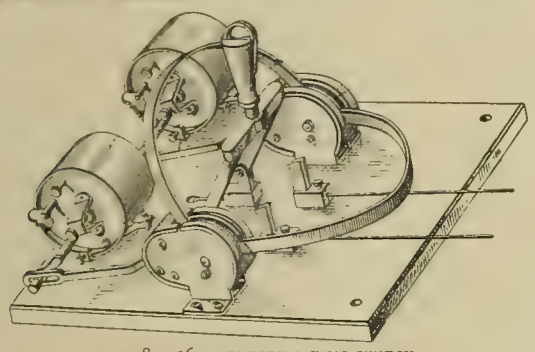
An air cylinder is in communication with a spring-actuated track valve, a piston being arranged for reciprocation in the air cylinder and having a spring associated with the air cylinder. A contact lever associated with the piston makes a circuit to operate a signal.

839,563. Splice for Electric Wires. Conrad J. Dorff, Chicago, Ill. Application filed November 18, 1905.

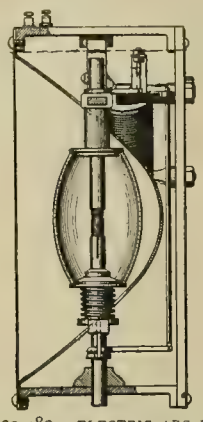
A plate is formed to enclose a portion of two wires lying parallel to each other.

839,564. Electrical Conduit Terminal. Conrad J. Dorff, Chicago, Ill., assignor to Fredric Greer, Chicago, Ill. Application filed December 21, 1905.

A nut body having a central bore is formed with screw threads and with an annular groove. One circular edge of a tubular bushing of ductile sheet metal is expanded into the annular groove, and the other edge is rolled back against the front of the nut body to effect a permanent attachment of bushing and afford a smooth exit for the conductors.



NO. 839,361.—ELECTRIC TIME-SWITCH.



NO. 839,482.—ELECTRIC ARC LAMP.

839,585. Manufacture of Luminant for Electric Lamps. John A. Heany, York, Pa. Original application filed December 29, 1904. Divided and this application filed November 27, 1906.

The filament for an incandescent lamp consists exclusively of a metallic alloy of tungsten and titanium in a dense, shiny, coherent state and homogeneous throughout.

839,606. Storage Battery. Jang Landsing, Boonton, N. J., assignor to General Storage Battery Company, New York, N. Y. Application filed November 24, 1905.

The frame of the battery plate is provided with ribs, and active members in the form of unit strips are supported at a number of points by cross supports secured to the ribs. The plate has intervals opposite the ends of the strips to afford provision for expansion. The outer cross supports are connected by flexible strips to the corners of the frame, the plate also having spaces opposite the ends of the cross supports to permit expansion.

839,609. Means for Controlling Fluid Compressors. Sam H. Libby, East Orange, N. J., assignor to General Electric Company, Schenectady, N. Y. Application filed June 6, 1904.

A common receptacle is supplied by a number of fluid reservoirs, and there are check valves between the several compressors and the receptacle. Governors control the several compressors, each of the governors being electro responsive both to simultaneous and to relative variations of pressure in the compressor and receptacle.

839,612. Variable-speed Polyphase Motor. Ralph D. Mershon, New York, N. Y. Application filed September 23, 1903.

The motor has leads for a number of phases greater than that of the supply circuit. One or more transformers are placed intermediate to the supply circuit and motor and arranged to produce phases of the number required for the motor and of different voltages. Means are provided for connecting the transformer with the motor circuits at points to produce different numbers of poles in the motor.

839,627. Automatic Door Opener and Closer. Kenzaemon Nishimoto, Oakland, Cal. Application filed June 25, 1906.

Electrically operated means turn a shaft to set a spring-actuated part which operates automatically to open and close a door.

839,636. Electric Cut-out Switch. Peter Peters, Pawtucket, R. I. Application filed February 20, 1906.

The wires of the electric lamp circuit have their ends connected to the binding posts of fixed lugs. The wires of an electric main circuit have their ends connected to the binding posts of fixed conducting pieces. Two arms are each pivotally mounted on each of the conducting pieces. Means are provided to force the upper portion of the arms in contact with the lugs of the lamp wires. A rod is loosely mounted in proper supports and has an integral curved extension, and means are provided for lifting the rod so that its extension forces inwardly the lower free ends of the arms and thus breaks the electric connection of the lamp circuit.

839,637. Pocket Ammeter. Hermann Poehn, Jersey City, N. J., and Maximilian Juruick, New York, N. Y. Application filed December 1, 1905.

The casing has a metal disk mounted in it. An electromagnet is secured to the disk and an S-shaped armature is mounted on a movable shaft between the poles of the electromagnet. A gear wheel is placed on the shaft above the armature, and a pinion is mounted on a second shaft in the center of the instrument. A hair spring is placed on the pinion shaft, and a loose top on the disk has an upward rectangular arm to which one end of the hair spring is secured so that the position of the armature ends may be adjusted in relation to the poles of the electromagnet.

839,655. Incandescent-lamp Socket. Frank E. Seeley, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed July 5, 1906.

The shell and cap are attached by means of a spring tongue carrying a beveled catch borne by one part and faced angled projections borne by one part, the other part having holes to receive the angled projections and the beveled catch.

839,665. Insulator for High Voltages. Louis Steinberger, New York, N. Y. Application filed June 22, 1905.

A cylindrical barrel is provided with a bottom and has a closure member. The bottom and the closure member are provided with means for supporting a conductor and are also provided with apertures.

839,666. Built-up Insulator. Louis Steinberger, New York, N. Y. Application filed October 28, 1905.

A number of separate supporting hoods are sandwiched intermediate of a number of protecting hoods and engage them. A supporting stem is common to all of the hoods.

839,687. Motor-control System. Harold E. White, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 8, 1905.

A resistance is connected in circuit with the secondary of an induction motor. Means are provided for automatically cutting the resistance gradually out of circuit when the primary circuit of the motor is closed. Means are also provided for automatically retarding the cutting out of said resistance and reinserting it in the rotor circuit when the primary current of the motor exceeds a predetermined amount.

839,690. Electrical Indicating Device. Georg Zapf, Cologne-Nippes, Germany. Application filed March 28, 1905.

Means are provided for indicating the discharge from a spark-gap safety device.

839,703. High-tension Oil Switch. Henry P. Ball, New York, N. Y., assignor to General Incandescent Arc Light Company, New York. Application filed July 2, 1902.

A band runs over a band wheel on a shaft, and a spring mechanism coacts with a switch lever to automatically shift it from one contact to another of a series of contacts. There is a bridging member, and mechanism is introduced between the shaft and the bridging member.

839,708. Electric Regulator. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Application filed February 9, 1905.

A resistance is connected to a series of insulated contacts and a resilient flexible conductor adapted to bear against them and thereby short-circuit the resistance. Electro-responsive means are provided for bending the conductor in one direction, and means are provided for exerting a mechanical force in an opposite direction.

839,709. Electric Regulator. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Application filed February 9, 1905.

A series of spring fingers are adapted to make contact with a number of contact segments having resistances connected to them. Flexible members co-operate with the segments. There is an actuating electro-responsive device, and means are provided for tightening and slackening the flexible members.

839,710. Booster Regulator. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Application filed November 25, 1905.

A liquid resistance is arranged in substantially parallel concentric lines in circular form. A contact arm is provided with contacts adapted to bridge adjacent pairs of the concentric lines of resistance, so that one portion of the resistance may be short-circuited while the other is included in circuit. Means are provided for actuating the arm.

839,711. Storage-battery Plate. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Application filed August 15, 1906.

The frames have sides and ends and intersecting ribs. Active members in the form of unit elements are supported at their central portions upon the intersections of the ribs, and means are provided for securing the frames to each other.

839,712. Storage Battery. Joseph Bijur, New York, York, N. Y., assignor to the General Storage tery Company. Application filed October 17, 1906.

A strap has dependent lugs of the same metal as the strap. Plates are joined to the lugs, the joints between the plates and lugs being in the length of the lugs instead of at the ends of the lugs.

839,713. Electric Regulator. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed September 24, 1904. Renewed November 9, 1906.

An electric conductor carrying a current is mounted for a substantially large range of movement in a uniform field of force and a substantially uniform mechanical pull opposes the movement of the conductor, so that when the balance between the electrical and mechanical forces is disturbed the conductor moves until the balance is restored. Means controlled by the instrument effect regulation of a circuit.

839,742. Electric Controller. Edwin C. Fellows, Philadelphia, Pa., assignor to the Enterprise Manufacturing Company of Pennsylvania, Philadelphia, Pa. Application filed June 1, 1906.

A series of contact buttons are placed upon a supporting table. There is an auxiliary contact. A contact arm is pivotally mounted on the plate and has a contact brush placed to engage the contact buttons. A contact finger is carried by the arm so as to remain in engagement with the auxiliary contact until after the brush has become disengaged from the first contact button when the arm is moved in either direction.

839,765. Electric Clock. Henry Iversen, Corsicana, Tex. Application filed September 16, 1905.

There is a master clock, and the secondary clocks are operated by an electromagnet, which operates the secondary clock mechanism and is governed by the master clock.

839,779. Automatic Engine-stop. Harry M. Martyn, Utica, N. Y., assignor to William L. Foley and Chester W. Davis, Utica, N. Y. Application filed March 5, 1906.

Electrically controlled means operate to close the throttle valve of the engine. The means are actuated by a clock.

839,788. Electric Switch. Henry L. Smith, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 15, 1905.

A pivoted manual lever has a pin-and-slot connection with a pivoted arm. A pin connects one of the co-operating contacts to the arm between the pivot of the arm and the pin-and-slot connection. A spring has one end secured to the pin and the other end to the lever.

839,794. Electric Thermostat. Magnus M. Vogel and William J. Meyer, Allegheny, Pa. Application filed July 3, 1906.

A cast-metal block or base has integral oppositely inclined corner lugs, and a central lug is adjacent to the lower edge of the block. A bowed strip of expansible sheet metal is secured to the inclined lugs, an adjustable screw extending through the central lug. An electric circuit is adapted to be closed by the expansion of the strip to sound an alarm.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 31, 1906:

418,198. Method of Making Collars on Axles by Electricity. H. Lemp and E. Thomson, Lynn, Mass.
418,227. Electric Exercising Machine. E. W. Robinson, Boston, Mass.
418,248. Electro-magnetic Motor. N. Tesla, New York, N. Y.
418,258. Electric railway Signal. E. C. Wiley, Independence, Va.
418,270. Combined Gas and Electric-light Fixture. D. J. Braun, Chicago, Ill.
418,284. Quadruplex Telegraphy. C. L. Healy, Brooklyn, N. Y.
418,301. Armature for Dynamos. J. J. Wood, Brooklyn, N. Y.
418,302. Automatic Regulator for Dynamo-electric Machines. J. J. Wood, Brooklyn, N. Y.
418,322. Electric Signal System for Letter Boxes. G. L. B. Rounseville, Chicago, Ill.
418,373. Electric Railway. H. W. Libbey, Boston, Mass.
418,402. Electric Brake Mechanism for Cars. W. H. Darling, New York, N. Y.
418,426. Incandescent Electric Lamp Socket. F. Thone, Oskaloosa, Ia.
418,443. Mechanical Telegraph Instrument. J. H. Bunnell, New York, N. Y.
418,444. Electric Arc Lamp. J. H. Bunnell, New York, N. Y.
418,472. Electric Meter. C. A. Pratt, Toledo, O.
418,474. Electric Light Carbon. L. Saunderson, Kingstown, Ireland.
418,483. Secondary Battery. A. E. Woolf, New York, N. Y.
418,551. Apparatus for the Manufacture of Gas by Electricity. M. C. Burt, Lake View, Ill.
418,559. Electric Motor. A. J. Frager, Paris, France.
418,636. Electric Light Fixture. G. C. Baillard, New York, N. Y.
418,652. Generation and Distribution of Electricity Currents. F. J. Patten, New York, N. Y.
418,653. System of Electrical Distribution. F. J. Patten, New York.
418,654. Electric Motor. F. J. Patten, New York, N. Y.
418,655. Distribution of Electric Currents. F. J. Patten, New York, N. Y.
418,659. Dynamo-electric Generator. W. Stanley, Jr., Great Barrington, Mass.

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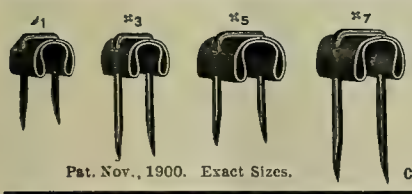

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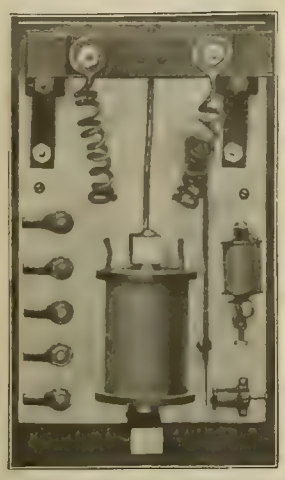

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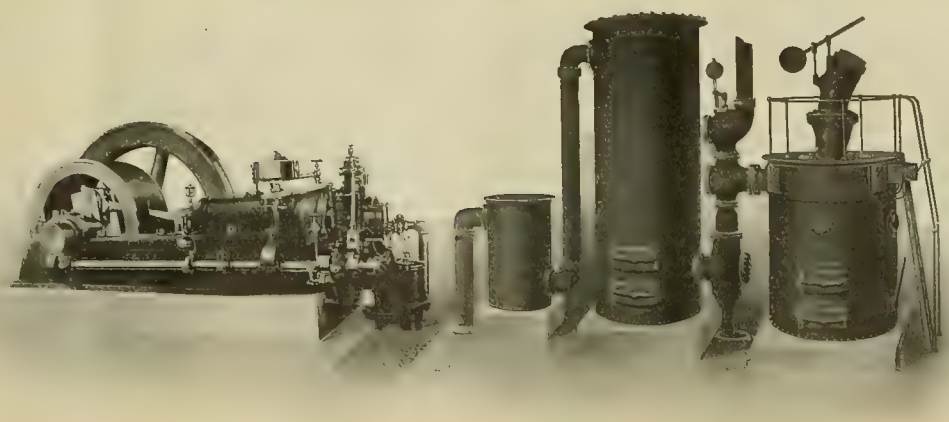

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NEW YORK CHICAGO SAN FRANCISCO

Chicago Electrical Show Numbers

Issues of January 12th, 19th and 26th

The second annual electrical show to be held in the Coliseum, Chicago, from January 14th to 26th, gives every promise of being even more successful than last year's show.

The issues of January 12th and 19th of the Western Electrician will be distributed at the show; the issue of the 26th will contain a full account of the show, illustrations of exhibits, etc.

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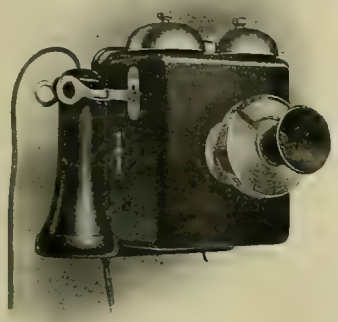

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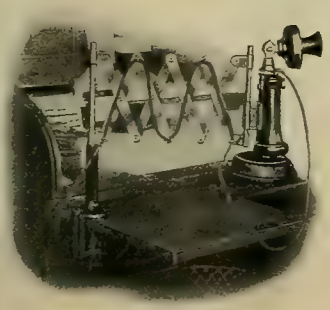

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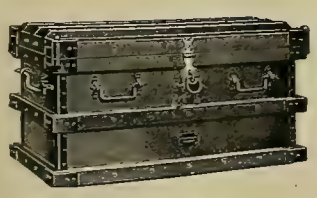

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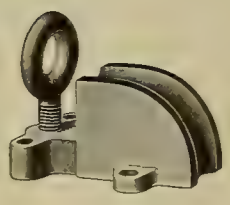

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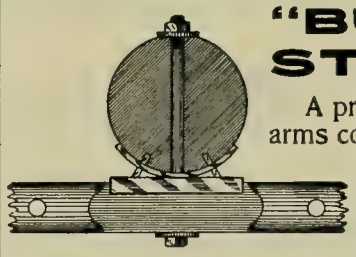

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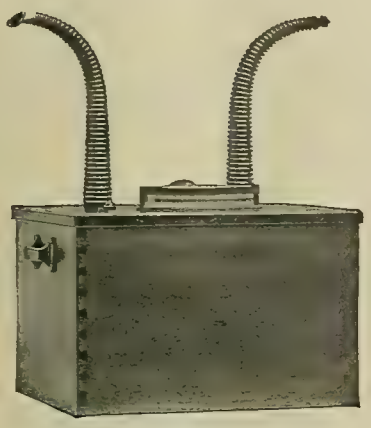

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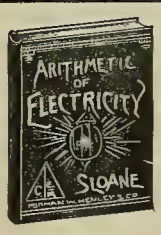

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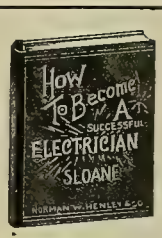

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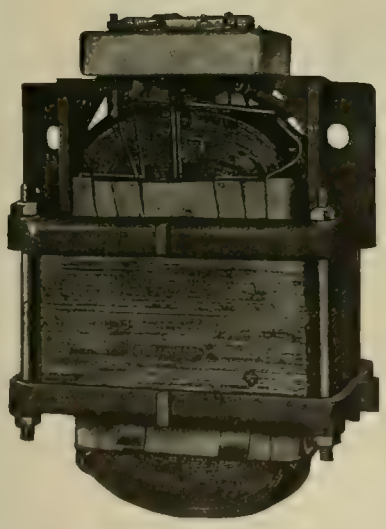

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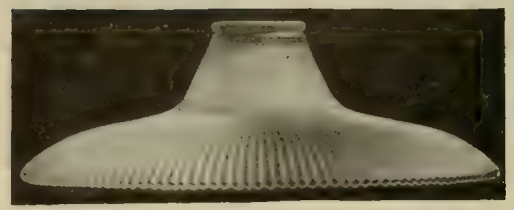

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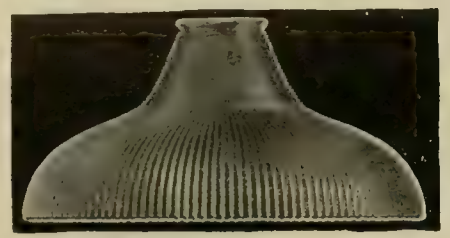

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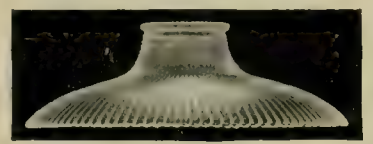

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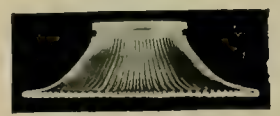

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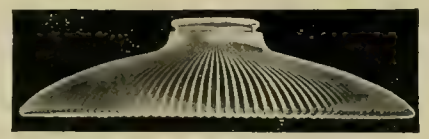

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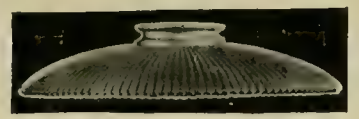

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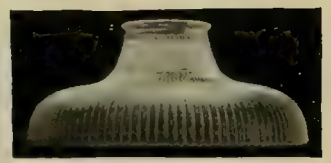

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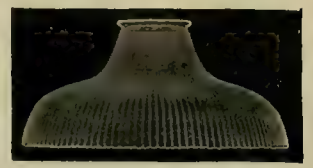

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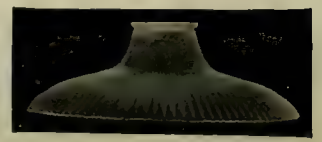

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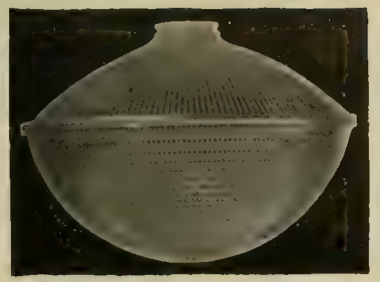
100-Watt Gem Lamps



⅙ Scale No. 6812
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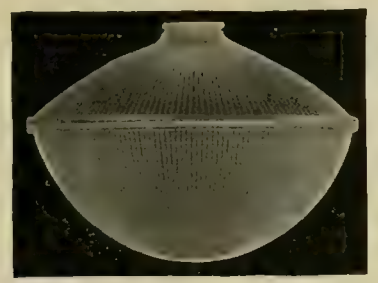

⅙ Scale No. 6912
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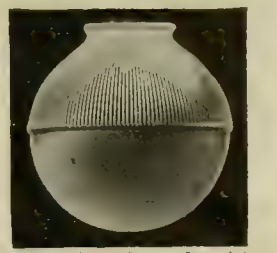

⅛ Scale No. 9510 Complete
Large Holophane Reflector Ball
(Two Pieces)

¼ Scale No. 4526
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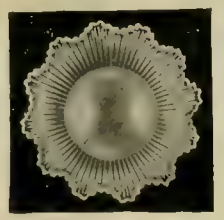

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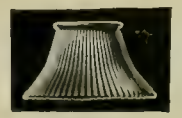

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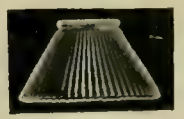

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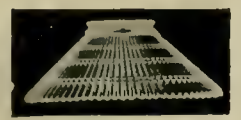
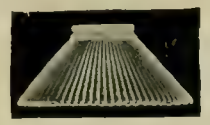
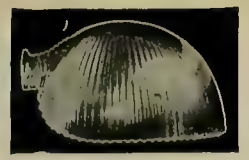
¼ Scale No. 295
Upright Electric



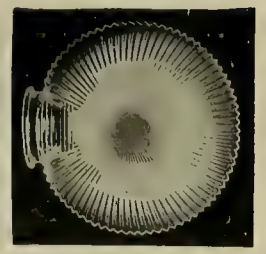
¼ Scale No. 2540
Holophane Reflectors
For Small Round Lamps



¼ Scale No. 2544
For use inside ground
glass balls, etc.



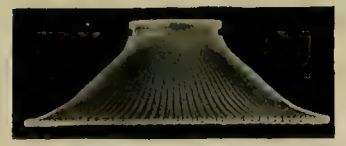
No. 255 Side View



No. 255 End View
¼ Scale Window Reflector

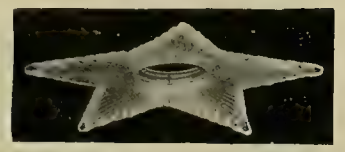
¼ Scale No. 9131
Holophane Reflector-Stalactite

¼ Scale No. 9132
Holophane Reflector-Stalactite



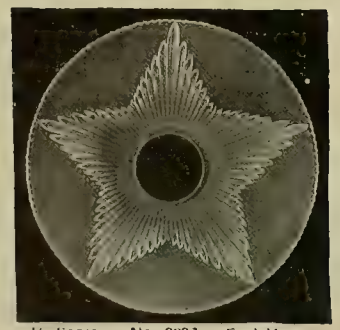
¼ Scale No. 2575
For Meridian Lamp

⅛ Scale No. 1206 J
Cut-Glass Bowl

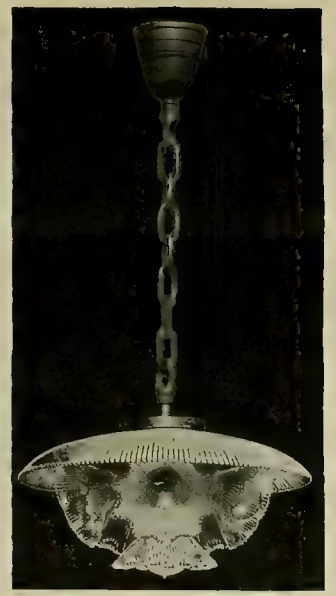


¼ Scale No. 9082

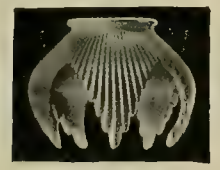
No. 9097 Side View



¼ Scale No. 9097 End View

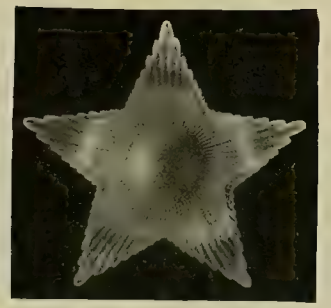


1-12 Scale No. 56
Holophane Reflecting Arc for 6-16 c. p. Lamps



¼ Scale No. 9083

No. 9081 Side View

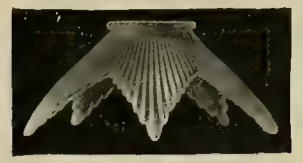


¼ Scale No. 9081
ORNAMENTAL STAR REFLECTORS

¼ Scale No. 411

¼ Scale No. 301
For Automobile Tonneau Ceilings

⅛ Scale No. 1208
Pressed Star Bowl



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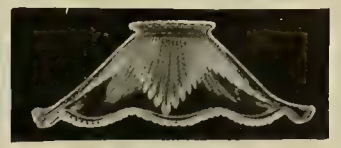
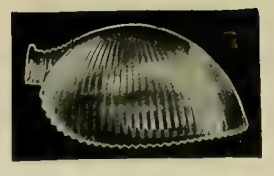
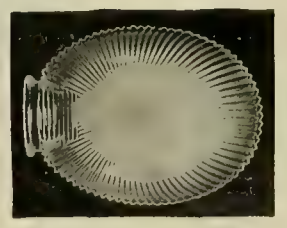


No. 9088 Side View

¼ Scale No. 9088

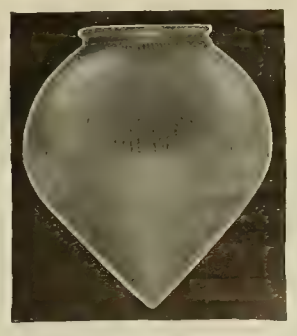


No. 256 Side View



No. 256 End View
¼ Scale Window Reflector

¼ Scale No. 9133
Holophane Reflector-Stalactite



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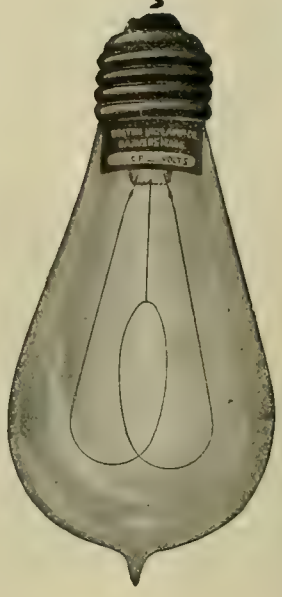

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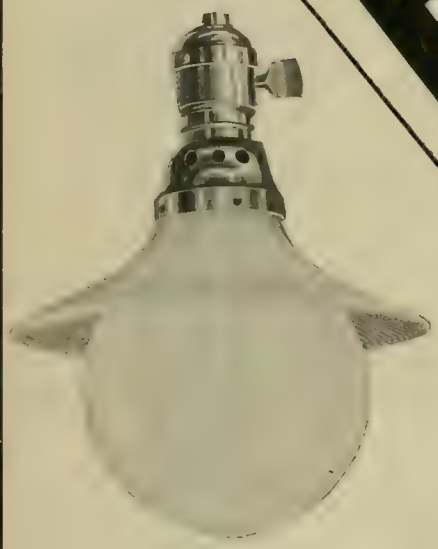

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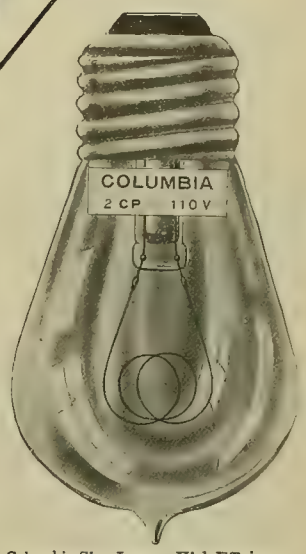

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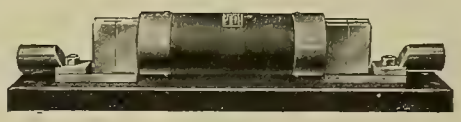
to furnish the latest improved line of

"SHAWMUT"

250 Volts 0–600 Amperes 600 Volts



N. E. Code St'd Enclosed Fuses

We trust it finds you prepared to use them

Full Description and Prices in Bulletin No. 36

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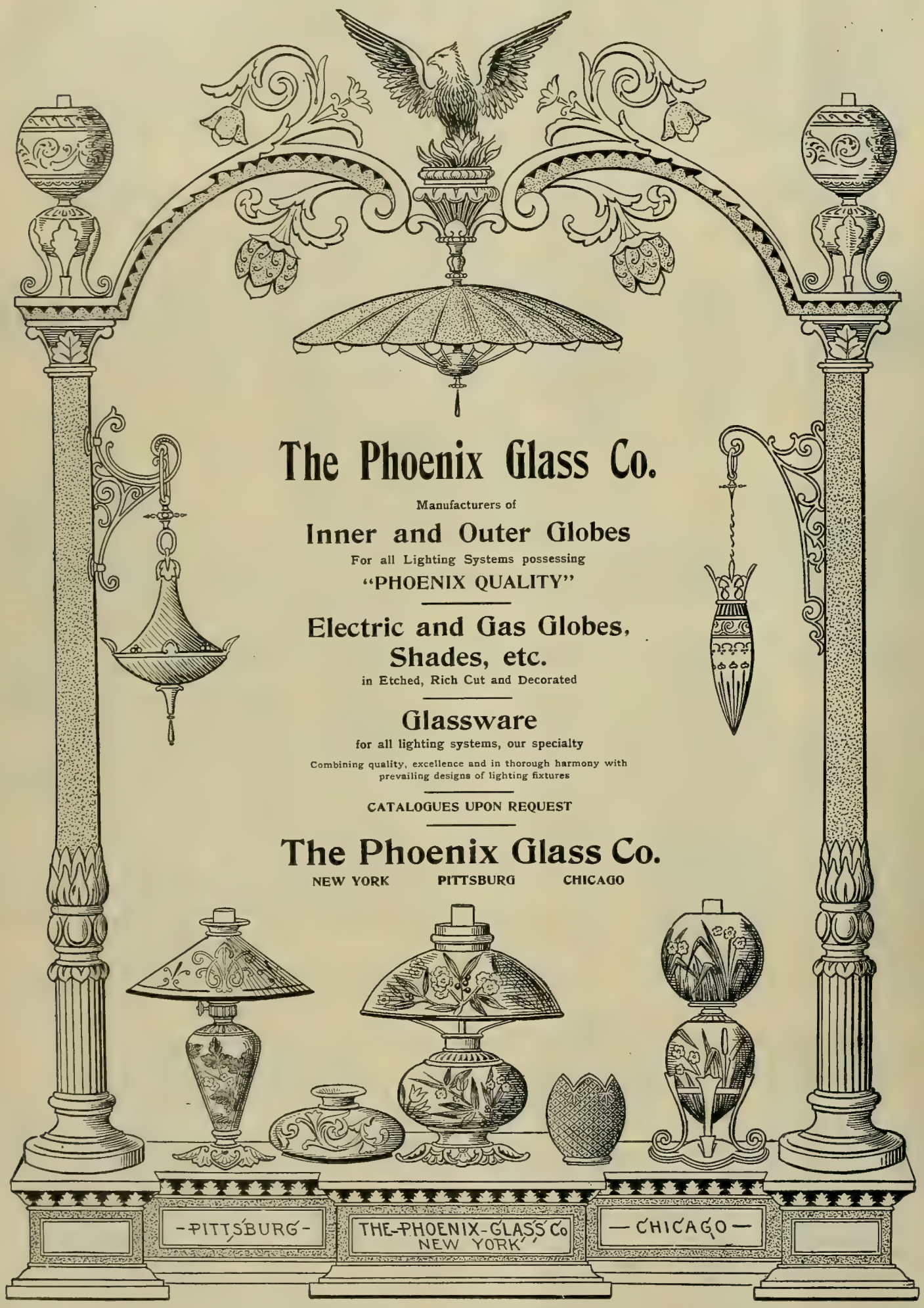
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Kearney Cable Clamps
For turning corners with
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They make stronger corners and save cable, time, labor and money. They do away with splicing and tapping at corners and dead ends.

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WEIGHS 4 POUNDS
MADE IN ONLY ONE SIZE

The Sterling Special Lamp

SEND US SPECIFICATION OF YOUR REQUIREMENTS OF
Low Voltage Tantalum Lamps
Used on all kinds of Storage Battery and Dry Cell Work. We are specialists in the manufacture of Tantalum Lamps.

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BY F. B. BADT

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This is, as the name indicates, a NEW BOOK, much more complete than the old one, with all the information, instructions and rules which are required by practical men, as Dynamo Tenders, Linemen, Stationary Engineers and owners and operators of all kinds of Electric Plants. It is the only book of the kind published in the English language. 9,000 copies of the old Dynamo Tenders' Hand-Book sold, and over 13,000 of the new.

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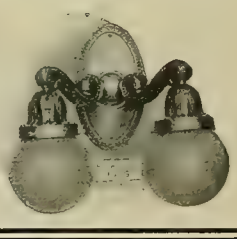
We are now in our New Factory at 176, 178 and 180 So. Clinton Street. Have **doubled** our capacity and can execute your orders promptly, and solicit your business.



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THE LIGHT THAT'S RIGHT
CENTRAL STATION MILL TYPE
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STANDARD ELECTRICAL MFG. CO., NILES, O.
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FIGHTING THE "ORGANIZATION"!
INTERESTING QUOTATIONS
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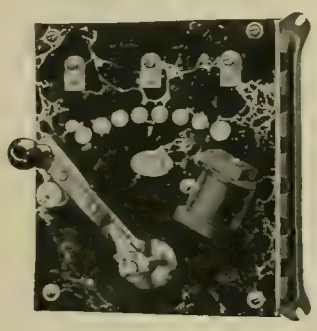
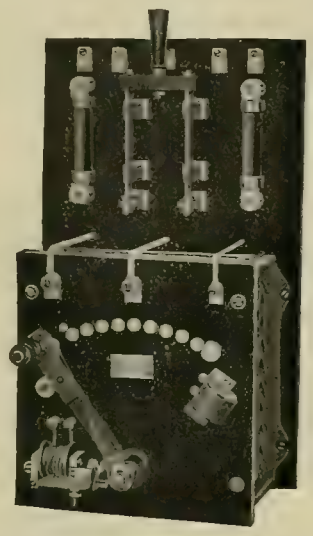
MOTOR STARTERS FOR EVERY SIZE OF INSTALLATION

Cutler-Hammer Starting Rheostats for All Classes of Service Under All Operating Conditions

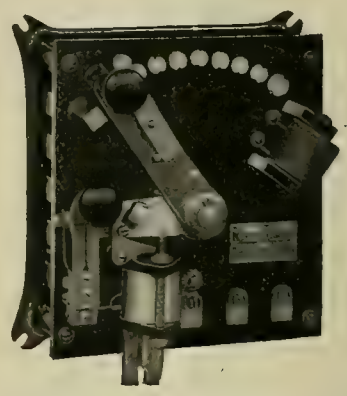
Built in Sizes to Fit Any Motor, from One-Fourth Horsepower into the Thousands



Standard Underload Release Type.
Simple and inexpensive. Suitable to use with almost any installation of moderate size.



Universal Type.
Fitted with underload and overload release, knife switch and fuses.



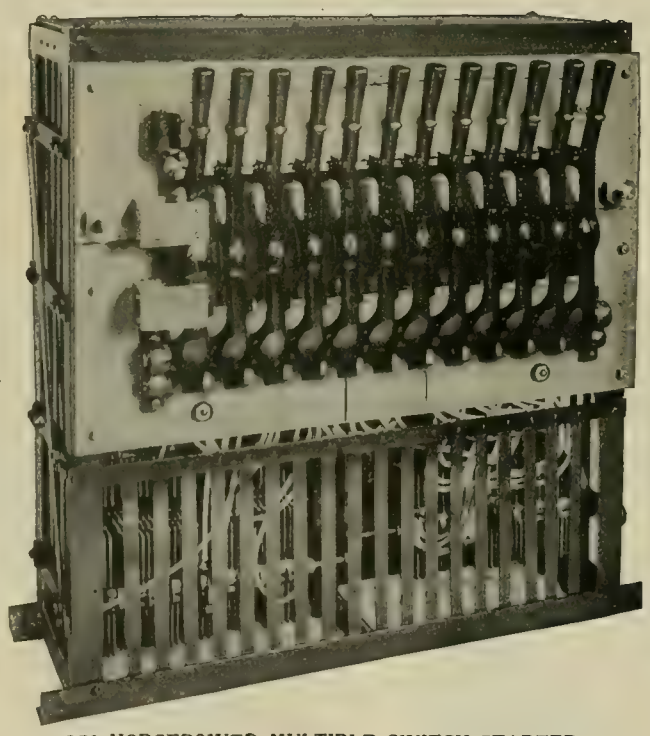
Double-Lever Type.
With underload release and interlocked overload circuit-breaker.

For installations above 50 H. P. the Multiple Switch Type of starter is recommended.

The point of its advantage lies in the fact that the contacts will not burn under the heavy currents carried.

Perfect and instantaneous contact is made by a series of laminated interlocked switches.

No burning or fusing with consequent deterioration.



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You will be interested in our complete catalogue of Electric-motor Controlling Devices. It includes not only Motor Starters, but Regulators, Automatic Control Systems, Controllers for all purposes, Theater Dimmers, etc.

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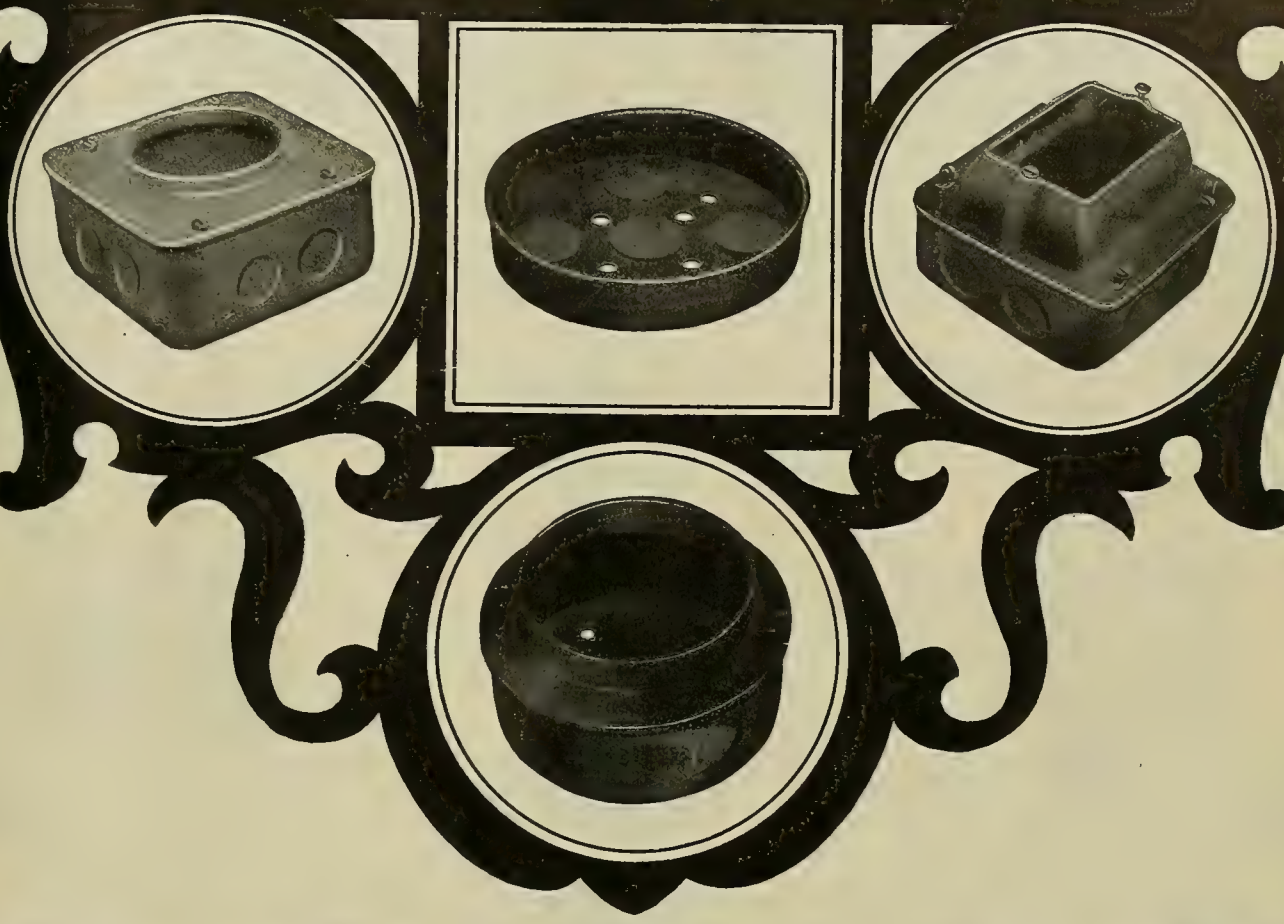
MILWAUKEE

NEW YORK BOSTON CHICAGO PITTSBURG

BOSSERT



DRAWN STEEL BOXES

Form an ideal arrangement for conduit outlets and one that is strictly in accordance with the Underwriters' requirements.

Our boxes are drawn from one piece of sheet steel, under heavy pressure, which renders them absolutely indestructible.

They are both fire and nail proof and cannot be bent or broken by carelessness of workmen or settling of buildings. They are thoroughly coated inside and outside with a heavy baked insulating enamel. They are made up with a sufficient number of outlets to meet all ordinary requirements, the holes being hermetically sealed with a steel disc which can be removed by a few sharp blows of a hammer. The removal of these discs leaves a clean, round hole the exact size of the conduit, entirely obviating the necessity of filing or reaming.

Bossert Boxes are a decided saving in time and material over the ordinary cast-iron knockout boxes.

We furnish the contractor any kind of a box necessary to a complete electrical installation and will gladly quote on special boxes on receipt of specifications or drawings.

We Also Manufacture

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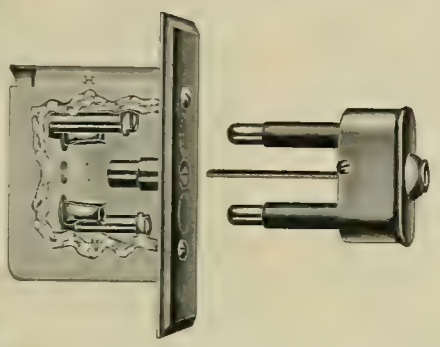
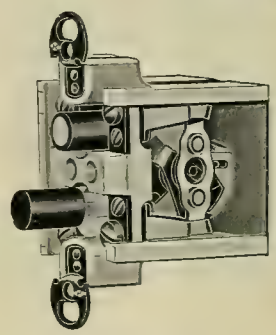
"DIAMOND H" SWITCHES AND RECEPTACLES

ARE WORTHY OF A THOROUGH INVESTIGATION

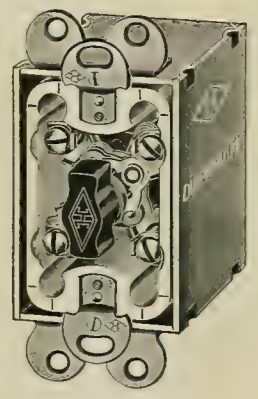


Receptacle with Plug Ready to Insert

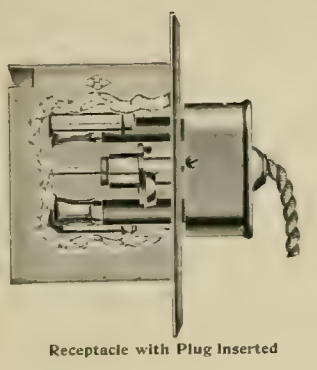
All "Diamond H" Switches are made of the finest material obtainable and are assembled by experts. In construction and design they are superior to all others.



Push-Button Switch with Mechanism Enclosed

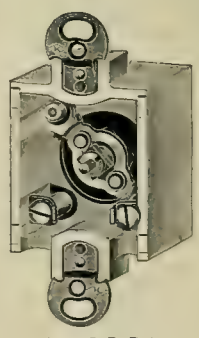


Rotary Flush Switch in Single Wall Case



Receptacle with Plug Inserted

"Diamond H" Receptacles are fitted with plates which open automatically at the insertion of the plugs and are the only ones made with this unique feature.



5-Amp. S. P. Rotary Flush No. 0105

"MADE IN ONE QUALITY ONLY"

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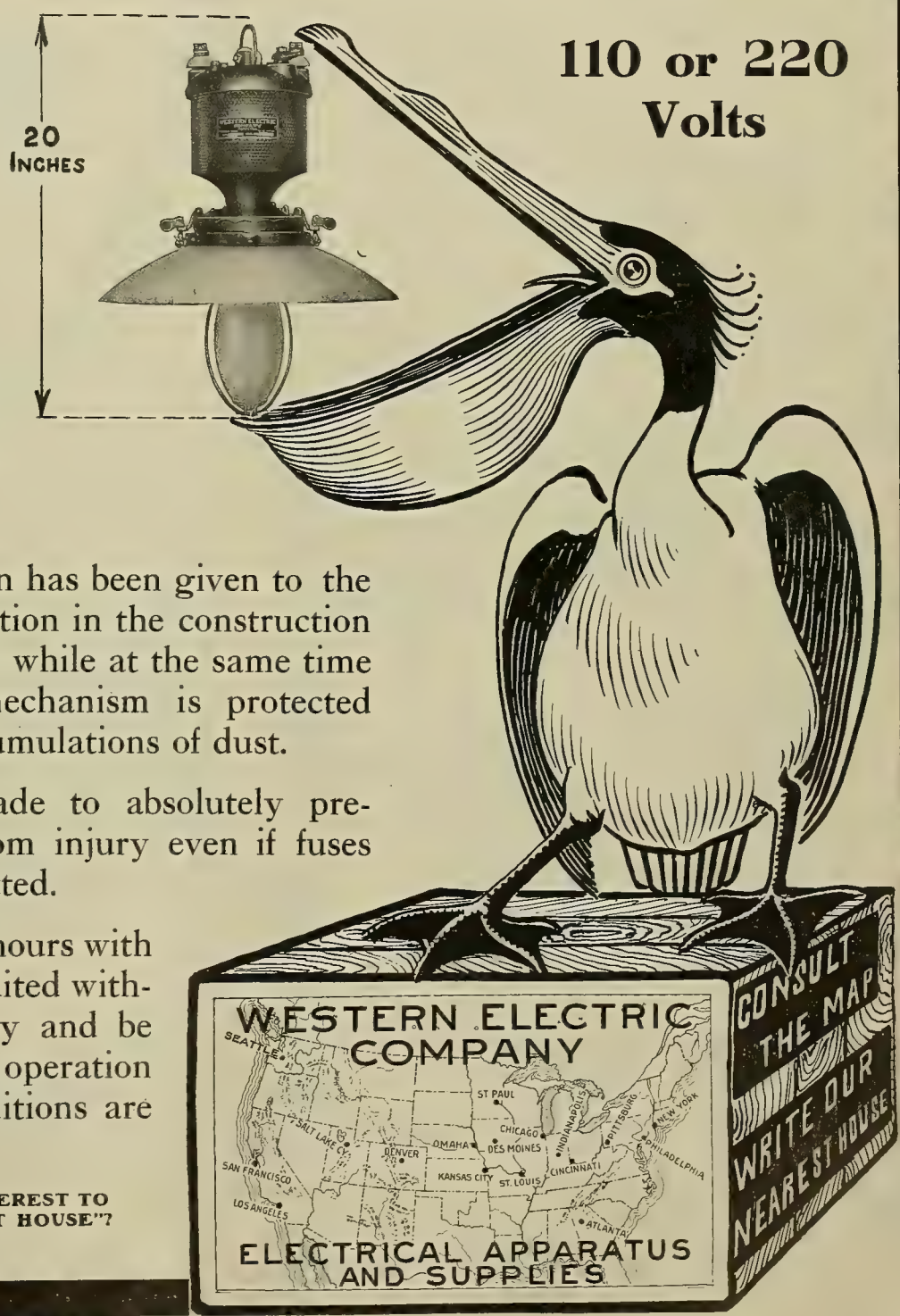
IT FILLS THE BILL
FOR ALL REQUIREMENTS

The "HAWTHORNE" Special Design SHORT ARC LAMP
For Low Ceilings—and High Ones as Well

A Guaranteed Burn of 100 Hours Each Trim

110 or 220 Volts



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MINIMUM CURRENT CONSUMPTION

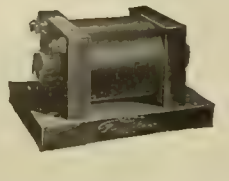
Will give years of service with but little expense for maintenance.

¶ Special attention has been given to the matter of ventilation in the construction of this new lamp, while at the same time the regulating mechanism is protected from harmful accumulations of dust.

¶ Provision is made to absolutely preserve the lamp from injury even if fuses were entirely omitted.

¶ Will stand for hours with the arc short circuited without material injury and be ready for normal operation when proper conditions are restored.

ISN'T IT TO YOUR INTEREST TO "WRITE OUR NEAREST HOUSE"?



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has no rough or soft spots to wear by abrasion, but is hard and smooth and thoroughly waterproofed.

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New M. C. Weatherproof Friction Tape—absorbs no moisture, high insulation. Used by many in place of splice.

The demand of the day is for special tapes.

You should demand for outside use our Waterproof Friction Tape No. 269, and enquire about our New M. C. Waterproof Paints.

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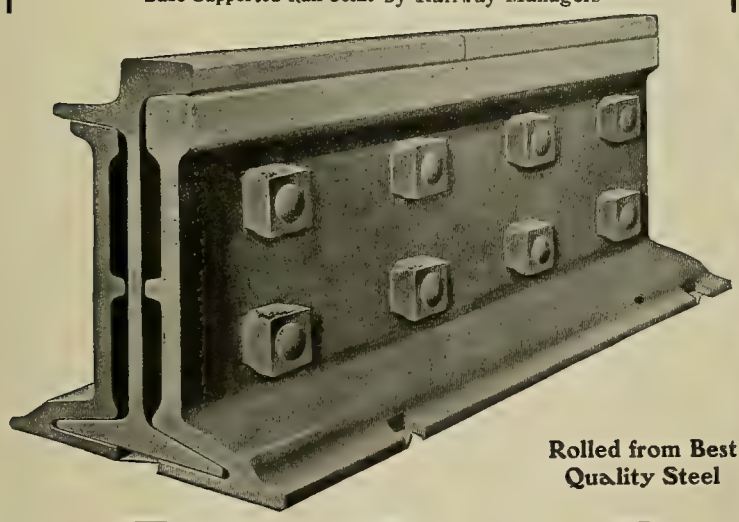
Showing the unprecedented approval of the **Base Supported Rail Joint** by Railway Managers



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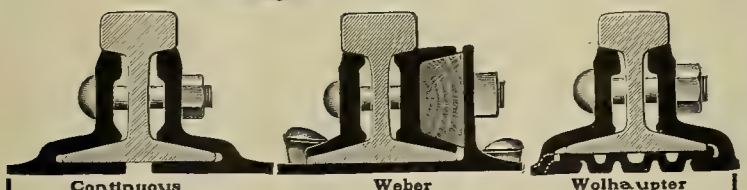

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MAKERS OF

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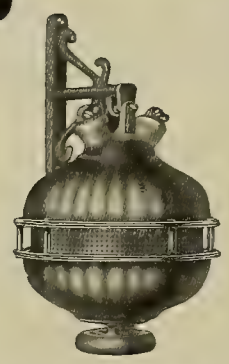

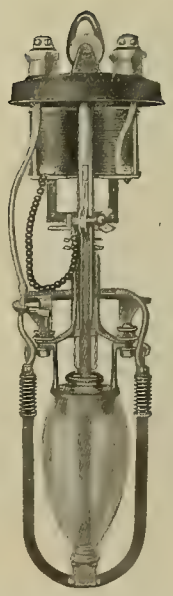

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Write for prices and further information.

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General Offices and Factory, Cleveland, Ohio.

143 Liberty St., New York City. 303 Dearborn St., Chicago, Ill.

An all around Gas Engine cell.

Long Life and Uniformity during life is our special claim for this cell.

Made in the five standard sizes. Our Guarantee is back of it.

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Seldom You Find It Nowadays

LOOK US UP Financially and you will see as a corporation **WE HAVE IT.**

EXPERIENCE Write us for copies of testimonials. You will find we have THAT also.

THE GOODS Electrically and mechanically perfect. We DO NOT KNOW HOW TO USE POOR MATERIAL, and aim to make THE BEST. TRY US.

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Ask your dealer for it or send us a sample order.

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WE KNOW, but you don't

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Those who KNOW and DEMAND the best find our Standard No. 8 the **right** battery for gas engines, telephone exchanges and high-class work. Costs more than Standard No. 6—the battery for general purposes—but is actually cheaper, because it lasts longer. Write Department A for prices.

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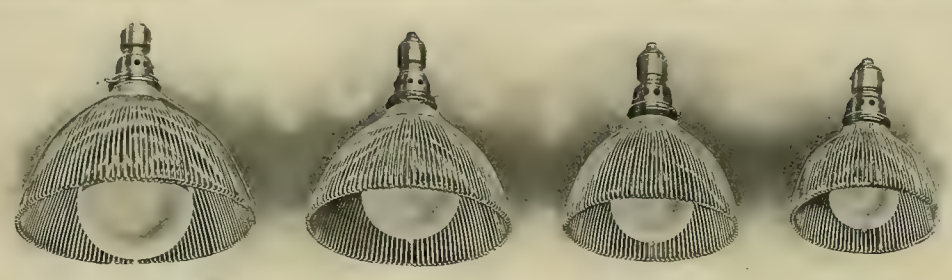
GEM Incandescent Units

WITH

The New Bowl Holophanes



No. 5 Unit
250 Watts with
B-5 Reflector

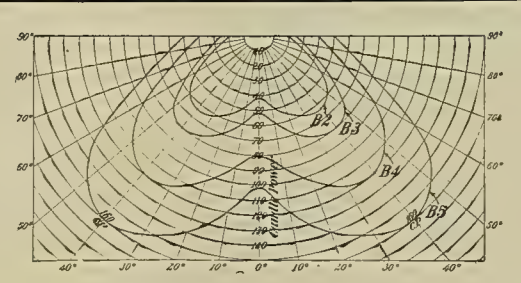
No. 4 Unit
187 Watts with
B-4 Reflector

No. 3 Unit
125 Watts with
B-3 Reflector

No. 2 Unit
100 Watts with
B-2 Reflector

The ideal reflector for general lighting
Throws the light down and spreads it out

Unequaled in Effectiveness and Efficiency



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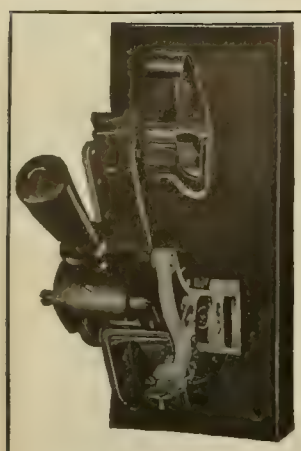
All Large Cities



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CLEVELAND: Crosby, Craft & Co. CHICAGO: Francis Raymond

DRY AND IMPREGNATE YOUR COILS BY VACUUM

(Cables—Transformers—Magnet Coils—Armatures)

OVER 700 APPARATUSES IN USE—"PASSBURG" SYSTEM
LARGEST ELECTRICAL FACTORIES IN U. S. NOW USE IT.

J. P. DEVINE CO., BUFFALO, N. Y.
428 MOONEY-BRISBANE BLDG.

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

CHICAGO MICA CO. : : : Valparaiso, Ind.

MICA Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

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We will fill your small orders as cheerfully as the large ones and at reasonable prices.

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Absolutely Will Not Gum The Brushes . . .

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RECO FLASHERS

Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

Reynolds Electric Flasher Mfg. Co.
191 Fifth Ave., CHICAGO

3-in-1 VOLT-AMMETERS

Measure low and high voltages, besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.

L. M. PIGNOLET
78-80 Cortlandt St. New York

CAUTION!

For the protection of our customers we call attention to the fact that our product is being imitated. This is not surprising, because Klein's tools are the result of years of experience and have stood the test of time. Our tools are stamped M. KLEIN & SONS, and purchasers wanting genuine Klein goods are cautioned to see that the full name, M. Klein & Sons, is stamped on them. No others are genuine.

There are tools on the market stamped "Klein's pattern," and a number of climbers have been sent to us in a defective condition which we have been asked to replace. Evidently the owners were under the impression that they were made by us.

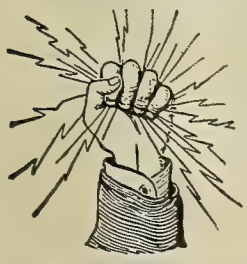
It pays to use only the genuine. Write for catalogue of our tools.

MATHIAS KLEIN & SONS
81 WEST VAN BUREN STREET, CHICAGO, ILL.

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

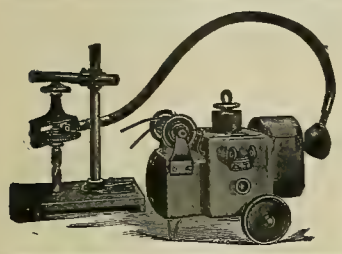
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, F. E. Donohoe, 26 Cortlandt St.
CHICAGO STORE, E. H. Hammond, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

READ BOOKS

on Electrical Subjects, and think Electrical Thoughts. We have the books. Send for a catalogue.

ELECTRICIAN PUBLISHING CO.,
507 Marquette Bldg., Chicago.



ESTABLISHED 1875.
COMBINATION OF
Stow Flexible Shaft
—AND—
MULTI-SPEED MOTOR
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.
STOW MFG. CO., Binghamton, N. Y.
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FARIES

WALL, DESK, FLOOR OR CEILING ADJUSTABLE FIXTURES

Adjust your light to any desired position INSTANTLY

Many shapes and styles—plain and ornamental—for shop, factory, store, office, residence; in fact, wherever the incandescent lamp is used.

Catalogue mailed upon request

FARIES MFG. CO.
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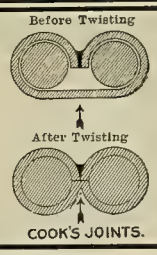
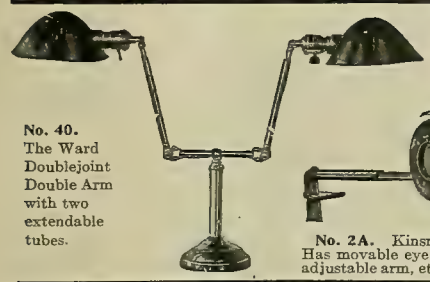


A PERMANENTLY PERFECT JOINT
Is an assured fact if you use
Cook's Self-Welding Wire Joint
No air spaces. No corrosion. Will carry any voltage.
Free sample will convince you.
Frank B. Cook. Manufacturer 235 W. Lake Street CHICAGO

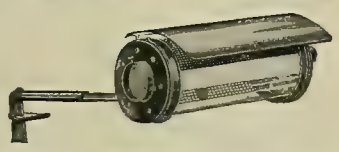


No. 40. The Ward Doublejoint Double Arm with two extendable tubes.

The "Kinsman & Ward" Desk Lamps and Portables

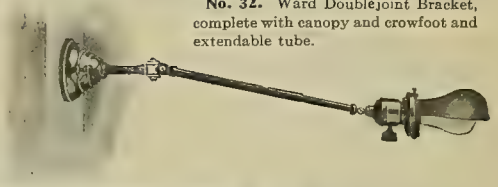
Have many advantages over any desk light, shade or reflector in the market.

Send for booklet illustrating other styles, also for prices.



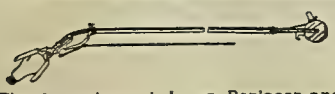
No. 2A. Kinsman Roll-top Desk Lamp. Has movable eye shade, inner glass cylinder, adjustable arm, etc.

No. 32. Ward Doublejoint Bracket, complete with canopy and crowfoot and extendable tube.



McLEOD, WARD & CO.
27 Thames St., New York

McKenney & Waterbury, Boston, Mass.
H. P. White & Co., Philadelphia, Pa.
Thos. G. Grier Co., Chicago, Ill.
Nicholas & Sellers, London, England.



The Incandescent Lamp Replacer and Cleaner replaces and cleans any C. P. lamp at any height or angle.
FRANK W. MORSE
Room 301, 116 Bedford St., Boston, Mass.

Manhattan Electrical Supply Co.
Something Electrical for Everybody
NEW YORK: 17 Park Pl. and 14 Murray St.
CHICAGO: 188 Fifth Ave
Factories: Jersey City, N. J.; Ravenna, Ohio

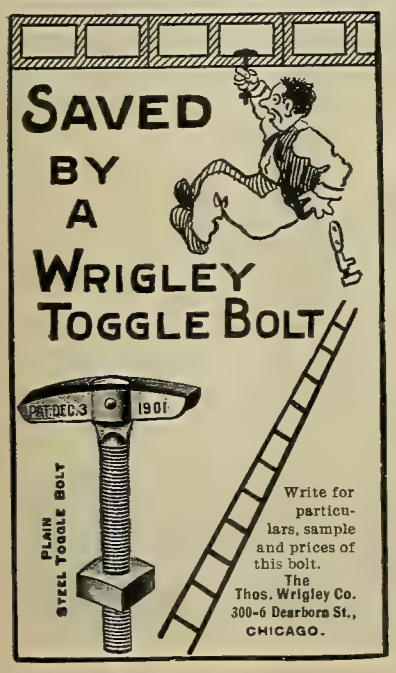
ARTISTIC PORCELAIN COMPANY
TRENTON, NEW JERSEY
Manufacturers of
Electric Specialties in High Grade Porcelain

We manufacture a beautiful quality of white, thoroughly vitrified, tough porcelain, especially adapted to electrical purposes. Correspondence solicited and prices quoted on application.

In 1906

The Western Electrician published 1096 LARGE pages of reading matter and 1650 illustrations. This is 3288 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber send in your order now.

Western Electrician
507 Marquette Building, Chicago



NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1 50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

Electrician and wireman, married, age 26. Nine years' experience in miscellaneous work. Desires position with interurban electric railway as signal man or in experimental department of electrical house. Am all-round artisan capable of making small parts, getting up ideas, designing electrical and mechanical effects of display. Address Box 680, care of Western Electrician, 507 Marquette Bldg., Chicago, Ill.

WANTED

Switchboard wireman:—Several A No. 1 wiremen at once to work on central station and substation boards. Wiremen thoroughly familiar with this class of wiring. Address Stone & Webster Engineering Corporation, Savings Bank Building, Terre Haute, Indiana.

WANTED

A reliable manufacturer is desirous of manufacturing and marketing some Electrical Specialties. Practical men the country over are constantly evolving schemes which save them time and money and which would be valuable to every man in the business. We want to acquire the right to manufacture and market some of these, of course compensating the inventor in a way to be arranged satisfactorily to both parties. If you have something good, write us. Address Lock Box 242, Chicago, Illinois.

FOR SALE

On account of building a brand-new light and power plant, this company will sell at a bargain, for delivery immediately after March 1st next, the entire equipment of the present plant, consisting of boilers, engines, generators, switchboards, etc. Call on or address us for particulars and prices. Palestine Electric Light Company, Palestine, Texas.

FOR SALE

Engine Lathe, Price $41.00

Swings 9¼ inches, takes 25 inches between centers; complete with full set change gears to cut all size threads 3 to 40 inch. Address L. F. Grammes & Sons, Allentown, Pa.

FOR SALE

One 62 K. W. 250-volt, one 50 K. W. 125-volt direct-connected dynamos and engines.
One 35 K. W. 220-volt 4-pole generator, direct connected to 50-horsepower Nash gasoline engine.
Two 25 K. W. and three 45 K. W. 125-volt Edison machines.
One 17 K. W. 125-volt 4-pole generator.
One 14x8½x10 Worthington pump, 50 and 400 horse Berryman heaters, 18x36-inch Allis Corliss engine, 10x12 Acme Vertical engine.

JAMES A. GRAHAM, 206 BROADWAY, NEW YORK.

OFFICE OF CONSTRUCTING OFFICER, U. S. SOLDIERS' HOME, Washington, D. C., December 31, 1906. Sealed proposals will be received here until two o'clock P. M., January 30, 1907, and then publicly opened, for erection of a building for a Power Plant and for Electric Elevators for new Mess Hall and Dormitory Building at the Soldiers' Home. Information on application. Deposit of $25.00 required on drawings for Power House. JOHN STEPHEN SEWELL, Capt. Engrs., Constructing Officer.

ROSSITER, MACGOVERN & CO., Inc.

ELECTRICAL AND STEAM MACHINERY, GUARANTEED, and at a PRICE considerably lower than for the same apparatus purchased from the manufacturers.

DIRECT CONNECTED A. C. UNITS.

6770—400 K. W. Westinghouse generator, 60 cycles, 2-phase, 1,150 volt, 150 RPM, direct connected to Williams vertical non-condensing engine 18x26.
6399—250 K. W. General Electric generator, 60 cycles, mono-cyclic, 2,400 volt, 200 RPM, direct connected to Ames horizontal, compound engine, 15½ and 26x18.
8659—150 K. W. Westinghouse, 60 cycles, single-phase, 2,200 volt, 257 RPM, direct connected to Harrisburg tandem compound engine, 12 and 24x14, complete with switchboard and exciters.

BELTED A. C. GENERATORS 60-Cycle, 3-Phase.

8476—450 K. W. Stanley, 2,200 volt, 360 RPM.
1517—150 K. W. General Electric, type A. T., class 12-150-600.
1136—100 K. W. General Electric, 2,300 volts type A. T. B., class 8-100-900.
1448—70 K. W. Thomson-Houston, 2,200 volt, class A-70, 515 RPM.

60-Cycle, 2-Phase.

1763—240 K. W. Stanley, 1,200-2,400 volt, 450 RPM.
1791—135 K. W. Stanley, 2,300 volt, 900 RPM.
7232—75 K. W. Westinghouse 2,200 volt, 720 RPM.

60-Cycle, Single-Phase.

7546—Two 300 K. W. Bullock, 110 volt, 16 poles, 465 RPM.
7634—Three 180 K. W. General Electric, 1,040 volt, type A. S., form A, 600 RPM.
1823—150 K. W. General Electric, 1,040-1,150 volts, type A. M., class 12-150-600.
1219—75 K. W. Westinghouse, 2,200 volt, class 10-75 900.

125-133-Cycle, Single-Phase.

6300—300 K. W. Westinghouse, 1,100-2,300 volts.
1279—120 K. W. Westinghouse, 1,100-2,200 volts, class 12-120-1375.
1344—90 K. W. General Electric, 2,300 volt, type A-6, class 12-90-1250.

ALTERNATING CURRENT MOTORS.

25-cycle, 60-cycle, 133-cycle, single-phase, 2-phase and 3-phase of various sizes and makes. Write for prices. Let us know your needs and we will quote you low prices.

Machinery For All Power Station Purposes.

17 Battery Place, New York

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Whether for temporary or permanent work, hard or easy, intermittent or constant, Northern Machines better shop and factory power transmissions, facilitate work, save power, time and labor. Used by progressive, successful workers in all industries.

NORTHERN ELECTRICAL MFG. CO.,
ENGINEERS—MANUFACTURERS
MADISON, WIS., - - U. S. A.
LEAFLET NO. 25130

DISTRICT OFFICES: 425 Monadnock Block, Chicago, Ill.
1236 Wells Bldg., Milwaukee, Wis. 801 Land Title Bldg., Philadelphia, Pa.
403-406 Atlas Bldg., 604 Mission St., San Francisco, Cal. 29 Broadway, New York. 21 East Fifth St., St. Paul, Minn.
200 Equitable Building, Boston, Mass.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
U.S. METAL POLISH 3 OUNCE BOX 10 CENTS SAMPLES SENT FREE GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

The Electrician Publishing Co., 507 Marquette Bldg., Chicago. Headquarters for all latest Electrical Books. Write for Catalogue.

Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths.
Price, 3 ft. 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

T. J. COPE
3244 North Fifteenth Street PHILADELPHIA, PA

FOR SALE
SPECIAL BARGAINS
TELEPHONE RINGERS

	H.P.		R.P.M.	Each.
6	½	Crocker-Wheeler,	110-80v 1,000	$10.00
45	½	Roth,	110-80v 1,000	10.00
6	½	Roth,	220-80v 1,000	10.00
1	¼	Crocker-Wheeler,	500vdc 110vac	20.00
1	½	Crocker-Wheeler,	500vdc to 75vac	25.00
1	½	Crocker-Wheeler,	500vdc 110vac	25.00
3	2	Crocker-Wheeler,	110vdc to 6vdc	60.00

Every one as good as new. Send for our **Monthly Bargain Sheet** showing complete list of machines on hand, with net prices.

GREGORY ELECTRIC CO.
Cor. 16th and Lincoln Sts.
CHICAGO

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

German Silver
in sheet, wire, rods blanks, etc.
Phosphor Bronze
Nickel and Copper Anodes

THE SEYMOUR MFG. CO.
Box 667, SEYMOUR, CONN.

WE BUY OLD BELTS
OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
LEATHER PRESERVER MFG. CORP.
27 W. MONROE ST., CHICAGO

ROBT. FERRIS' BOOK ON METERS
IS SO SIMPLE THAT ONE WONDERS AT THE COURAGE OF THE AUTHOR
IT TELLS JUST WHAT SOME PEOPLE THINK THEY KNOW.
Written expressly for the men who handle the pliers.
Sent prepaid on receipt of $1.00. Address
ELECTRICIAN PUB. CO.,
Marquette Bldg., CHICAGO.

Crimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

NEW YORK INSULATED WIRE COMPANY,

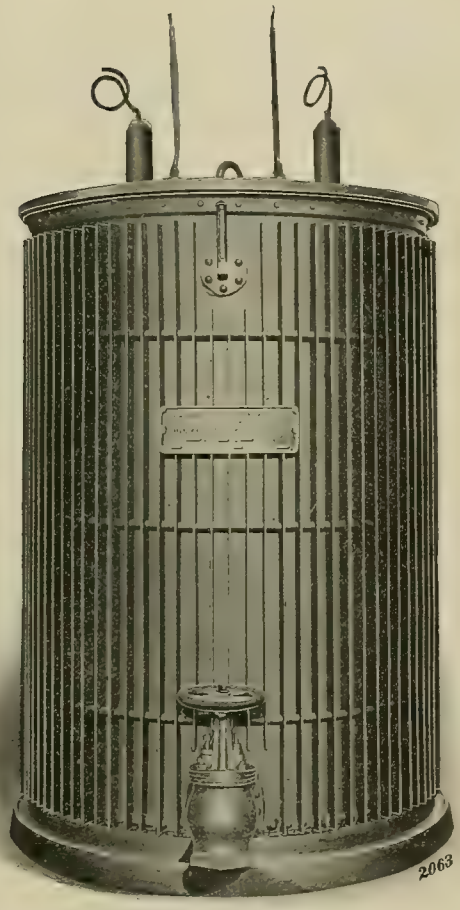
MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 766 Folsom St.

CHICAGO EDISON COMPANY REPAIR SHOPS
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280
FIRST CLASS EQUIPMENT THROUGHOUT
High-Grade Machine Work of All Kinds. Correspondence Solicited.
Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

Wagner Electric Mfg. Co.

ST. LOUIS, U. S. A.

LARGE TRANSFORMER UNITS



100-K. W., 2,200 to 24,000-volt, oil-filled, self-cooled "Heavy Duty" Transformer.

Transformers manufactured by this company take their full load and operate satisfactorily from the time of their first installation. In other words, they go out of our factory right, and do not have to be rebuilt on the job.

Large transformer units manufactured by this company eight and nine years ago are still operating without any signs of deterioration or stress.

We Solicit Work Requiring a High Degree of Engineering Skill.

SEND US YOUR TRANSFORMER SPECIFICATIONS

$2,600.00 IN PRIZES

For ELECTRICAL SOLICITORS HANDBOOK OFFERED

BY

It is desired to secure a handbook which will be instructive and stimulating to representatives of central stations, contractors or others who are soliciting the public for the sale of electric service for light, heat and power.

A committee appointed by the President of the National Electric Light Association will judge the handbooks and the awards will be made at the next meeting of the Association.

DIVIDED AS FOLLOWS:

1st Section ON LIGHT, $1,000.00
- 1st prize, $500.00
- 2nd prize, 300.00
- 3rd prize, 200.00

2nd Section ON POWER, $1,000.00
- 1st prize, $500.00
- 2nd prize, 300.00
- 3rd prize, 200.00

3rd Section ON HEAT, $600.00
- 1st prize, $300.00
- 2nd prize, 200.00
- 3rd prize, 100.00

FOR FURTHER PARTICULARS WRITE FOR PAMPHLET

Co-Operative Electrical Development Association

CLEVELAND, OHIO

CHICAGO'S BANNER BOOSTER—SECOND ANNUAL

ELECTRICAL SHOW

JANUARY 14-26

COLISEUM—CHICAGO

GREATEST OF ALL TRADE EXPOSITIONS

Thirty thousand square feet of exhibits embracing every branch of the electrical field and including every leading manufacturer in America.

SPECIAL SOUVENIR DAYS

Benj. Franklin Day, Thursday, Jan. 17
Telephone Day, Monday, Jan. 21
Thomas A. Edison Day, Wednesday, Jan. 24

SPECIAL DATES FOR ORGANIZATIONS

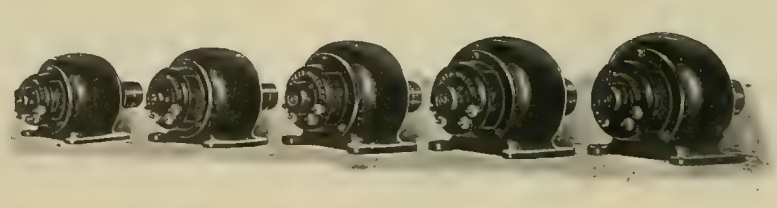
Northwestern Electrical Association, Jan. 16, 17 & 18
Illuminating Engineers' Society, Jan. 17
Rejuvenated Sons of Jove, Jan. 16
American Electrical Salesmen's Association, Jan. 24

FOR ANY OTHER INFORMATION ADDRESS

HOMER E. NIESZ, Managing Director

ELECTRICAL TRADES EXPOSITION CO., 1006-7 Monadnock Bldg.

CARRYING A BIG STOCK
OF MOTORS IN CHICAGO



C-W *Form L Motors, 1-10 to 5 H. P., which are always kept in stock in Chicago.*

Enables us to handle the great volume of orders that come to our Chicago office.

Thousands of C-W motors run year in and year out in the city alone.

Chicago will soon be lighted with current generated at Lockport by our three 4,000 K. V. A. Alternators, purchased by the Sanitary District.

SEND FOR BULLETIN 60-M CONTAINING DATA OF VALUE TO MOTOR USERS

CROCKER-WHEELER
COMPANY

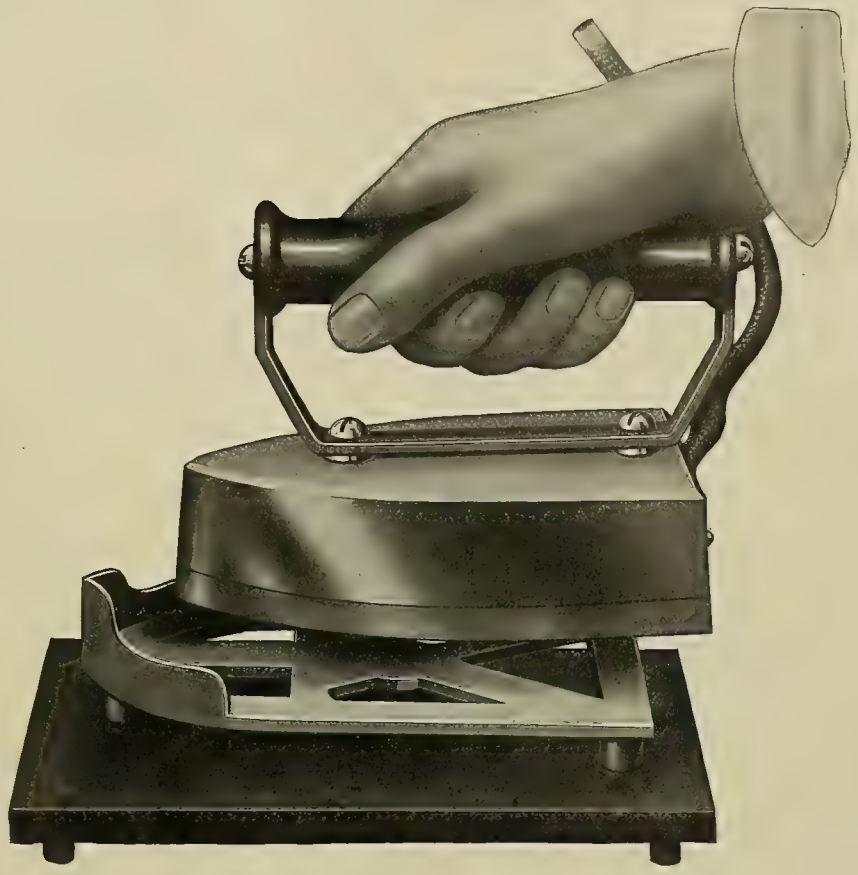
ALTERNATING AND DIRECT CURRENT MACHINERY

WORKS, AMPERE, N. J.

CHICAGO OFFICE - - - - - OLD COLONY BLDG.

1896 **1907**

The Standard of the World



SIMPLEX S.E.H.Co. QUALITY

A SCIENTIFIC
PRACTICAL
COMMERCIAL
SUCCESS

SIMPLEX ELECTRIC HEATING CO.

CHICAGO: Monadnock Blk. CAMBRIDGE, MASS.

SEE US AT

THE ELECTRICAL SHOW

CHICAGO, JANUARY 14 TO 26

Space 16, Section C

If You Want the Best Use and Specify

J. ALLEN HAINES INC. ELECTRICAL NECESSITIES

American Electric Heating Apparatus
"Bishop" Insulated Wires and Cables
"Clifton" Tape and Splicing Compounds
"Apple" Igniters and Ignition Outfits
"Reed" Annunciator and Office Wire
"Schwarze" Bells "Faraday" Bells
"Hubbell" Floor Boxes
"Fielding" Charging Receptacles
"Voltax" Wires and Cables
"Voltax" Weatherproof Wire
"Romeoid" Telephone, Rubber Insulated, Bare and Magnet Wire
"Voltax" Insulating and Preservative Paint

WESTERN DISTRIBUTORS:

J. ALLEN HAINES

(INCORPORATED)

324 Dearborn Street CHICAGO, U. S. A.

NOTICE

THE PATENTED DEVICE which has brought the ELECTRO-DYNAMIC COMPANY'S INTER-POLE VARIABLE SPEED MOTOR to its present state of high efficiency is owned by the

ELECTRO-DYNAMIC COMPANY

Unlicensed Manufacturers are now making and offering for sale Variable Speed Motors embodying this device, and variously termed "Auxiliary Pole," "Commutating Pole," etc., etc., which INFRINGE the patent No. 775,310, dated November 22, 1904, owned by the ELECTRO-DYNAMIC COMPANY.

NOTICE IS HEREBY GIVEN

that such INFRINGERS, including users of such infringing apparatus, render themselves liable for damages, and will be prosecuted forthwith.

Pursuant to the above notice, suit has been begun on November 23, 1906, by the filing of a bill of complaint against The Westinghouse Electric and Manufacturing Company.

ELECTRO-DYNAMIC CO.,
BAYONNE, N. J.

THE NEW INCANDESCENT LAMP!

We offer you a strictly first class lamp at a reasonable price — **and that price is less than the "association price."**

It is "up to you," Mr. Lamp Buyer.

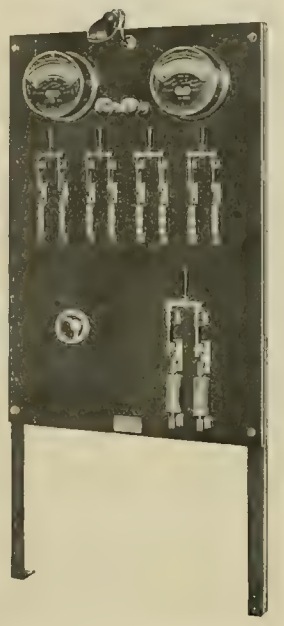
Ours is a New Lamp, but we know the business. Give us a trial and we will prove our proposition so you will stay with us.

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

NOVELTY INCANDESCENT LAMP CO.
Emporium, Pa.

ALVIN & JACKSON, Western Sales Agents, 602 Monadnock Block, Chicago, Ill.

WORCESTER
Standard Switchboards



Are Electrically and Mechanically Perfect. They are easy to install because we do all the wiring for the ground detector, pilot lamps and instruments, thus giving you a complete finished switchboard on which you save time and money.

Our factory is especially equipped for handling special switchboards, panelboards and knife switches and can guarantee prompt delivery.

Write us and we will send you our Switchboard and Knife Switch Catalog No. 7 by return mail.

Worcester Electric Mfg. Co.
WORCESTER, MASS., U. S. A.

To obtain the full benefit of the Chicago Electrical Show, insert an attractive advertising announcement in the Western Electrician's Electrical Show Numbers, Issues January 12, 19 and 26, 1907. Mail copy TO-DAY.

GEO. Q. HILL Co
Boston Mass.
Special Screws – Screw Machine Products – and Small Stamped Parts in Quantity

The more a man advertises, the greater his business. The greater his business, the more he advertises.

Home of Mission Furniture

FURNITURE suitable for the home, office or club. Our aim is to sell good, well made and well finished furniture at reasonable prices.

Largest stock in Mission Styles in the city.

Special prices on Sectional Bookcases.

We furnish all of the booths at the Electrical Show.

Storey Furniture Company
295-297 Wabash Avenue
Phone Harrison 2471 Near Van Buren Street

THE HOME OF

"PAISTE QUALITY"

A WHOLE BUILDING DEVOTED TO MANUFACTURING THE **"PAISTE"** LINE OF

ELECTRIC LIGHT SUPPLIES

SOCKETS—CUT OUTS—TAPLETS—PANEL CUT OUTS—ATTACHMENT PLUGS—ROSETTES—PANELETTES—ARC LAMP HANGER BOARDS—BABY KNIFE SWITCHES—ETC., ETC., ETC., ETC.

Each Article Correctly Designed, Carefully Made, Separately Inspected

WRITE US FOR SAMPLES, CATALOG AND PRICES

H. T. PAISTE COMPANY

PHILADELPHIA, PA.

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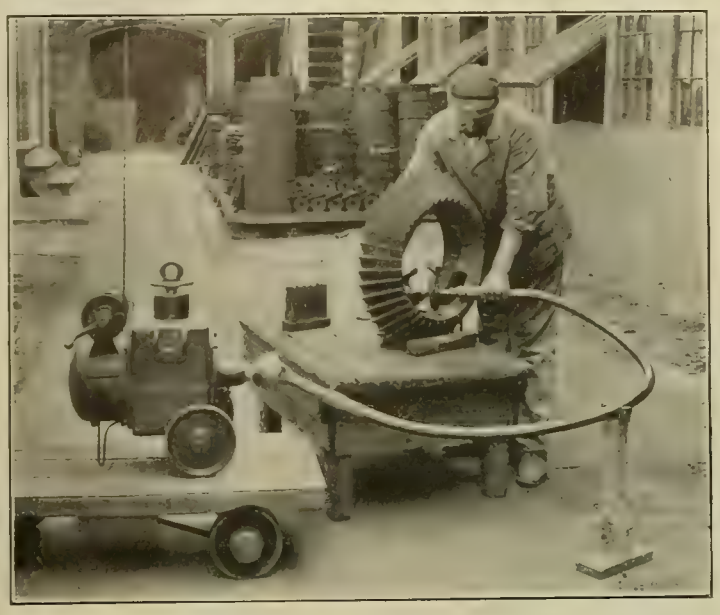

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as manufactured by

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General European Agents

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We build these in four sizes:

No. 4—¾ H. P. Motor
Emery Wheel capacity 6x1¼ in.

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Emery Wheel capacity 10x1½ in.

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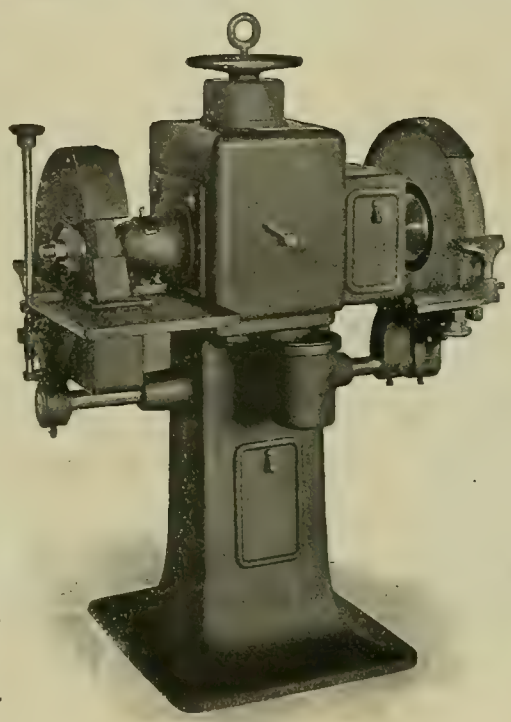
Emery Wheel capacity 12x2 in.

For 110 or 220 volts they are furnished as shown in cut. For 500 volts with wood truck for better insulation. This latter is extensively used by street railways for grinding rails in bonding.



The

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is used in these machines.

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Wide Range of Speed
Infinite Variation in Speed

A fraction of a turn of the regulating wheel on top of motor will make a corresponding change in speed of emery wheel

Mechanical Regulation of Speed

No rheostats or controllers to fill up with dust and burn out.

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Perhaps **Semi-Portable** would be a better name for this machine, because by loosening a few bolts it can be readily changed from place to place without regard to counter shafts or line shafts.

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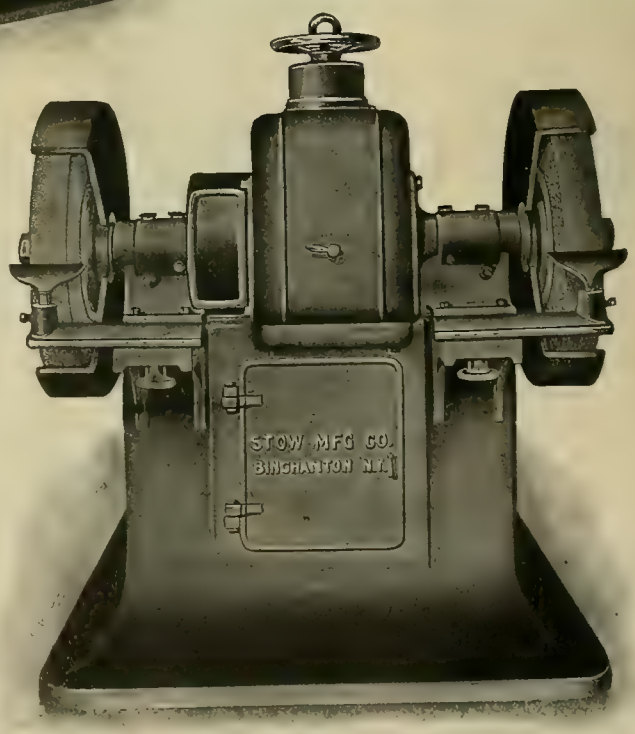

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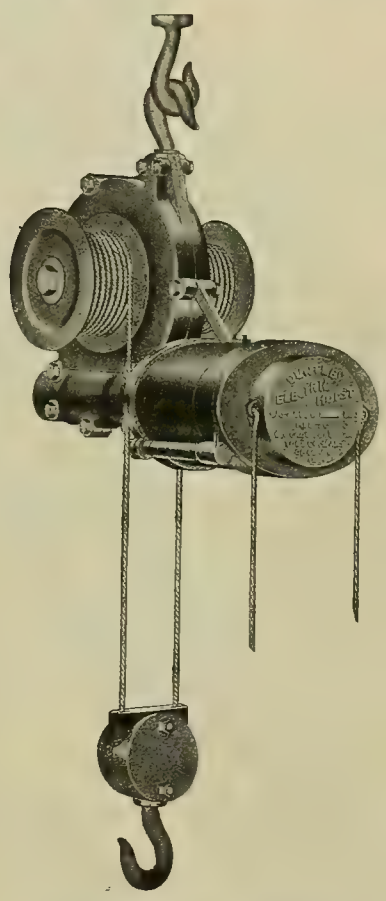

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Duntley Portable Grinders are made in three sizes, carrying 5 to 10-inch diam. wheels.

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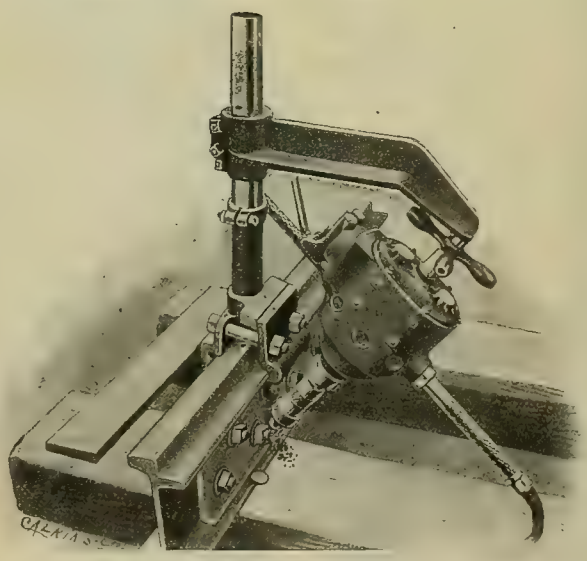

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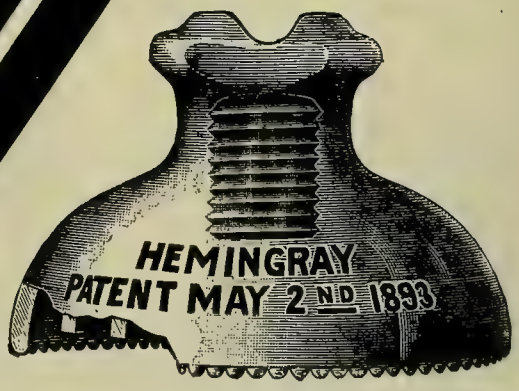

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39th ANNUAL STATEMENT

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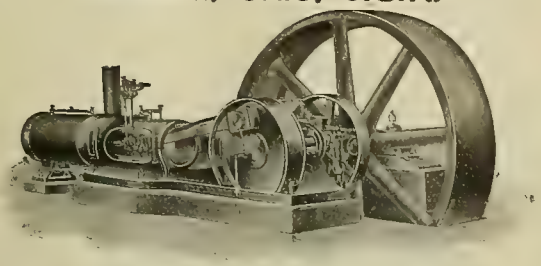

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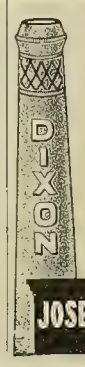

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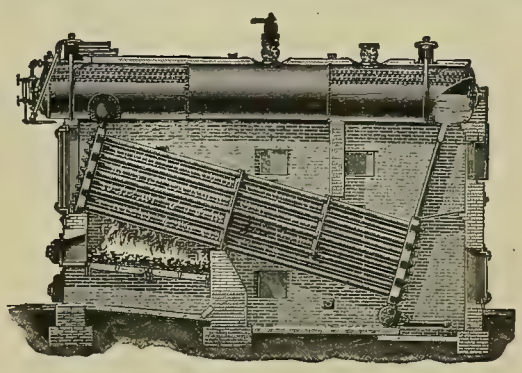

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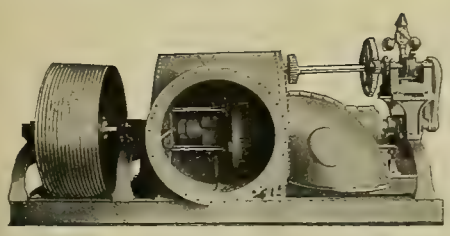

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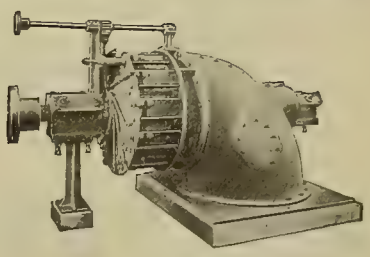

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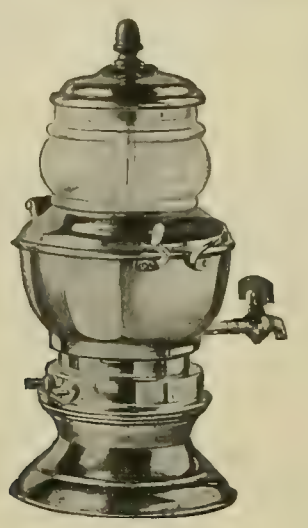

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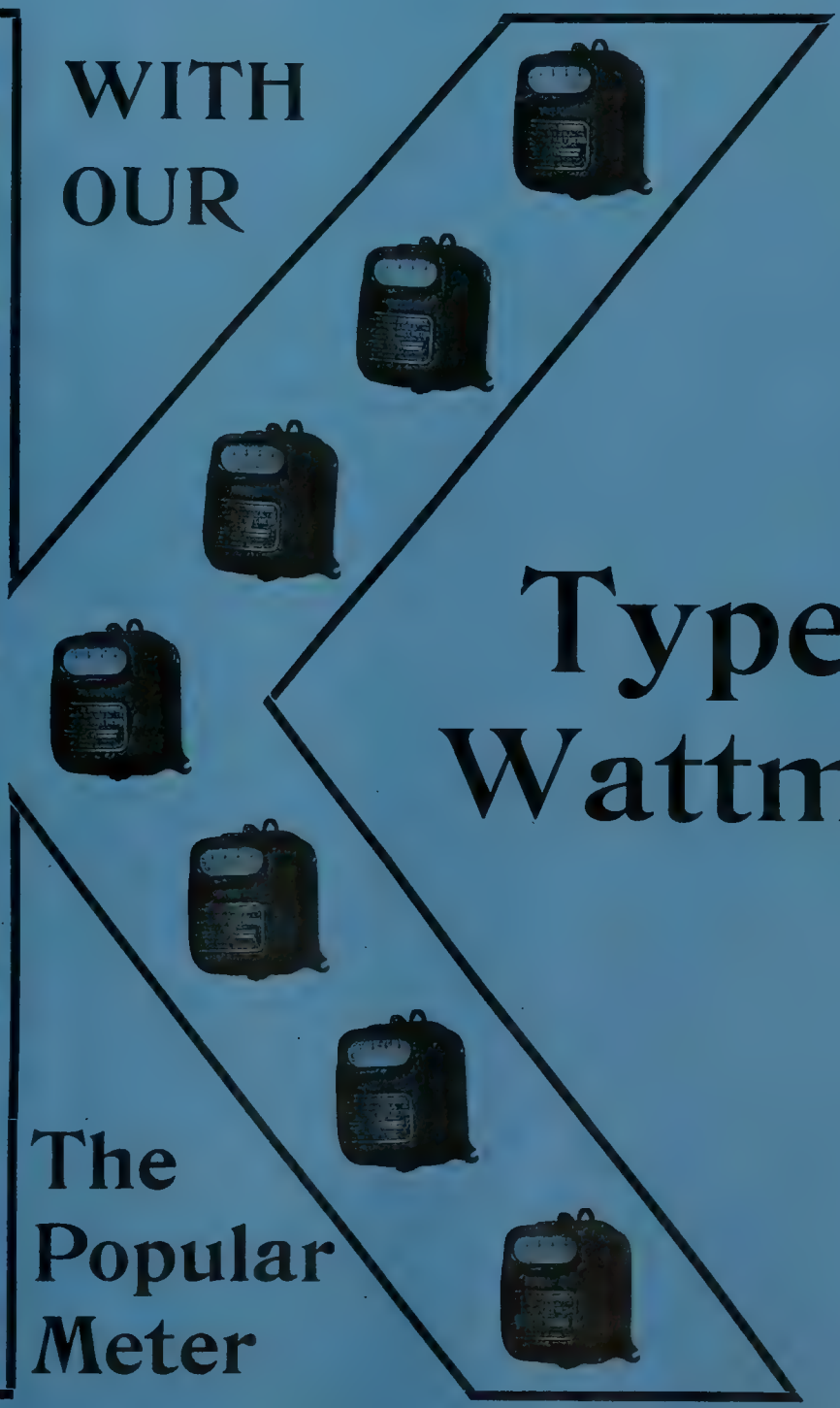

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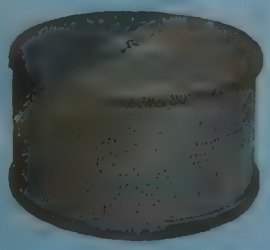
527



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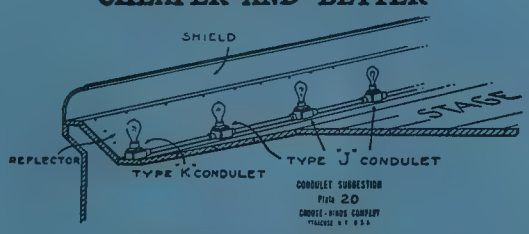

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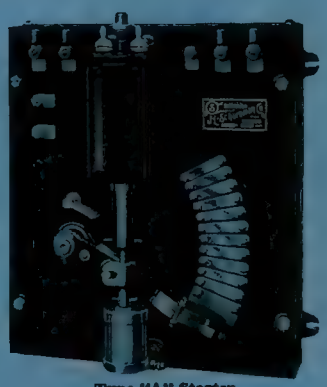

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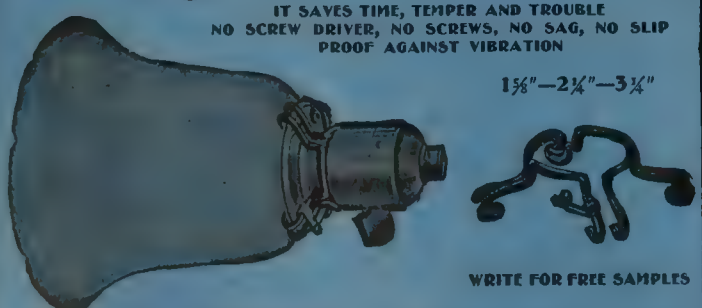

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Electric Railways in Mediterranean Countries.

One of the most important interurban traction lines in Italy is the road which has been lately constructed from Milan to Monza, and it is the first line of the kind to be installed in the country. The electrical equipment for the road was supplied by the Mediterranean Thomson-Houston Company and was ordered by the Société Edison, which also operates the city traction system of Milan. The interurban line from Milan to Monza has a total length of about 10 miles, and, like the city traction lines, it utilizes the power which is produced in a large hydraulic station located on the Paderno.

A 20-mile overhead line brings the current from Paderno to Milan, where it is received in a sub-station. The interurban road is fed at one end, that is, the junction point with the city tramways, by the same sub-station which supplies the latter, and is also supplied by three feeders, one of which is connected upon the line near the city and the two others at points lying near Monza. The two feeders on the outlying part are run from a second sub-station erected near Cesto, at the crossing point of the high-tension line from Paderno and the traction line.

In the Cesto sub-station the current, which is taken from the overhead line at 13,500 volts, three-phase, is first reduced to 340 volts by a bank of transformers and then sent into rotary converters which supply direct current at 550 volts. The rotaries in this case are formed of six-pole railway generators running at 840 revolutions per minute and are regulated on the three-phase side by induction regulators. The sub-station is also provided with a storage battery, which is run in parallel on the tramway line, or in other cases is used to supply two sets of motor-generators, each composed of a dynamo and an induction motor of the 50-horsepower type, mounted on the same shaft. These groups are designed to raise the voltage in the feeder, and are also employed to charge the storage battery. For the latter purpose the dynamos are provided with an independent winding.

ELECTRIC-RAILWAY CARS IN MILAN, ITALY.

STARTING POINT OF CARS OF ELECTRIC STREET RAILWAYS OF FLORENCE, ITALY, NEAR CATHEDRAL.

The rolling stock of the line at last accounts consisted of 14 motor cars and 10 trailers of the type which is shown in an accompanying illustration. Mounted on double trucks, the motor cars are spacious and comfortable and contain 48 places in all. They have two 50-horsepower motors and electric brakes. The latter are fitted upon the trailers as well.

Although recently installed, the Milan-Monza line now takes nearly all the passenger traffic between these two points, even though they are connected by a steam railroad. Some days the cars carry more than 8,000 passengers.

Florence has a street-railway system which is one of the best in Italy. It is controlled by the Florentine Tramway Company. The city is built almost entirely on the right bank of the Arno and is surrounded by well-populated suburbs which are situated in a picturesque and hilly country. Some of these neighborhoods, such as Fiesole and Sesto, have as many as 14,000 inhabitants. Thus the region is one in which the advantages of a good city and suburban traction system are appreciated.

In general the Florence system includes three main lines, which start from the Cathedral in the center of the city and radiate to the suburbs, there dividing into seven lines. A belt line laid upon the boulevards which surround the city completes the system and unites the other lines. In most cases there are numerous grades and short turns. For instance, the suburban line running from Florence to Fiesole reaches the latter town by a continuous series of grades which take the cars up to 1,000 feet altitude, or 800 feet above the city, and the track winds around many curves, some of which are quite sharp.

Current is furnished from a large generating plant situated in the outskirts of the city. In the boiler room of the station are erected four boilers of the Weinlig pattern, with two superposed cylinders. Each boiler, having heat surface of 170 square yards, can supply 6,000 pounds of steam per hour at 135 pounds pressure. Combined with the boiler is a Schwörer steam dryer, and the station also uses a Green economizer. Placed beside the boiler-room, the main dynamo hall contains three main generating sets. Each of these is composed of a horizontal steam engine direct-coupled to a multipolar railway generator. The steam engines of the plant are of the tandem compound type, working with condensation or free exhaust as desired. Two of the engines have a capacity of 700 indicated horsepower and operate at 120 revolutions per minute. Of somewhat smaller size, the third engine works at the same speed, but is rated at 400 horsepower. The engines were furnished by Escher, Wyss & Co. For the condenser water supply is used a 25-horsepower electric motor which drives a turbine pump. Mounted on the shaft of each of the large engines is a Thomson-Houston multipolar railway generator rated at 425 kilowatts and giving 550 volts for the feeders. On the smaller engine is mounted a similar generator which gives 225 kilowatts at the same voltage.

For the city lines as well as in the suburban portions of the road the overhead line is formed of a double trolley wire, which is suspended inside the city by cross-wires stretched between iron poles or between rosettes attached to the houses, or in other cases it is hung from bracket poles. The overhead line is divided into sections 1,600 feet in length, each section having a set of switches, and these are arranged so that one of the two parallel wires can be cut out of the circuit, allowing the trolley to be run on the second wire. In the center of the city the feeders are laid underground and are encased in armored cable, but they are composed of bare copper overhead cable in the suburbs.

On the lines inside the city the track is made up of Broca rails weighing 75 pounds per yard, laid on metallic ties weighing about 40 pounds, using seven ties per rail length of 33 feet. In the suburbs Vignole rails are used weighing 53 pounds to the yard and placed on oak ties. The return is formed as usual by the track rails, using Chicago rail-bonds and cross-connections between

the rails every 350 feet. The return feeders are made up of old rails connected electrically and buried at a depth of one yard in the ground, and they join the chosen points of the track rails to the negative bus-bar in the station.

The type of motor car and trailer will be observed in the accompanying view, which shows the cars at the city terminus of the lines at the Cathedral. On the motor cars are mounted 25-horsepower motors, two for each car in general, but 50-horsepower motors are used on some of the cars, which are of a heavier build. All the cars are equipped with magnetic brakes. The trailers are mainly of the open-car pattern and are largely used.

Since it was first installed the Florence tramway system has been well patronized by the public, and at present it carries a large amount of traffic both on the city and the suburban lines.

MILAN-MONZA INTERURBAN ELECTRIC RAILWAY IN ITALY.

The first electric tramway to be installed in the French possessions of Africa was built at Algiers a few years ago, and it is now in good running order. Starting from the Dey's Hospital at one end of town it crosses the lower portion of the city and then mounts up into the hilly portion of the Mustapha commune, passing by the Governor's Palace, at which the accompanying view is taken, and reaching the terminal point at the Voisol Column on the summit of the hill.

The generating plant has a capacity of 700 horsepower and is well laid out. In the boiler-room are erected three tubular boilers which can furnish 5,500 pounds of steam per hour, using the third unit as a standby. The dynamo room is equipped with two main generating sets of 200 kilowatts each, with space for a third group. Corliss engines, furnished by the French Creusot works, are used here, and they are rated at 350 horsepower and operate at 65 revolutions per minute, being connected to Thomson-Houston 200-kilowatt generators which deliver 550 volts. A large car barn forms one of the features of the station and contains nine tracks, being well laid out for overhauling the cars. The trolley wire of the lines is formed of an 8.25 millimeter wire and is suspended at 20 feet from the ground, being held from a steel cross-wire supported from iron poles or rosettes. The latter are used especially in the central part of town between the high buildings, where the streets are narrow, and they have no disagreeable effect.

In the lower part of the city the line runs on a level, but when it reaches the suburb of Mustapha it climbs up the hill at a very heavy grade and has some short turns. Toward the latter part the cars run up a continuous grade of two miles and reach the top of the hill at a height of nearly 400 feet above the lower part of the line. Here the grade is about 4½ per cent., but sometimes reaches 6.7 per cent. The illustration shows the type of car which is used on the Algiers system. It is fitted with two 25-horsepower motors. The line is well patronized both by the European and the Arab population.

Equitable Street-lighting Contract.

A new committee just appointed by President Williams of the National Electric Light Association has been created for the purpose of formulating a model contract and specification for street lighting. Many inquiries have been made for such a contract—one that would be fair both to the lighting company and to the municipality and one that would permit of changes in the form of illumination as new developments are made in the art, on a basis satisfactory to both parties to the contract.

The personnel of the committee is exceptionally strong, the members being Dudley Farrand, Louis A. Ferguson, Paul Spencer, Charles P. Steinmetz and A. E. Kennelly, and useful results are looked for in the report to be presented at the thirtieth convention of the association, to be held in May or June next.

The Austin Dam Project.

Under date of January 4th the Texas correspondent of the Western Electrician writes as follows from Austin:

The project of rebuilding the great dam across the Colorado River at Austin is being agitated by the people here, and it is thought that a satisfactory plan may be devised for bringing about the accomplishment of the undertaking.

The original dam and its adjunct waterworks and electric power plant were constructed at a cost of $1,600,000. It was a municipal enterprise, and its main object was to lower the rates of service for public utilities. The dam and plant were destroyed in a great flood in the Colorado River in the spring of 1900. Several lives were lost in the flood at the time the dam was swept away. The water was pouring over the granite wall of the dam to a height of more than 10 feet when a portion of the structure was suddenly uplifted and carried some distance down stream and there set down again in its perpendicular shape. The torrent of water which swept into the lower river when the opening in the dam occurred swept through the power house and waterworks plant and wrecked the machinery.

By the destruction of this valuable municipal property, for which bonds had been issued to pay the cost of construction, the city was left in an embarrassed financial condition. A large debt was saddled upon the taxpayers without anything to show for it. The city was forced to install a steam plant for supplying the public with water and electric lights, and this has been operated at considerable cost. The water and light rates had to be raised in order to meet the emergency. Finally the outstanding bonds were refunded at a lower rate of interest, and the city is now beginning to see its way clear to arrange for the reconstruction of the dam and the rehabilitation of the water and light plant on the scale originally operated. The thing which has stood in the way of the city making a contract with private persons for the re-establishment of the enterprise is a clause which is written in the bonds prohibiting the lease or sale of the plant to private persons. It is thought, however, that this difficulty can be overcome if a satisfactory proposition is received looking to the rebuilding of the dam.

A number of propositions have been made to the City Council by New York investors during the last few months looking to rebuilding the structure, but up to this time none have met with the approval of that body. It is hoped that some satisfactory arrangement for carrying out the big undertaking may be devised and put into effect during the present year. The sentiment is very strong against the city again owning and operating the enterprise. It is declared that municipal ownership of public utilities has proved a failure so far as Austin is concerned. If the consent of the bondholders can be obtained to the proposition of leasing or selling outright the ruins of the dam and power house, it is believed that no serious difficulty will be experienced in making a deal for the reconstruction and rehabilitation of the enterprise.

There is a portion of the original dam remaining, and it is said by engineers that it could be used again after being strengthened. The cost of rebuilding the dam is estimated at $500,000 to $800,000. Some engineers hold to the opinion that the plan upon which the dam was built is wrong and that an entirely new structure should be constructed.

The dam was 60 feet high. It formed a lake of water about 30 miles long and one-fourth to one-half mile wide. It was a popular pleasure resort for a large portion of the state. H.

Annual Meeting and Dinner of the Western Society of Engineers.

The annual meeting and dinner of the Western Society of Engineers was held at the Midday Club in the First National Bank Building, Chicago, on January 8th. The annual election of officers took place, Mr. William L. Abbott, chief operating engineer of the Chicago Edison Company, being elected president of the society for the coming year.

The retiring president, Mr. B. J. Arnold, made a short address, giving a statement of the condition of the society during the last year. The organization has a membership of 925 engineers, an increase of 96 in the last year.

ELECTRIC-RAILWAY CAR IN FRONT OF THE GOVERNOR'S PALACE IN ALGIERS.

After Mr. Arnold's remarks the newly elected president, Mr. Abbott, in a few appropriate words, accepted the office. The new president was promoted from the vice-presidency. He has a wide acquaintance among mechanical and electrical engineers in Chicago, by whom he is highly esteemed.

The toastmaster for the evening was Willard A. Smith, and he called upon Mr. Julius Stern, who made a short speech. Following Mr. Stern, W. H. Finley, past-president of the society, responded to a call from the toastmaster. Mr. B. J. Arnold then presented the main address of the evening on the

electrification of the New York Central and Hudson River Railway and other American and European railways, which was well illustrated with a number of lantern slides.

In the address Mr. Arnold referred to the prediction he made in 1904 that electricity would supplant steam in many fields, especially in railroad terminals. The wonderful advances made by eastern roads in improving their terminal facilities by use of electric power was referred to.

The new officers elected for the coming year are: President, William L. Abbott; vice-presidents, Andrews Allen, E. N. Layfield and Prof. A. M. Talbot; treasurer, Albert Reichmann; trustee for three years, W. C. Armstrong.

Electrical Effects at the Charity Ball.

Of unusual brilliance was the annual charity ball which was held at the First Regiment Armory, Chicago, New Years Eve. The decorations were especially attractive. The floor was circled by 52 boxes lined with rich decorations in gold, while the balconies above were trellised with white and ornamented by vines, palms and flowers.

DECORATIVE ELECTRIC LIGHTING AT THE CHARITY BALL.

An especially pleasing feature was the artistic arrangement and design of the electric lighting. Over 2,000 lamps, contained in Harter three to six-light opal clusters, were used. There were no colored lights, the color effects being produced by reflection from the walls and especially arranged colored reflectors. Suspended about the hall were beautiful basket electroliers, ranging in number of lamps from 65 to 85 each. Groups of lamps representing garlands of lilies were interspersed between the baskets. Four of the large baskets in the center were suspended 90 feet from the ceiling. The accompanying view gives an idea of the arrangement. Mr. Arthur Heun designed the decorations. The electrical installation was done by the Wadeford Electric Company. Current was taken from the Edison mains.

At midnight all the lights were turned out and after a silence for a minute showers of confetti were released from the overhead baskets and floated downward with a whirling effect given by numerous electric fans. Ten spot lights were used to play upon the scene with fine effect. After this had continued for a short time the new year was welcomed by the turning on of all of the lights in the hall. Princess Cantacuzene and Major-General Adolphus W. Greely, commanding the northern division of the United States Army, led the grand march. General Greely is distinguished as an Arctic explorer, a scientist and as a soldier. He was formerly chief signal officer of the United States Army.

Altogether the ball was a great success, financially as well as artistically, the net proceeds to be devoted to charity being about $22,000.

Cable-boring Insect Reported in Chicago.

Insects that bore into lead-covered cables have been reported from Australia and perhaps other places, but their ravages have hitherto been practically unknown in this country. But the Chicago fire underwriters seem to think that they may have to reckon with such a pest in the future. The insect in question was discovered at one of the "bone houses" of the Union Stock Yards, Chicago. Some time ago failures to receive signals from the watch boxes began to occur and then to grow more frequent, until it was decided to rewire the building. Upon tearing out the lead-covered cable in the basement the trouble was found. An insect—known in the yards as the "bone bug"—had eaten through the lead covering, through the rubber insulation, and laid bare the copper wires. The incident was referred to the Underwriters' Laboratories and specimens of the insect were sent to the biological department of the University of Chicago, but no official report on the new hazard has yet been made public.

Recent Investigations of Lightning Protective Apparatus.

At the meeting of the American Institute of Electrical Engineers in New York on December 28th R. P. Jackson presented a paper on "Recent Investigation of Lightning Protective Apparatus."

In the paper Mr. Jackson called attention to the fact that, owing to the peculiar nature of lightning and similar disturbances, opinions differ concerning their action and concerning the usefulness of the various devices used for protection against them.

The following analogy, while not new, is especially well fitted to represent the static elements of an electric circuit:

An elastic fluid, like a heavy gas, having inertia and capable of various states of pressure and motion without changing its characteristics, is en-

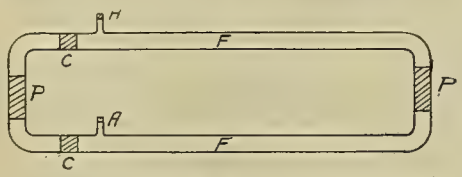

FIG. 1. ANALOGY BETWEEN FLUID IN PIPES AND ELECTRIC TRANSMISSION SYSTEM

closed in a pipe provided with pistons, as shown in Fig. 1. One of the pistons (P) may receive power and the other deliver it. If one of the pistons is moved back and forth the fluid in the pipes is compressed and expanded in turn, while the other piston moves a little later in phase and may do work. The amplitude of the motion determines the flow of fluid.

Considering one piston as representing a generator and the other a translating device, such as a transformer, the ability of the fluid to be compressed and expanded would be represented as corresponding to the electrostatic capacity of the line, while the inductance and resistance would be represented by the inertia and frictional resistance of the fluid. Smaller pistons (C) (C) having considerable inertia but free movement in the pipe, may represent choke coils. Small plugged vents (A) (A) are the equivalent of the lightning arresters. The resistance to the flow of fluid through them after the plugs have been ejected corresponds to the series resistance of the arrester, while the security with which the plugs are held represents the length of the spark gap.

The size of the vent necessary to limit the pressure at a given point to any value is dependent upon the rapidity with which fluid at any objectional higher pressure can reach the vicinity of the vent. The result of numerous experiments indicates that a true conception of the effect of lightning and other static phenomena on transformers and generators is only to be had by considering them as analogous to cases of impact of surges in an elastic fluid.

If an explosion occurs in the pipe, causing an immensely increased pressure of the fluid for some length of the pipe, it will expand in each direction, if retained by the pipe, with a rapidity controlled by the inertia and elasticity of the fluid. If the wave strikes a piston of great inertia an additional rise in pressure and a reflection of the wave will occur. If it is desired to keep the pipe from bursting near the piston, or if the pipe is necessarily made weaker at that point, there are two devices which may serve to relieve the stress at that point.

In Fig. 1 a loose piston (C) (C) or choke coil will reflect part of the wave before it reaches the main power piston and relieve the strain on the pipe at that point. Also, a suitable vent (A) (A) or arrester will permit the escape of sufficient fluid to limit the rise in pressure.

Fig. 2 serves to show how the impact of the wave strikes the piston or transformer when it is unprotected. It may be noted that there is a large difference of potential between the lead and a point a short distance in on the winding. This is the cause of the breaking of insulation between turns of transformers and generators, one of the commonest manifestations of lightning trouble.

As indicated in Fig. 3, there is for an instant a large difference of potential between the terminals of the choke coil, and a moment later a condition similar to that in Fig. 3 occurs in the transformer, but to a less degree. The amount of inductance in the choke coil determines the amount of impact taken up by the coil and the corresponding relief to the transformer.

It would appear that in an unprotected transformer the first turns take the greater part of the strain, and they also act as a choke coil to the rest of the transformer.

Coils of low inductance are of little value as

FIG. 2. PRESSURE SURGE MEETING PISTON OR TRANSLATING DEVICE.

protection, while investigation indicates that with coils of greater induction than 0.06 henry the protection increases very little with the increase of inductance of the coil. The useful range of values from the point of view of protection is indicated at from 0.002 to 0.025 henry.

From the investigation it appears impossible to obtain much choke-coil protection for 60-cycle circuits of low voltage and power factor and large currents on account of the prohibitive drop.

The Lightning Arrester.

In Fig. 1 the lightning arrester is of the nature of a relief valve. In an electrical transmission line if a potential wave of irregular contour and, say, of 100,000 volts approaches the transformer, and, if the resistance in series with the arrester were correct, the arrester would allow the surge to escape without reflection. The calculation of this series resistance placed it at 400 ohms in the present case, taking the electrostatic capacity of the conductor to ground as 0.0135 microfarad per mile.

If a resistance greater than the critical value is used in series with the arrester, there will be a partial rise and reflection and a partial escape.

From these considerations it would seem that the resistance of an arrester should be low, and not greater than 400 ohms in any case.

Mr. Jackson finds that no arrester with a reasonable gap will disrupt its dynamic arc if the circuit is carrying power from generators of large capacity unless the power current is limited in some way, so, by using multigaps of non-arcing metal of such number that a rise of 300 per cent. will just break over, and adding an equal number of gaps shunted by resistance, an arrester may be made, which, on moderate power, will disrupt its arc without the use of series resistance.

Comparison of Arc-suppressing Devices.

The two devices most generally used for disrupting the arc in an arrester are the horn-type gap and the non-arcing metal multigap. Either

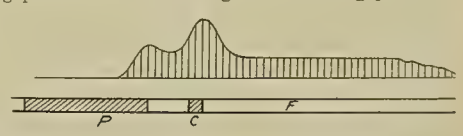

FIG. 3. EFFECT OF CHOKE COIL UPON PRESSURE SURGE.

device should work without series resistance on circuits where the power is so limited that the short-circuit current is not more than 50 amperes.

Where the power is large, the non-arcing metal is superior to the horn-type, because the arc is more easily and more quickly suppressed. On the other hand, the horn-type arrester may be placed out of doors, while the multigap should be under cover.

An arrester of the multigap type that would

break over at 75,000 volts when located away from walls or the ground would, when placed near the ground, break over at 40,000 volts. The ability to disrupt the arc apparently falls in about the same proportion.

Mr. Jackson's tests of materials to determine their suitability for use with lightning arresters indicated that when electrolytic and metallic resistances are placed in parallel the equivalent spark gap is halved, while with carbon, carborundum and graphite, the equivalent of a stick or bar seems to be a function of the length, and several bars in parallel will give an equivalent gap practically the same as a single bar.

THE GAP AND FUSE ARRESTER.

An open wire fuse will almost invariably take so long to suppress its arc that it is likely to open the circuit-breakers, while the same wire, enclosed in a tube, will open its arc in one or two alternations. Experience shows that several gaps and fuses may be placed in parallel, and usually only one fuse will blow at a time.

THE ELECTROLYTIC ARRESTER.

What is really needed is a device having the characteristics of a safety valve. Such a device has been found in the aluminum electrolytic cell.

In certain electrolytes, aluminum forms an extremely thin non-conducting film on its surface that will withstand a voltage of 380 to 400. Above this voltage the film will be punctured with many small holes and a large current may pass, but when the pressure is reduced the film forms again and reseals the device. It is a simple matter to make a unit of this kind which will have an equivalent gap representing any required voltage.

Apparently this cell can be connected in series with a suitable gap between each line and the ground and will suppress all abnormal rises of potential at that point.

In general, it may be said that the electrical characteristics of the device are ideal for the purpose, but certain mechanical difficulties will have to be overcome to make it suitable for commercial use.

DISCUSSION.

The discussion was opened by Ralph D. Mershon, New York, who said that the phenomena resulting from lightning discharges occur at such irregular intervals and are apparently so erratic that no satisfactory searching study has been made of them. Mr. Mershon did not agree with the author in regard to choke coils. A choke coil, if of any considerable size, is awkward and expensive and would add to the complication of the station wiring. If necessary, they could be placed in the same case as the transformers, but it would be better still to do away with them altogether and put such extra insulation as is needed on the end turns of the transformers. While this would be more expensive, it would be of little, if any, greater expense than separate choke coils, and the space they take up.

Mr. Mershon expressed his interest in the electrolytic condenser, but thought that some difficulties would have to be met with in practice, such as the freezing of the electrolyte and sudden formation of vapor in case of a lightning discharge of extreme severity.

C. P. Steinmetz expressed his interest in the paper and said that it is obvious that a reactive choke coil cannot be considered as a perfect protection because the charge of the total system rises above that of the ground. He did not agree with Mr. Jackson's figures as to the value of minimum effective reactance, because, in his opinion, they are merely incidents to the particular conditions of the experiment from which they are derived.

To insulate the end coils of a transformer against full voltage is not always desirable, and in the opinion of Dr. Steinmetz an additional reactance is desirable.

In discussing the series resistance, for the protection and safety of the arrester, the higher the resistance the better, and this is a view taken by the designer of the arrester. From the point of view of the operator of the transmission system any series resistance may be objectionable. In case switches fail or a short-circuit takes place, the current cannot instantly leave the system and backs up the voltage, and the system will not be appreciably relieved by the discharge through, say, 400 ohms of resistance.

A number of spark gaps set for different voltages giving the current a choice either to jump only at the last spark gap or the next one, etc., is good.

Percy H. Thomas of New York said that he thought a little more explanation of the method by which a choke coil protects the transformer is needed. The concentration of potential on the outer turns results from the electrostatic capacity within the winding of the transformer. Mr. Thomas proposed for protection of the transmission line that a resistance lightning arrester be placed at the station, near the apparatus. At a point some distance away, place a number of enclosed fuses with spark gaps to ground. The gaps of the latter fuses are adjusted considerably higher than the gap at the station. Thus, the station will be protected against weak disturbances and occasionally high disturbances.

Prof. F. E. F. Creighton, of Union University, Schenectady, N. Y., spoke of experiments which indicate that, in the matter of equivalent needle gaps, the same laws apply to measure voltage with the needle gap as those which apply to meters. In speaking of electrolytic cells, with which Professor Creighton has worked for several years, he said that considerable experimental data have been collected concerning their operation, which will be presented at a later meeting. In practice the cell has been installed with its critical potential about 25 per cent. above normal. The current will discharge through this cell without increasing the potential to a dangerous value, if constructed correctly.

In regard to the screening of a multi-gap arrester, it was found that without the screen the spark potential of a certain multigap arrester having 190 one-thirty-second-inch gaps in series on a 60-cycle circuit was 68 kilovolts. With a screen the spark potential was 60.4 kilovolts. With one terminal permanently grounded the spark potential was 47.5 kilovolts without the screen. With a screen the spark potential was 53.9 kilovolts. With one terminal arcing to the ground and no screen the spark potential was between 34 and 36 kilovolts. Under the same conditions with a screen the spark potential was between 40 and 43 kilovolts. It will be seen from this that the tendency of the screen is to make the spark potential more uniform for all conditions. But the screen does not entirely accomplish the result.

H. B. Alverson of Buffalo, N. Y., speaking of results obtained with lightning arresters in stations having 700 to 1,200-kilowatt circuits, with station capacity of 3,000 to 6,000 kilowatts, said that arresters without series resistance were of no value. His experience extended over several years, and the stations are now equipped with choke coils and low-equivalent lightning arresters. With this outfit no interruption to service has occurred.

P. M. Lincoln of Pittsburg said that in designing apparatus there are two things to protect. One is the apparatus and the other, the service. A simple spark gap is the most perfect protection to the apparatus, but it interrupts the service. Most operating engineers will take some risks with apparatus to protect the service.

J. F. Vaughan of Boston, Mass., in a communication, called attention to the method used in protecting the 50,000-volt Taylors Falls transmission line in Minnesota. In addition to a number of other devices it was protected, last summer, from direct lightning stroke, by poles at the side of the line carrying rods 25 feet above the upper transmission wire. It is interesting to note that, while six transmission lines in different parts of the line were splintered the previous summer, before the rods were put up, last summer several lightning-rod poles showed punctured tell-tale papers inserted in their ground connections.

In this lamp the mechanism, inner globe and all supports and wires are completely enclosed in a glass housing. The lamp is placed near a park, and is well adapted for this use, as it is sufficiently near the ground to go under the branches of trees.

FIRST COMPLETELY ENCLOSED ARC LAMP.

The Washington (D. C.) Railway and Electric Company and its allied companies have established a new pension system, which went into effect January 1st. Employes who have attained the age of 70 years, those who have worked continuously for 20 years or more in the service of the company and those who become physically disqualified by reason of injuries received in the line of duty, will be benefited. The railway company has appropriated the sum of $5,000 annually.

Street Illumination by Arc Lamps.

By W. E. DANIELS.

Since the development of the electric arc lamp and its use for street and park illumination pronounced improvements have been made in the lamp itself, but not much in the method of supporting or hanging the lamp, beyond a few details of insulators or appurtenances. Arc lamps are still being hung in the same unsightly and expensive manner of the earlier days.

It remained for the South Park commissioners of Chicago to make important and radical changes in this direction. Realizing that an arc lamp and its carrying devices might be made ornamental, or at least fairly so, and perform its useful functions at night without being unsightly in the daytime, their engineers were instructed to make an experimental investigation of the subject. An added impulse was given to the movement by the Municipal Art League of Chicago and the American Civic Association, both of which worthy bodies have been working along the same lines for some time past. But the South Park commissioners have been the first ones of whom I have any knowledge to get a satisfactory design out of the drafting room and erected in place ready for the test of its practicability.

PRESENT TYPE OF THE COMPLETELY ENCLOSED ARC LAMP WITHOUT BAND ON GLOBE.

The lamp itself (spoken of as the "completely enclosed lamp") is illustrated herewith. It is of a special construction, working on the well-known differential principle, using a current of 7½ amperes and 72 volts at the arc, burning in series on a constant alternating current. The entire mechanism and wires are concealed within a 20-inch plain, flint, opalescent glass ball, supported by the lamp-post capital. The post in this instance is one designed for another purpose, and shows the general scheme to rather poor advantage, as it was only intended for testing purposes.

In the test about completed seven lamps were used in a block of 400 feet, and a very satisfactory distribution of light was found, all of the mechanism being concealed within the translucent glass. Shadows, light waves, dark spots and other usual annoying features were conspicuous by their absence. The area of useful light was found to be

equal to the regularly constructed lamps, and the character of light decidedly better.

The number of lamps for each block, of course, depends upon the character of the space to be lighted and the desire to have it well lighted or otherwise.

Luminometer type No. 6 is considered to be a fair standard for street lighting, but since the advent of the swiftly moving gasoline juggernaut more light is needed, and it is the writer's opinion

Operative Turns Out a Greater Number of Yards per Day than Formerly, and this is a Great Factor.

LUMINOMETER TYPE NO. 6.

Earnings of people in Olneyville alone show a sum of more than $5,000 a week, which in turn will pass in the course of trade through the business channels of this community. The announcement produced rejoicing, although there was no great outward show of feeling.

LUMINOMETER TYPE NO. 8.

that, for streets that are subjected to crowded and rapid traffic, luminometer type No. 8 should be the standard, meaning that this size type should be read readily, when held in the hand, at any point on the drive.

In these days of rapid automobile travel the subject of boulevard lighting is worthy of much study and attention.

Referring to the lamp just described, I am of the opinion that, when the width of drive will permit, the lamp posts should be placed in the center of the drive, for the following reasons:

First—To keep the traffic on the right-hand side

This illustration gives an opportunity of comparing the new style of support with the older overhanging type.

A ROW OF THE NEW COMPLETELY ENCLOSED ARC LAMPS ON MICHIGAN AVENUE.

of the street, and particularly so at street intersections, where most of the accidents occur.

Second—To get the light where it is needed, as lamps set at the curb line give one-half their useful light to adjacent property.

Third—Lamps placed at one side of the street only—of which there are many examples in the city—give the property owners on one side of the street a decided advantage over the householders on the opposite side.

Fourth—Construction cost, in reference to the underground system, amounts to little more than one-half the cost of curb installation, there being only one conduit to run in the center system in place of two in the side system.

Fifth—In streets having two street-railway tracks the space between tracks is not available for traffic, and lamps placed in this space would help keep all traffic on the right side of the street.

Before the development of the "completely enclosed" lamp the center system was out of the question, on account of the shadows cast by the pole, lamp, side arms, globe holder, etc.

The lighting of streets by small units of light has been tried in many ways, notably by the incandescent-cluster method, which was found to be more decorative than useful.

When we consider that an incandescent lamp uses 3½ watts per candlepower, and the arc lamp gives 3½ candlepower per watt, there can be no doubt of the current cost per candlepower obtained, and it, therefore, seems to be about 12 to one in favor of the arc lamp, letting the trimming ex-

ANOTHER VIEW OF COMPLETELY ENCLOSED ARC LAMPS ON MICHIGAN AVENUE.

penses on the arc lamp offset the lamp renewals and globe cleaning of the incandescent lamp. The construction cost for a post carrying incandescent lights will be approximately $100 for each post, while the arc lamp and poles can be installed at one-half of this sum.

The height of an arc lamp above the street depends, of course, on the distance apart they are placed, also the height to which trees can be trimmed.

The lamp just described gave the best results as to illumination at a height of 12 to 14 feet from ground to center of globe.

Freight and Express Business on Electric Railways.

That the Illinois Traction Company will not confine its business to passenger travel is shown by the project to have several grain cars built to haul corn. These cars are to be provided with a corn sheller, and the power to operate the sheller is to be taken from the trolley wire. At Decatur there is to be an elevator for the express purpose of caring for the corn that comes to the city over the road. The company is now hauling coal; in fact, the bulk of the coal that goes into Champaign is hauled by its cars.

It is said that the old express companies operating on steam railroads are thinking of bidding for the express privileges on the electric railways in Indiana and Ohio. The interurbans have been doing an express business in connection with their passenger service, but this has never been developed to any great extent because of the fact that the roads were limited in their equipment. The service proved attractive, however. Merchants in small towns have found it a quick means of getting merchandise from jobbers and wholesale dealers. Fruit, ice cream and perishable foodstuffs

AN OLD-STYLE INARTISTIC LAMP SUSPENSION NOW IN USE ON A MUNICIPAL BUILDING IN CHICAGO.

were easily obtained without delay, as the passenger cars traverse the lines every hour.

The report says that should the express companies lease the privileges on the traction lines additional equipment will be placed in service. Delivery will be established in all the larger towns and cities.

A New "Pit's Mouth" Power Project in Pennsylvania.

From Hazleton, Pa., comes a report that a charter has been applied for a corporation which will manufacture electricity and furnish it for the purposes of light, heat and power in several counties in Pennsylvania.

It is said that behind the scheme is an experiment which although often suggested has never been attempted on a large scale, and which, if successful, would, in a measure, tend to revolutionize the sale and transmission of electricity to points within 100 miles of the coal mines.

The coal operators have taken up the idea of manufacturing electricity at the mines where fuel is cheap and then marketing it to all the country for miles around. A large power plant is being erected at Harwood, and lines of wire will reach from the mines to Reading, Allentown, Sunbury, Mauch Chunk, Pottsville, Shamokin, Bloomsburg and all the towns and hamlets where electricity can be used.

It is proposed to use the vast banks of culm and rice coal that have accumulated during the last 50 years.

It is also said that the projectors propose eventually to transmit their product to Philadelphia and New York and that the operators declare that they will be at much less expense for plant than the great electrical concerns now building on the Susquehanna River near York. If the latter can supply Philadelphia and furnish power to run its street cars, then the coal operators declare that they will be bidders against them for the same purpose.

Good Electric-railway Year in Indiana.

Referring more particularly to the state of Indiana, the year 1906 will, when records are compared, rank in electric-railway history as a year of unprecedented large traffic, and in spite of the large increase in expenditure for material and labor, has been gratifying in its results, there being a notable lack of failures and receiverships. All of the Indiana traction roads earned expenses and interest on their bonds and will be able to pass a considerable sum to the dividend and reserve accounts. According to figures compiled by the Indiana state statistician, there were 14,000,000 more passengers carried on the Indiana electric roads than were carried the year previous, which tends to show the increased popularity with which they are regarded by the traveling public. There were 284 miles of new track constructed, which brought the total mileage up to 1,002 miles, over which 127,616,952 passengers were carried. Indiana electric roads earned over $2,000,000 more than during the previous year and employed 4,095 men, who, during the year 1906, were paid in wages a total aggregate of $2,524,475.08.

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FUNDAMENTALS are important and always important. It is the fundamental, underlying principles of the art which will be treated in the serial on "Elements of Electrical Engineering," by Mr. George K. Metcalfe, which will be begun in the Western Electrician of February 2, 1907, and run through thirty issues or more. The author is a technical writer of wide experience, and in his series of "practical talks" he purposes to "discuss and explain in as simple language as possible some of the important features of electrical engineering practice, together with descriptions of the construction and design of the machinery and instruments in common use." All beginners, all practical men seeking help, all engineers who want to "brush up" will find this series of real assistance. It will be begun in the issue dated February 2d.

As A PART of this issue of the Western Electrician the Index of Volume XXXIX. (comprising the 26 numbers that appeared in the latter half of 1906) is issued to all subscribers. This Index has been prepared with much care, and its size and the diversified nature of its contents indicate the multiplicity of topics now connected with the science of electricity and the arts of electrical application.

THE AMERICAN Association for the Advancement of Science has made a commendable choice in electing as its president Dr. Edward L. Nichols, professor of physics at Cornell University. Professor Nichols takes high rank among the physicists of the United States, and is a man who possesses the true scientific spirit. In electricity his work has been particularly valuable and has covered a wide range; and it was no meaningless honor when he was chosen chairman of Section A (Mathematical and Experimental) of the International Electrical Congress of St. Louis of 1904. Electrical men will be disposed to congratulate both the association and Professor Nichols on this selection.

THAT great improvement can be made in the methods of lighting streets and open spaces, particularly boulevards and parks, by arc lamps, is shown by the interesting article in this issue, by Mr. W. E. Daniels, on "Street Illumination by Arc Lamps." The combination of lamp and support which Mr. Daniels illustrates and describes is strikingly graceful and attractive, and as "a thing of beauty" is certainly a great advance on older methods of support. The lamp itself is of the ordinary series, alternating enclosed-arc type, we believe, but the whole mechanism, including inner globe, carbons, and all supports and wires, is enclosed in an opalescent glass ball or housing, which rests directly on the capital of the slender fluted iron post which supports it. The light is much nearer the ground than has hitherto been the general practice, the best results as to illumination being attained at a distance of from 12 to 14 feet from ground to center of globe.

No exact details of efficiency of the new street arc lamp, as compared with older types, are given in Mr. Daniels' article, the tests in actual service not being completed at the time of writing. However, with the higher efficiency lighting units which the electrical engineer has now at his disposal, this aspect of the subject does not assume an importance formerly accorded to it. And it is likely, moreover, that the loss of efficiency, if any, will not be sufficient to offset the undoubted advantages which the new arrangement seems to possess.

The interesting recommendation is made by the author that in using lamps of this construction for boulevard lighting they be placed in the center of the drive, or between the drives where there are two, rather than at the curb, as is now almost universally the case. Obviously this plan is only adapted to wide streets, mainly or wholly devoted to pleasure travel; but in such cases Mr. Daniels gives several plausible reasons (one being decreased cost of construction) why it may well be adopted. It is difficult to see why the center arrangement would not be an excellent one. But perhaps there may be objection both to this plan and to the form of lamp, and we are sure that the author will welcome intelligent criticism.

REVIEWING the progress of electricity on steam railroads in 1906, in his presidential address before the Western Society of Engineers on January 8th, Mr. Bion J. Arnold gave a valuable resumé of one of the most interesting, important and active of all the departments of applied electricity. Although available time and space will not permit in this number, we hope to be able to print this instructive address practically in full next week. In the meantime, however, we cannot refrain from quoting the concluding paragraphs:

"From what has been said it can be seen that rapid progress is being made in the application of electricity to steam railroads. Some installations have been made on account of the economy in operation to be effected, and the increased earning capacity to be gained, while others have been made under public pressure.

"With the completion of the work now under construction by the New York Central and the New York, New Haven and Hartford Railroad companies, the steam locomotive will disappear forever from the Island of Manhattan and its surrounding territory.

"From an examination of the map of the business district of Chicago, bounded by Sixteenth Street, Halsted Street, Chicago Avenue and Lake Michigan, it will be seen that 23 per cent. of this area is occupied by the tracks of steam-railroad companies. In view of the present state of the art of electric railroading, the right to vitiate the air of our congested districts by the emission of large quantities of carbonic dioxide from the stacks of numerous locomotives is as questionable as the right to foul the air by the stenches from our stock yards. As there is now a possibility of the removal of these yards, is it unreasonable to hope that all of the steam-railroad companies, through the wise foresight of their officers, may help to purify and beautify the city by assisting the general movement now under way by our progressive, civic bodies for this purpose? In my judgment, at least one, and probably three, of the companies now operating in the city of Chicago would profit by the electrical operations of suburban trains."

Mr. Arnold knows what he is talking about, and he is a man who weighs his words carefully. His vigorous language is amply justified by the nuisance caused by steam locomotives in Chicago. This is a nuisance that can be abated, and which ought to be abated at once so far as the suburban passenger trains are concerned. If the railroad companies do not voluntarily make this greatly needed improvement, it is almost certain that they will be compelled to do so.

THERE was a debate of several hours' duration in the British House of Commons on December 18th on the subject of the ratification of the convention adopted by the Berlin International Wireless Conference of last October. It appears that only moderate interest was taken in the subject, judging from the attendance. No facts of technical interest were brought out, but the discussion was significant, as it elicited the declaration from the government that a select committee would be appointed to inquire into the proposals contained in the convention before it was ratified.

The debate was opened by Sir E. Sassoon, who submitted a resolution representing that, in view of the experimental and undeveloped condition of radio-telegraphy, any engagements relating thereto which hampered the state's complete freedom of action should be regarded with suspicion, and that a select committee should be appointed to inquire into the proposals contained in the convention before it was ratified. Declaring that Great Britain possessed the best existing system of wireless telegraphy, the speaker contended that it ought not, in an outburst of altruistic benevolence, to deprive itself of the unquestionable initial advantages which it enjoyed.

Major Seely of Liverpool, dealing with the stragetical aspect of the question, held that the country ought not rashly to commit itself to the convention, for in war it probably should have to depend upon wireless telegraphy for communication with its fleets. Englishmen might bitterly regret agreeing to the setting up of other stations alongside their own. The House did not understand radio-telegraphy, nor yet did Mr. Marconi; and who could say where the country might be driven by the decision of the conference? As a plain man he had a great dread of experts assembled upon matters affecting the very life of the nation.

Replying for the government, Mr. Buxton at the outset disarmed the critics of the course which the government had taken by announcing that the demand for a select committee would be granted. The subject, of course, was intricate and bristling with details, and members might be aided to arrive at a just judgment by the evidence of experts. At an early period of next session, therefore, a committee would be appointed. The inquiry would cause no inconvenience, he said, as the ratification of the convention need not take place for a considerable time.

While it is true that the convention may be ratified by the other countries without the co-operation of Great Britain, yet the international concert in "wireless" will be seriously impaired by the withdrawal of the leading maritime nation. In view of this delay, it will be interesting to observe what action will be taken by Congress in the premises.

WHAT TO SEE AT THE ELECTRICAL SHOW

There will be more to see at the Chicago Electrical Show, beginning next Monday night, than there was at the last year's show, and the exhibition of last year was a notably successful one, both from the viewpoint of the exhibitor and of the visitor. Electrical concerns from all over the country will be present, representing the various branches of the industry, and there will be several exhibits of foreign electrical products.

Under the able management of Mr. Homer E. Niesz, as managing director of the Electrical Trades Exposition Company, there has been sold for the coming show 30,000 square feet of space, 25 per cent. more than at last year's show. The exhibitors have made elaborate arrangements in the preparation of their booths and displays, and in many of the booths there will be interesting and instructive demonstrations. Besides these, the Exposition company has arranged for special features every day.

HOMER E. NIESZ.

The Coliseum is to be elaborately decorated in purple and gold, Ellery's Band will furnish the musical programmes every afternoon and evening, and scores of interesting things have been prepared to offset in a measure the "trade" aspect of the show. The show will be opened on Monday night, January 14th, and will run from 10 a. m. to 11 p. m. every day, but Sunday, until January 26th. The opening will be a formal affair, largely by invitation.

Throughout the two weeks there will be special days and a number of conventions and meetings. On Wednesday, January 16th, the Northwestern Electrical Association will open its annual meeting, continuing Thursday and Friday. Thursday, January 17th, will be the anniversary of the birth of Benjamin Franklin, and in honor of this event handsome souvenirs will be distributed. Wednesday night, January 16th, the Sons of Jove will have a rejuvenation, and many officers and members of the order from various parts of the country will assist in the initiation of a large number of candidates. Thursday evening, January 17th, the Illuminating Engineering Society is scheduled to meet. Monday, January 21st, has been designated as "telephone" day, when appropriate souvenirs will again be distributed. Wednesday, January 23d, is another souvenir event, Thomas A. Edison day. The American Electrical Salesmen's Association will meet Thursday, January 24th.

Prof. W. J. Clarke of Mt. Vernon, N. Y., who entertained the people at the electrical show a year ago with his demonstrations, has been engaged for this year. Professor Clarke has many new things to show, including highly perfected moving pictures. He will also demonstrate electrical welding, wireless telephony, the loud-speaking telephone, the talking arc lamp, the X-ray and Tesla's high-frequency experiments. All of Professor Clarke's demonstrations will be accompanied with a descriptive talk. These lectures and demonstrations will be free.

Plenty of amusement will be afforded by the Electrical Midway, a new feature of the show, installed in the Coliseum Annex. Mr. Niesz has contracted for the production of "The Shipwreck," an electrical attraction created by the Aetna Electric Stage Lighting Company of Chicago; it has never been seen on any stage. Another new creation along the same lines will be the "Aurora Borealis," the work of Edgar Healy, the well-known scenic artist and inventor, for which arrangements have already been made. The "Midway" will have Ralph Radnor Earle's electric shadowgraphs, which made a big hit at the "Streets of Paris," for which society women in Chicago posed. There will be every detail that will add to the fun and entertainment.

Special interest is being taken in the proposed long-distance test of Dr. Cahill's telharmonium, of which considerable has been printed in the Western Electrician. The greatest distance that music has been transmitted by this instrument has been about 100 miles. Consequently the effort to transmit it from New York to Chicago will be watched with no little interest. The music will be furnished from the instruments of the New York Electric Music Company over the wires of the American Telephone and Telegraph Company, through the exchange of the Chicago Telephone Company, and into the Coliseum. Both the Chicago Telephone Company and the American Telephone and Telegraph Company will have interesting exhibits.

The central feature of the Coliseum this year is to be an illuminated statue of "Electra" mounted on a massive and handsomely designed base. The huge revolving star which attracted so much attention on the balcony at the south end of the building last year will be replaced by a flashing figure of Jupiter, which from time to time will become a dancing skeleton. This exhibit will be made by the Reynolds Dull Flasher Company.

The Coliseum company will have completed a new buffet and restaurant in the basement of the building, the seating capacity of which will be greater than that of the room used in the Annex a year ago. The Hofbrau people will handle the concession, and the meals will be served from an electric kitchen.

The poster for the show is from the brush of C. H. Henrich, a local artist. The poster shows the goddess "Electra" guiding the shaft of lightning from the storm clouds into the sea. The idea is worked out in six colors and gold. A black-and-white reproduction is shown herewith.

Charles R. Macloon is the capable press representative of the Chicago electrical show.

The technical press will be well represented as follows: American Telephone Journal, Electrical Review, Electrical World, Electrocraft Publishing Company, Engineer Publishing Company, Engineering World, Public Service (anti-municipal-ownership journal), Telephony Publishing Company, Western Electrician. The Western Electrician will occupy space in Section F 24. An invitation is extended to visitors, who will be welcomed at the booth by representatives of the paper. Copies of the Western Electrician will be available, as well as other good electrical literature.

A diagram of the main-floor plan of the Coliseum is given on page 41. Underneath is a list of the exhibitors, with the location of their exhibits designated. Reference to these will make it easy for the visitor to locate any exhibit he may wish to find.

The different interesting things which will be exhibited at the show will number into the thousands, and it would be useless to attempt to describe them here. Following, however, will be found a brief outline of some of the exhibits which the Western Electrician has been able to secure in advance.

Aetna Electric Stage Lighting Company, Chicago.—This company will display stage-lighting appliances and effects, spot lamps, olivette lamps, sciopticans, border lights, strip lights and electric effects; also moving clouds, cyclone, snowstorm, rain, cyclorama, and the effects that are used in theatrical productions will be shown. In the Electrical Midway will be presented an entirely new production to be known as "The Shipwreck." This show is a companion show to "The Kansas Cyclone" operated at Riverview Park, Chicago, last season.

Allis-Chalmers Company, Milwaukee.—The machinery exhibit will consist of a new 75-horsepower self-contained type AB alternating-current generator, a 10-horsepower induction motor-generator set, a 15-horsepower high-speed engine-generating unit, a line of new type K motors for direct current 1½ to 20 horsepower, and six induction motors one to 20-horsepower capacity. With the latter, for all sizes above five horsepower inclusive, potential starters will be exhibited. A small model will show both the movable and stationary rings of blading of a 500-kilowatt Allis-Chalmers steam turbine. Catalogues, bulletins and advertising matter will be displayed, also illustrations and photographs showing electrical apparatus, steam engines, gas engines, hydraulic turbines, steam turbines, sawmill machinery, pumping machinery, flour-mill machinery, mining and milling machinery, crushing and cement-making machinery, power-transmission machinery, timber-preserving machinery, etc. Room is provided to receive and seat visitors, and the booth will be furnished in "mission" style, with a large electric sign bearing the company's name suspended over it. The exhibit will be in charge of C. A. Tupper and S. R. Kerr, assisted by J. W. Gardner, manager of the Chicago district office of Allis-Chalmers Company, and a number of the salesmen, including C. H. Melvey, C. S. Buell, Ervin Dryer, F. L. Webster, J. M. Denniston, E. R. Jacobs, D. K. Chadbourne, H. I. Keen, J. C. Buckbee, A. W. Catlin, L. St. J. Smith, P. C. Van Zandt, George Voigt and C. H. Howe.

American Clock Company, Chicago.—Automatic self-winding electric wall and mantel clocks and other lines of ornamental and street clocks will be shown. A demonstration of a dozen or 15 clocks equipped with the company's secondary movement and operated by a master clock will be given. This system is used in large buildings where numerous clocks are necessary. The practicability of synchronizing clocks over telephone wires by the American Clock Company's patented system will be demonstrated. Another feature will be the electric time stamp, which dates to the minute any papers that may require such action; also a system for recording the time of employes. The company will show its electric insurance-vending machine. By dropping a 25-cent piece in the slot one gets an accident insurance policy that is said to be as good as any policy that can be written by any insurance company.

American Electrical Novelty and Manufacturing Company, Chicago.—The following lines will be exhibited: "Ever Ready" dry batteries, voltmeters and ammeters, Bulldog battery connec-

POSTER FOR THE 1907 ELECTRICAL SHOW.

ors, flash lights, portable electric novelties, electric clocks, and a complete line of miniature and candelabra novelty and decorative incandescent lamps.

American Steel and Wire Company, Chicago.—A fine display of different forms of rail bonds—the "Crown" and the "United States" bonds—will be made. There will also be a complete outfit of high-grade tools for installing rail bonds, the wide variety of which will be interesting. An extensive exhibit of the company's W. & M. telephone wire will be made, consisting of a telephone line erected over the exhibit, with arms carrying 25 wires, all converging in a grand tower built of wire. There will also be exhibited the different kinds of electrical wires and cables which the company makes, together with its fence for enclosing rights-of-way of electric railway, and also its new concrete reinforcement for building power houses and electrical stations and subways and all construction for which concrete is employed and which needs steel reinforcing.

Antiseptic Company, Chicago.—On exhibition will be a device designed to remove the liability of contracting disease through the telephone transmitter. It is a mouthpiece readily attached to the telephone and said to protect the user from contagion.

Armour Institute of Technology, Chicago.—It is intended to show to the student of electrical engineering the possibilities afforded by the Institute for acquiring a thorough knowledge of the theory and practice of the profession of an electrical engineer. There will be a number of experiments in operation illustrating some of the more intricate and interesting phenomena, such as electromagnetic induction, rotating magnetic fields, etc. The oscillograph will again be on exhibition, by means of which one will be able to study, visually, alternating-current and electromotive-force wave forms as well as their phase relation to one another under various conditions of actual operation. The instrument itself will be explained to those desiring it. There will also be on exhibition a fine display of the latest types of electrical instruments chosen from the laboratory stock in everyday use. Many of these cannot be found elsewhere in this part of the country. There will

be samples of student work in power-plant design and also in the various electrical laboratories.

Automatic Electric Company, Chicago.—A working "cross-section" of a 100,000-line automatic telephone system, such as is planned for installing in Chicago for the Independent Telephone Company of Chicago, under the franchise rights of the Illinois Tunnel Company, will be exhibited. The exhibit consists of two of the Automatic Electric Company's new "Keith units" of 100 switches each, connected by a trunking section and representing a portion of each of two branch exchanges, "A" and "F." There will be 12 telephones connected up, six on each section. Novel and attractive souvenirs will be distributed and the exhibit will be demonstrated at frequent intervals by the company's representatives. The exchange exhibit will be separated from the rest of the booth. The exhibit will be in charge of H. H. Woodworth, advertising manager, together with C. L. Fisher, sales manager; J. A. Russell, R. B. Tyler, J. E. Fisher and P. J. Eubanks of the sales department, and F. Lubberger and J. S. Engh of the engineering department.

Brilliant Electric Company, Cleveland.—On exhibition for the first time will be the Brilliant 44-watt lamp. This lamp is guaranteed to give illumination equal to the ordinary 56-watt lamp, taking but 44 watts. The new tantalum lamp will be exhibited, also the tungsten lamp, the Brilliant Gem, the Brilliant Tantalum, standard tipped and tipless, Brilliant special lamps, and a complete line of miniature lamps.

Central Electric Company, Chicago.—Around this booth will run a railing made of 2½-inch loricated conduit, the Central Electric Company being sales agent for this conduit. In one corner will stand a column consisting of reels of Okonite wire, on a side of which appears the Okonite "rubber biscuit," which was one of the features of last year's show, showing rubber in its natural state, and from which the famous Okonite insulation is made. On the other side of this column will be shown a piece of Okonite submarine cable which attracted so much attention last year, this piece of cable having been twisted in the screw of an ocean tug in New York harbor, without any damage whatsoever to the insulation. In the center of the booth there will be a large column around which will be displayed Columbia lamps, D. & W. enclosed fuses and safety devices, Deltabeston magnet wire, Knowles high-tension insulators, Edison primary batteries, Bristol recording instruments, as well as many other specialties. A complete line of Columbia lamps will be shown, this exhibit including a live display of Columbia tantalums and Columbia gems. The new types of D. & W. fuses will be shown, in addition to those which were exhibited last year; also a number of coils of Deltabeston magnet wire, showing the various stages through which the coil passes before it is finished. One of the instructive features of this display will be the breakdown test of Deltabeston magnet wire.

Chicago Edison Company and Commonwealth Electric Company, Chicago.—This booth will offer a wide range of interesting things. About 2,000 electric lamps, variously disposed, will furnish the light and illumination. Above will be a sign containing 1,200 incandescent lamps. A feature will be the illuminating of the booth by beams of light emanating from the ceiling, no fixtures of any kind being visible. Some pretty illuminating effects are to be produced. The outside of the booth will be lighted by concealed lamps. A large reception room is provided for the comfort of visitors. Here some large pictures of the companies' stations and sub-stations will be shown; also stereopticon views showing correct lighting and power installations. A picture showing how the companies' feeder lines radiate throughout the city will be exhibited. Space will be devoted to an electric kitchen, where all kinds of cooking appliances and kitchen utensils, all electrical, will be shown in use. Demonstrators will hand out good things to eat, prepared by electricity. Adjoining the kitchen will be a department devoted to household motor-driven appliances showing the application of electric motors to the household; also household heating appliances, electric ironing, etc. There will be a large power exhibit devoted to a wide range of motor-driven machines, among them a printing press doing work on the Electric City. General supplies will receive attention in another department.

Frank B. Cook, Chicago.—A complete line of telephone protective apparatus and construction specialties will be displayed. One feature will be a sectional iron distributing frame equipped with the various types of switchboard protectors that Mr. Cook has made. Cook's pole cable terminals, adapted to every conceivable method of construction, will be shown; also four different types of protectors for protecting telephone instruments themselves. Of interest to electric-light companies, power-transmission companies, street-railway companies, telephone companies and all who use construction specialties of any kind will be the Cook universal guy clamp, the Cook clip and the Cook self-welding wire joint. A land anchor which bores its own way into any depth of earth desired will be shown; also a line of marlin cable hangers, paper sleeves and various other telephone and general electric construction specialties.

William P. Crockett Company, Chicago.—There will be a complete line of electric specialties, Diamond H switches, Bossert boxes, Pittsburg standard conduit, Sterling flexible conduit, Dale specialties, DeVeau telephones, Sarco specialties, Keystone instruments and enclosed fuses. There will be connected up for demonstration a complete set of DeVeau intercommunicating telephones. Also telephones for mines and tunnel use will be shown, as well as equipments for hotels, offices, factories and residences.

Dean Electric Company, Elyria, Ohio.—A complete line of telephone apparatus and switchboard equipment, including a standard mahogany common-battery multiple switchboard arranged for the Dean harmonic four-party selective ringing system, with individual indicating ringing keys on each cord circuit, may be seen. A special feature will be the Dean harmonic converter, which is replacing party-line ringing machines. This will be shown in actual operation. A full line of telephone instruments and apparatus parts will be shown in addition to magneto switchboards and private branch exchange boards. Telephones will be connected up in order to show the actual operation of the company's party-line system and workings of its boards.

Diehl Manufacturing Company, Elizabethport, N. J.—The exhibit will consist of a small steam-driven generating set; printing-press motors and controllers for small job presses; direct-connected exhaust wheels; desk and ceiling fans; motors for direct connection to shafts of sewing-machine tables, and particularly individual motors for driving sewing-machines, the latter being shown in both direct and alternating-current types and for both home and manufacturing trade uses. All of the other exhibits will be in direct current only. The particular feature of the exhibit will be the motors for driving family sewing-machines, and demonstrations will be given showing their ease and economy of operation and their simplicity.

Joseph Dixon Crucible Company, Jersey City, N. J.—A display will be made of crucibles of various sizes and shapes for melting brass; Dixon's pure graphite motor brushes for motors and generators; pure flake lubricating graphite, and graphite greases of all consistencies to meet all requirements in the lubricating line; also many other graphite specialties for the electrical trade, including resistance rods of any size and any resistance. In addition to the display of graphite products, callers will be entertained with some concave and convex mirrors which will be arranged so that all will be able to enjoy a good laugh.

Dossert & Co., New York.—This company manufactures the well-known Dossert joints and solderless connectors and terminals for wires and cables. It will exhibit a full line of the Dossert appliances, including many new and novel features.

Electric Appliance Company, Chicago.—This company will represent and exhibit Sangamo wattmeters, Packard incandescent lamps, Packard transformers, Adams-Bagnall arc lamps, O. K. weatherproof wire, Paranite rubber-covered wire, Eaco telephones, etc.

Electric Service Supplies Company, Chicago.—The auto motoneer to be exhibited is a circular iron box which is attached to the controller of an electric car. It is so constructed that a motorman is prevented from turning on the full current in one sweep of the controller handle. It appeals to the general public because cars cannot be started so quickly as to injure people when boarding or alighting, or to throw them from their feet when standing in the car. To the railway operator it means a saving in current.

Electric Storage Battery Company, Philadelphia.—A complete exhibit will be made of the various styles of Chloride accumulators and Exide batteries. The many types of cells will show the great variety and size of the batteries manufactured by this company from the type H, which, when installed, stands over five feet high, down to the small BT in glass jars, seven inches in height, which is used largely for telephone, fire-alarm and telegraph work. One important feature of the exhibit will be the R-85 tank, which is the same size as the eight batteries of this capacity now being installed for the New York Central and Hudson River Railroad Company in the electrification of its lines from New York to Poughkeepsie. The various types of car-lighting batteries, which the company has developed to a great degree of excellence, will be shown; also those for railway signal work. The Exide battery will be shown arranged for use in electric vehicles both for propulsion and ignition duty. There will also be a line of portable batteries for phonograph, medical and other applications necessitating the use of a compact portable cell. The exhibit will be in charge of the Chicago office staff, consisting of G. H. Atkin, J. M. S. Waring, H. B. Marshall, W. F. Rath, W. F. Bauer and F. W. Hyde.

Erwin & Co., Chicago.—The exhibit will consist of modern methods of water supply operated and controlled automatically by electricity. Erwin & Co. are making a specialty of designing, building, and if necessary installing, electrically driven pumping machinery for all purposes. Four types of electric pumps in running order will be shown. Probably the most unique is the method of supplying water to buildings when dispensing with the roof and storage tank. A special switch, made and designed for operating this outfit, will be shown. For demonstrating this outfit there will be used a self-contained two-stage centrifugal pump direct-connected by coupling to a three-phase alternating-current motor. Another outfit demonstrated will be an electric seepage ejector designed to remove automatically water that accumulates in basements, boiler pits and catch basins which are below the level of the sewer. It is also used to elevate return water from heating systems. The pump is direct-connected to a vertical direct or alternating-current motor and is entirely automatic in starting and stopping. An automatic electric pump using an automatic electric float switch will be shown, also one of the methods of mounting and belting a small triplex pump for use in suburban residences for elevating cistern water and for use in city buildings. This pump will be belted to a direct-current motor mounted on a sliding base.

Fort Wayne Electric Works, Fort Wayne, Ind.—In one part of the building a motor-generating set of 150 kilowatts capacity, installed by this company, will furnish all energy for exhibitors at the Electrical Show. This generating unit comprises a direct-current motor fed from the Chicago Edison Company's mains and belted to a 150-kilowatt multiphase alternator. The feature of the company's regular exhibit is a complete working demonstration of its series alternating-current arc-lighting system of 25-light capacity. It will also exhibit its standard line of supplies, types K and W single-phase, multiphase and prepayment wattmeters, and its prepayment devices used separately with either its type K or W standard wattmeters. A few interesting applications of small power motors, together with a standard line of fan motors, will also be shown.

General Electric Company, Chicago.—The large space of this company will be devoted almost entirely to its well-known line of electric cooking and heating appliances. The wide range of uses to which electricity can be put in the household will be shown. A corps of demonstrators will exemplify the art of electric cooking. Of its other products the company will show some of the smaller machines, lamps, etc.

Dr. Emil H. Grubbe, Chicago.—The exhibit will consist of a sample of each of the appliances which Dr. Grubbé has devised for the application of electricity to medicine and surgery. A complete office equipment will be installed in the booth and actual demonstrations made of the many medical uses of electricity, including X-rays. Only the medical profession is invited to this exhibit.

Guarantee Electric Company, Chicago.—An interesting motor exhibit will be the new Kimble-Gregory variable-speed alternating and direct-current motors shown by this company. The motors are designed for operating printing presses, air pumps, dental engines, jewelers' lathes and other small manufacturing tools that heretofore have seemed of too little importance to attract the attention of other manufacturers of motors. Electric forge blowers will also be shown. An aluminum turbine disk is mounted on the shaft of a variable-speed motor and suitably encased, and by simply moving a lever a pressure of from one-tenth of an ounce to six ounces per square inch is easily obtainable.

J. Allen Haines, Chicago.—The most interesting part of this exhibit will be the same exhibit of insulated wires and cables manufactured by the Bishop Gutta-Percha Company as these people exhibited in the Centennial Exposition at Philadelphia in 1876. This is a real historical exhibit. The Haines company will also have a very interesting exhibit of an entirely new type of telephone which is radical in every way and which may supersede the ordinary type. A fine line of insulating tape, armature tape, Chatterton's compound and splicing compound will be exhibited, also radically new lines of electric heating material for all possible uses. Electric coffee percolators which have the French drip method and electric tea kettles, as well as electric chafing-dishes and hot-water urns of very handsome design and neat finish will be shown.

Felix Hamburger, New York.—Among the articles to be exhibited by Mr. Hamburger are: 1. The original flaming arc lamps (Siemens), direct current and alternating current. 2. Domestic flaming arc lamps called "Jupiter," for direct current and alternating current, 10 and 12 amperes. These lamps are made in this country. 3. Lilliput arc lamps (Siemens), direct current and alternating current, two and three amperes. 4. Economy arc lamps (Siemens), direct current, five amperes.

5. Radiante lamps, made by the Carbone company, Berlin, direct current, five amperes. 6. Various types of flaming arc lamps, also made by the Carbone company of Berlin for five, six, eight and 10 amperes, burning singly, and with ordinary carbons and not with the impregnated "effect" carbons. 7. The new Bivolta lamps, made by Siemens, for 10 amperes. 8. The Sirene, a new acoustic apparatus. The characteristic feature of this apparatus is its extraordinary noise, which is most penetrating and makes it very useful for signals of all kinds. Mr. Max Austrich will be in charge of the exhibit.

Kellogg Switchboard and Supply Company, Chicago.—The entire exhibit will be given to the demonstration of a few of the company's specialties, including its eight-party selective-ringing telephone system, common-battery private branch switchboard, and also one of the latest type magneto switchboards.

W. N. Matthews & Bro., St. Louis.—These gentlemen will exhibit "money-saving patented specialties." They started in business in 1899 with one specialty, the Stombaugh guy anchor, and since that time have added the Kearney cable clamp, Callahan cable roller, the Hargis cable-splicing joint or sleeve, the Lima jack box and plug, the O. K. sleet cutter and the Hold Fast lamp guard, all of charge of V. L. Crawford and James R. Kearney, inventor of the Kearney clamp. Messrs. W. N. and Claude L. Matthews expect to be present during the show.

Monarch Electric and Wire Company, Chicago.—This company will have on exhibition goods manufactured by the following-named concerns which it represents: Long Distance Telephone Manufacturing Company, South Bend, Ind.; Hemingray Glass Company, Covington, Ky.; Crescent Insulated Wire and Cable Company, Trenton, N. J.; H. W. Johns-Manville Company, New York; Helios Manufacturing Company, Philadelphia; H. T. Paiste Company, Philadelphia; Crescent Company, Valparaiso, Ind. In representing the above manufacturers the Monarch company will have samples of different materials that they manufacture.

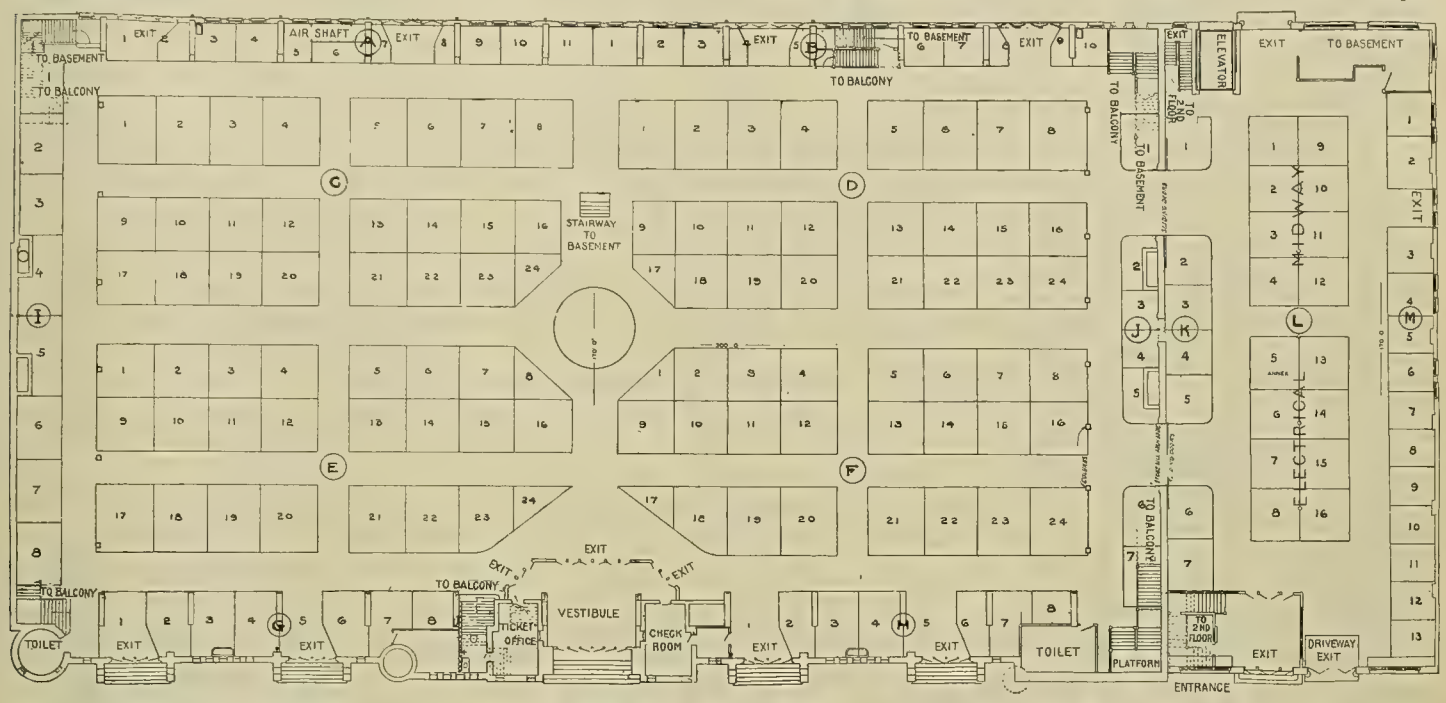
National Electric Lamp Association, Cleveland.—An exhibit of interest to central-station men, operators of isolated plants and consumers of current for lighting purposes will be conducted by the engineering department of the National Electric Lamp Association. Here will be found tungsten, tantalum, metallized and the recent improvements in the incandescent-lamp field. The engineering department has arranged a unique and interesting display that will be attractive to the layman. Complete technical data will be at hand covering the most recent accomplishments of this department. This, with accurate instruments in the hands of experts, will be instructive and interesting to the more technical visitors. A complete and clever device is being constructed to illustrate the value of tantalum, tungsten and metallized filament lamps as regards true color values. The similarity to daylight of the new lamp will prove an attractive point.

Oliver Manufacturing Company, Philadelphia.—Here will be seen the Flexiphone, an entirely new conception of telephone construction, said to eradicate the annoyances common to telephone instruments and to show a decided forward step in the art and to a large degree eliminate trouble and maintenance cost. The Oliver company will also exhibit in the same space an innovation in electric lamps called the electric Flexilite for business offices, banks, the office of the professional man and the home library.

Oneida Community, Ltd., Oneida, N. Y.—Oneida galvanized chain for the suspension of arc and incandescent street lamps will be exhibited. The decorative characteristics of the chain make it attractive. Here will be found also complete equipment for the suspension of street lamps. The exhibit will be complete in detail, showing all attachments necessary for the most exacting requirements.

Peabody Coal Company, Chicago.—This exhibit will consist more particularly of pictures showing various designs of furnaces suitable for the smokeless and economical burning of coal, as well as other information of an educational nature concerning the analysis, analytical characteristics and production of coal.

Peirce Specialty Company, Chicago.—An exhibit of the various specialties of this company for steel construction will be made, a great deal of which has been standardized by the leading telephone and electrical engineers in this country. There will also be an exhibit of clay conduit, of which this company is the sales agent for the Clay



Aetna Stage Lighting Co., Chicago, D 8.
Allis-Chalmers Co., Milwaukee, C 5, 6, 7, 8.
American Clock Co., Chicago, H 4.
American Electrical Novelty and Mfg. Co., Chicago, C 18.
American Sewer Pipe Co., G 6.
American Steel and Wire Co., Chicago, D 17, 18.
American Telephone Journal, Chicago, D 6.
American Telephone and Telegraph Co., Chicago, D 19, 20.
American Vibrator Co., St. Louis, C 3.
Anderson, Albert & J. M., Mfg. Co., Boston, H 8.
Antiseptic Co., The, Chicago, A 7.
Armour Institute, Chicago, D 23.
Automatic Electric Co., Chicago, C 19, 20.
Bidwell Electric Co., Chicago, D 8.
Bigley Telephone Co., Chicago, I 2.
Bryant Zinc Co., Chicago, C 3.
Burns, W. J., Chicago, I 7.
Central Electric Co., Chicago, D 9.
Representing: Edison Mfg. Co., Irons, N. Y.; D. & W. Fuse Co., Providence, R. I.; Columbian Incandescent Lamp Co., St. Louis; Okonite Co., New York; Switchboard Equipment Co.
Central Electric Mfg. Co., Rock Island, Ill., C 15.
Chicago Battery Co., Chicago, B 2, 3.
Chicago Compound Battery Co., Chicago, D 7.
Chicago Edison Co., Chicago, F 1, 2, 3, 4.
Chicago Lamp and Reflector Co., Chicago, C 17.
Chicago Pneumatic Tool Co., Chicago, F 5.
Chicago Telephone Co., Chicago, D 11, 12.
Commonwealth Electric Co., Chicago, F 9, 10, 11, 12.
Consumers Co., The, Chicago, A 2.
Cook, Frank B., Chicago, E 3, 4.
Crane Co., Chicago, C 4.
Crockett, W. P., Co., Chicago, E 9.
Representing: Bosster Electric Construction Co., Utica, N. Y.; Hart Mfg. Co., Hartford, Conn.; DeVeau Telephone Mfg. Co., New York; Sterling Electric Co., Troy, N. Y.; Enameled Metals Co., Pittsburg; Keystone Electrical Instrument Co., Philadelphia; The Sarco Co., New York; Briner Pogue Mfg. Co., St. Louis; The Dale Co., New York.
Dean Electric Co., Elyria, O., C 9, 10.
Diehl Mfg. Co., Elizabethport, N. J., D 14.
Dixon, Joseph, Crucible Co., Jersey City, N. J., A 4.
Dossert & Co., New York, C 2.
Duncan Electric Mfg. Co., Lafayette, Ind., E 19.
Edwards Electric Headlight Co., Chicago, I 4.
Electrocraft, Detroit, B 10.
Electric Appliance Co., Chicago, E 8, 16.
Representing: Sangamo Electric Co., Springfield, Ill.; New York and Ohio Co., Warren, Ohio; Packard Electric Co., Warren, Ohio; Indiana Rubber and Insulated Wire Co., Jonesboro, Ind.; Phillips Insulated Wire Co., Pawtucket, R. I.; Whitney Electrical Instrument Co., Penacook, N. H.
Electric Rotary Floor Polisher Co., Chicago, J 1.
Electric Storage Battery Co., Philadelphia, D 21, 22.
Electric Service Supplies Co., Chicago, F 13.
Representing: Locke Insulator Mfg. Co., Victor, N. Y.; R. D. Nuttall Co., Pittsburg, Pa.; Speer Carbon Co., St. Marys, Pa.; Lyon Metallic Mfg. Co., Aurora, Ill.; Wilson Trolley Catcher Co., Boston, Mass.; Crouse-Hinds Co., Syracuse, N. Y.; Hunter Illuminated Car Sign Co., New York; Miller Anchor Co., Norwalk, Ohio; Sterling Varnish Co., Pittsburg, Pa.; Colonial Electric Co., Warren, Ohio; Protected Rail Bond Co., Philadelphia; Dittrick-Jordan Electric Co., Cleveland, Ohio.
Electrical Review, New York, F 23.
Electrical World, New York, F 24.
Engineer Publishing Co., Chicago, J 6.
Engineering World, New York, F 22.
Erwin & Co., Chicago, F 17, 18.
Eureka Electric Co., Genoa, Ill., E 18.
Everson, C. G., & Co., Chicago, D 5½.
Federal Electric Co., Chicago, E 7.
Fort Wayne Electric Works, Fort Wayne, Ind., C 13.
General Electric Co., Schenectady, N. Y., F 19, 20.
Gould Storage Battery Co., New York, E 20.
Grubbe, Emil H., M. D., Chicago, J 7.
Guarantee Electric Co., Chicago, B 4½.
Haines, J. Allen, Chicago, C 16.
Representing: American Electric Heater Co., Detroit, Mich.; Bishop Gutta Percha Co., New York, N. Y.; Baton Electrical Mfg. Co., Baton, Ohio; Electric Cable Co., Bridgeport, Conn.; Reed Electric Cordage Co., Syracuse, N. Y.; Stanley & Patterson, New York; Wire and Tel. Co. of America, Rome, N. Y.
Haller Machine Co., Chicago, J 2, 3, 4, 5.
Hamburger, Felix, New York, H 6.
Health Vibrator Co., Chicago, C 2.
Hepburn Telephone Co., Chicago, A 8.
Holtzer-Cabot Electric Co., Boston, C 1.
International Correspondence Schools, Scranton, Pa., H 7.
Johns-Manville Co., H. W., New York, E 15.
Kellogg Switchboard and Supply Co., Chicago, E 17.
Lang, J., Electric Co., Chicago, A 6.
Matthews, W. N., & Bro., St. Louis, A 3.
McRoy Clay Works, Chicago, F 22.
Metropolitan Electrical Supply Co., Chicago, C 2.
Monarch Electric and Wire Co., Chicago, C 23, 24.
Representing: Crescent Insulated Wire and Cable Co., Trenton, N. J.; Crawfordsville Wire and Nail Co., Crawfordsville, Ind.; Faries Mfg. Co., Decatur, Ill.; Nurnberg Flaming Arc Lamp Co., Hamburg, Germany; H. T. Paiste Co., Philadelphia; Crescent Co., Valparaiso, Ind.; Helios Manufacturing Company, Bridesburg, Philadelphia.
National Battery Co., New York, F 14.
National Carbon Co., Cleveland, E 6.
National Electric Lamp Association, Cleveland, F 7, 8.
Nungesser Electric Battery Co., Cleveland, A 5.
Ohio Brass Co., Mansfield, Ohio, D 7.
Oliver Manufacturing Co., Philadelphia, E 1.
Oneida Community, Ltd., Oneida, N. Y., F 16.
Peabody Coal Co., Chicago, I 5.
Peirce Specialty Co., Chicago, E 2.
Peterson, H. A., Mfg. Co., Harvey, Ill., D 5.
Phelps Co., The, Detroit, C 2.
Phœnix Glass Co., New York, A 9.
Public Service Co., Chicago, F 23.
Reynolds Dull Flasher Co., Chicago, J 2, 3, 4, 5.
Roth Bros. & Co., Chicago, D 24.
Schott, W. H., Chicago, C 22.
Schureman, J. L., Co., Chicago, B 1.
Shelton Electric Co., Chicago, C 14.
Simplex Electric Heating Co., Cambridge, Mass., F 21, 22.
Stolz Electrophone Co., Chicago, F 15.
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y., E 5, 13.
Swedish-American Telephone Co., Chicago, E 11, 12.
Swedish Electric Vibrator Co., Chicago, G 2.
Telephony Publishing Co., Chicago, D 6.
Thomas & Smith, Chicago, B 7.
Thompson & Read, Chicago, B 8.
Universal Electric Storage Battery Co., Chicago, D 13.
Universal Mfg. Co., Chicago, G 7.
Vesta Accumulator Co., Chicago, A 10.
Vim Co., Chicago, E 19.
Vote-Berger Co., Chicago, E 10.
Vulcan Electric Heating Co., Chicago, E 14.
Wagner Electric Mfg. Co., St. Louis, D 10.
Western Electric Co., Chicago, E 21, 22, 23, 24.
Western Electrician, Chicago, F 24.
Westinghouse Companies, The, Pittsburg, D 1, 2, 3, 4.
Wilson Co., The, Chicago, D 6.

DIAGRAM OF EXHIBIT SPACES AT CHICAGO ELECTRICAL SHOW.

Product Company of Brazil, Ind. The conduit is made of natural clay, unmixed, and of high grade.

Phoenix Glass Company, New York.—A large display of varied and effective lines of electrical glassware will be made, consisting of etched, rich cut, decorated and other effects; also the "Phoenix Quality" inner globes. E. H. Fox and C. C. Fricke of the Chicago branch will be in charge.

Rolfe Electric Company, Rochester, N. Y.—The feature of this exhibit will be Rolfe enclosed fuses and other specialties made by this company.

W. H. Schott, Chicago.—Instead of exhibiting goods or apparatus of any kind pertaining to the business, Mr. Schott has designed a booth symbolical of the general contracting business, to which he devotes the greater part of his time and energy. The Schott trademark is carried throughout in the design of the booth, which is in the colonial style. Competent men will explain the merits of the Schott systems of central-station heating and light and power plants. A reception booth will be open to all interested in public utilities, where visitors can make themselves at home.

J. L. Schureman Company, Chicago.—This company's display will include automatic pump starters arranged to control the action of a motor-driven pump, so that when the height of water in the tank or the pressure is increased to a certain point the motor is automatically stopped and will not be again started until the pressure or height has receded to a predetermined point. These starters are designed for motors of from 25 horsepower to 200 horsepower. A full line of elevator controllers for hand-cable control, lever or wheel control and full electrical control will be shown. Among the other things will be a drum-type reversing switch, arranged particularly for a direct connection to the operating mechanism of an elevator; a new type of full electrical control, in which the series of magnet switches is replaced by a series of mechanical switches actuated from a solenoid-operated cam shaft, and a full line of magnet switches, designed for the distant control of light and power circuits.

Shelton Electric Company, Chicago.—In this booth will be exhibited a vibratory massage instrument for home use, to operate from any electric-lighting circuit. Massage of the head, face, neck, arms and body is easily self-administered by its use.

Simplex Electric Heating Company, Cambridge, Mass.—Electric heating and cooking appliances for the office, home and factory will be shown. Among other things, there will be stoves, ovens, broilers, curling-iron heaters, teakettles, heating pads, urns, waffle irons, soldering irons, glue pots, solder pots, sealing-wax pots, coffee percolators, chafing-dishes, and a complete line of electric irons for all requirements. Some heaters just placed on the market consist of new-type coffee percolators, "Marcel-wave" curling-iron heaters, dental sterilizers and an "electric range." This last device will be of special interest to the visitors. It is an electric cooking outfit built on the lines of a range.

Stolz Electrophone Company, Chicago.—This company will exhibit a pocket telephone for the deaf. It is not a trumpet or artificial ear drum, but an electrical device in two parts, transmitter and battery case in one and ear-piece in the other.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.—The fundamental plan followed in the preparation of this exhibit is to show the growth of the Independent telephone development, showing the most approved telephone apparatus for both exchange and sub-station use; also cable for underground and aerial construction work. The apparatus to be exhibited consists of one 10,000-capacity multiple switchboard section, equipped with machine ringing four-party-line keys; one lamp signal non-multiple switchboard; private branch exchange switchboards of different types; generator call visual-signal switchboard; reels of underground and aerial cable; samples of various types of telephones, both straight line and selective party-line; intercommunicating telephone system, and samples of street-car and mine telephones. A very attractive part of the exhibit will consist of a huge map of the United States, showing thereon, by means of miniature lamps, a number of switchboard installations furnished by the Stromberg-Carlson Telephone Manufacturing Company. These switchboards will be indicated by colored lamps, which will be flashed.

Vim Company, Chicago.—A complete line of electrical apparatus designed for the amusement and instruction of juvenile electricians will be exhibited. The exhibit is distinctly original. A complete practical telephone, that sells for less than half a dollar, is one of the latest attractions, a line being in operation. Among the interesting demonstrations, under the direction of an expert, are a miniature dynamo, generating 30 candle-power, a complete electric railway in full operation, and a complete assortment of flashlights and battery incandescent electric lamps.

Vulcan Electric Heating Company, Chicago.—Here will be shown "Red Hot" electric branding tools. A large electric soldering tool will operate on a continuous seam, propelled by an electric motor. There will be electric soldering tools of various sizes and shapes for convenient operation, electric solder pots and wax pots and other thoroughly practical high-temperature tools which will clearly demonstrate the current consumption, and, therefore, the cost of operation. It is proposed to prove that Vulcan electric soldering and branding appliances have been perfected to such a degree that they are bound to replace those which are heated by other methods. Electrically branded souvenirs, hot from the Vulcan electric branders, will be given to visitors, and the thoroughly practical operation of these tools demonstrated.

Wagner Electric Manufacturing Company, St. Louis.—A working single-phase elevator motor, complete with controller, will be a feature of the exhibit. These motors are built by the Wagner company in sizes from five horsepower to 25 horsepower, and are of such construction as to be susceptible of operation by unskillful attendants. The inside construction of a transformer will be exhibited. To those people who have no conception of electrical instruments the complete display of switchboard and portable instruments found in the booth will be interesting. Variable-speed single-phase motors will be in operation in the booth, and the possibility of this form of drive will be demonstrated; also a line of single-phase vertical motors manufactured by the Wagner company. All interested in polyphase motors will have an opportunity to examine the construction of these motors.

Western Electric Company, Chicago.—A large and handsome water-color painting of the new 110-acre plant at Hawthorne, Ill., will be shown. In this plant are facilities second to none for building heavy power apparatus and switchboards. The exhibits will include American transformers, Thomas high-tension insulators, Electros insulating material, Western Electric Company's arc lamps and direct and alternating-current motors, also series or multiple lamps for both alternating current and direct current. The company makes a specialty of a direct-current indestructible lamp, the magnets of which are wound with Deltabeston magnet wire, and will give a demonstration of the heat-resisting qualities of this wire as compared with cotton-covered magnet wire. Another interesting feature will be that of a series alternating equipment in full operation, including switchboard, regulator and transformers. The company will also show the new 1907 line of fan motors, and a switchboard equipped with some recently perfected devices. An indestructible field coil for railway motors, wound with Deltabeston wire and guaranteed for one year, is an article which will form no small part of the display. The new 20-inch arc lamp, the new induction motor recently perfected, and sewing-machine motors will be exhibited. Ample preparations have been made to take care of customers and guests. The following-named gentlemen, assisted by a large staff, including some of the out-of-town representatives, will be in charge: H. A. Halligan, assistant manager Chicago house; C. A. S. Howlett, manager, Chicago power apparatus sales; L. J. Baldwin, manager Chicago supply sales; L. B. Dixon, manager Chicago telephone sales; H. Walton Heegstra, general advertising manager.

Westinghouse Electric and Manufacturing Company, Pittsburg.—The idea of the exhibit will be to show what is being done to meet the demand for electric-driven devices. All kinds of electrically driven machines and other devices using electricity will be shown, including a dough mixer; centrifugal pump; a mangle for domestic use, the motor for which is driven from a lamp socket connection; electrically operated sewing machine; laundry washer for hotels and large houses; triplex pump; ice-cream freezer; lathes; sanitary vacuum dust remover, etc. A phonograph for commercial purposes will be operated from a lamp cord. An interesting feature will be a small electric generating outfit consisting of a small steam engine direct connected to a Westinghouse direct-current generator. There will be a complete refrigerating plant in operation, also an engine lathe, combined coffee grinder and pulverizer, dish washer, printing press, automatic circular saw sharpener, drill press, etc. An interesting exhibit of electrical measuring instruments will be made, including instruments of precision, graphic recording instruments, and switches, circuit-breakers, etc. The exhibit will be lighted by Westinghouse arc lamps, among which will be multiple alternating-current, multiple direct-current and series direct-current arcs. A series street-lighting system will be shown for utilizing Nernst lamps with arc lamps, balancing being accomplished by a six-light regulator. Cooper Hewitt mercury-vapor lamps for shop lighting with new automatic tilters will be exhibited. The following-named gentlemen with a large corps of assistants will be in charge: T. P. Gaylord, manager Chicago territory; J. C. McQuiston, manager publicity department; E. M. Bischoff, manager resales department; A. L. Millard, manager arc lamp and switchboard department, Chicago territory; C. W. Davis, manager Chicago territory Nernst Lamp Company, and George C. Keech, manager Chicago territory Cooper Hewitt Company. A large reception room has been provided where visitors will be welcomed.

Central Stations Benefited by the Study of Illumination.

At the monthly meeting of the contract department of the Chicago Edison Company on January 8th the subject of "Illumination" was presented in an interesting lecture by Mr. A. J. Marshall of the Holophane Glass Company of New York. The lecture was supplemented with stereopticon views and was very instructive. Mr. Marshall, who is an illuminating engineer, spoke for 2½ hours. He pointed out the benefits resulting from the scientific study of illumination and the application of the resulting knowledge by trained hands. Considerable of his talk was devoted to means for educating the public to the better knowledge of illumination.

First of all, Mr. Marshall said, the subjects of light and illumination must be entirely divorced to get good results, as there is such a vast difference between the application of the two. Examples were given of interiors having an abundance of light yet being poorly illuminated. The fault was in the misplacing of the lights and ill-advised selection of lamps and reflectors. A lamp or fixture giving excellent results in one location might be just the wrong thing in another application. No particular make of lamp, shade, reflector or fixture was given prominence by Mr. Marshall, his lecture covering strictly the principles of illumination. It can be said, however, that the company which Mr. Marshall represents is prominent among the contributors to the cause of scientific illumination.

The speaker showed diagrams and curves of efficiency tests and gave the results of the measurements of various forms of illumination. He went into the subject of diffusion of light and exhibited some interesting curves relating to the results obtained from scientific reflectors and ordinary shades. A portable dark-room was displayed with which a very clear idea was given of the method in which photometric data are obtained. Instances were cited where proper arrangement and diffusion of light saved one-third the current. This at first thought would not please the central-station man, but when the fact is recorded that the list of customers invariably grows as a result of the properly lighted store it is contended that the result is beneficial to all concerned.

Mr. Marshall has been giving a series of illustrated lectures on illuminating engineering in the larger cities of the Central West, endeavoring to explain to the public the wonderful advances which have been made in the field of illuminating engineering with all forms of illuminants. In some places where the consumer seemed to think that the gas and electric companies were working against and not with them in the matter of the right kind, quantity and location of light, these lectures are said to have had a decided tendency to eliminate such feeling. Some of the companies before whom Mr. Marshall has lectured are quoted as saying that the work of their complaint department has been materially decreased and that this department is gradually being changed to a department of illuminating engineering.

This lecture work is being done under the auspices of the central stations and is in no way an advertising scheme, but it is meant to awaken the public to the possibilities in this field and the advantages to be gained by having their illumination scientifically and practically engineered. Mr. Marshall's services are free of charge to central-station companies, the only expense to the company being the furnishing of a suitable place for holding the lecture and furnishing a lantern, screen and operator to show views. This work is largely along the lines of the Co-operative Electrical Development Association, except that in this case the entire expense is borne by the Holophane company.

An example is cited of the modern movement toward giving customers better illumination in the case of Bennington, Vt. This is a place of only 5,600 people with 9,000 incandescents on its circuits, but nearly 2,000 of these are the new Gem high-efficiency lamps, in this case equipped with Holophane reflectors. The management under Mr. J. E. Larrabee, president and general manager, has gone out of its way to push modern lamps and endeavor to give the customer more illumination for the same or less expenditure of energy. The result has been that the standard of illumination in the town has been raised so that customers today are better satisfied than formerly and at the same time are spending more money for electric current for lighting purposes. The company has endeavored not only to give the customers new types of lamps and reflectors but has endeavored to so place and select the same according to the modern principles of illuminating engineering as to give the customer the best possible illumination at the lowest cost. If the attitude of this company were adopted by all the electric

companies throughout the United States it would do much to still the cry for municipal ownership. It is also this attitude which makes it possible for the electric company not only to complete successfully with gas but far outstrip it, despite the fact that first cost of installation is in many cases somewhat higher and the fact that the operating cost per candlepower is somewhat higher. The Bennington company does not aim to sell the customer so many kilowatt-hours at a given price, but rather to give the customer the best illumination.

American Association for the Advancement of Science.

The American Association for the Advancement of Science held its annual meeting at Columbia University, New York city, beginning December 27, 1906. The events of the first three days of the session were reported in the last issue of the Western Electrician.

On Monday, December 31st, the convention decided to have no meeting next summer, but during the winter it will convene in Chicago.

An invitation was received from the residents of Winnipeg to join in the meeting of the British Association, to be held in that city in the summer of 1908. It was brought by Dr. George Bryce, who came to New York especially for that purpose, and also by Dr. Janes Fletcher, secretary of the Royal Society of Canada. It was, however, left over until a formal invitation had been received from the executive of the British Association.

The officers for next year will be: President—E. L. Nichols, professor of physics, Cornell; general secretary, President F. W. McNair, School of Mines, Michigan; secretary of the council, William Harper Davis, Lehigh University; vice-presidents—mathematics and astronomy, Prof. E. O. Lovett, Princeton; physics, Prof. Dayton C. Miller, Case Applied School, Cleveland, Ohio; chemistry, Prof. H. P. Talbot, Massachusetts Institute of Technology; mechanical science and engineering, Prof. O. H. Landreth, Union College; geology and geography, Prof. J. P. Iddings, Chicago; zoology, Prof. E. B. Wilson, Columbia; botany, Prof. C. E. Bossey, University of Nebraska; anthropology and psychology, Prof. Franz Boas, Columbia; social and economic science, J. F. Crowell, New York city; physiology and experimental medicine, Dr. L. Hektoen, Chicago; education, Elmer Brown, United States commissioner of education; secretaries—physics, A. D. Cole, Ohio University; education, Edwin G. Dexter, University of Illinois; social and economic sciences, Prof. J. P. Norton, Yale.

The Education Section is a new one, instituted last year. A complimentary dinner was tendered to the president of this year, Dr. W. H. Welch of Johns Hopkins University, by a number of scientists of New York at the University Club.

After a short meeting on Tuesday, January 1st, the society adjourned.

The Faraday Society.

At a meeting of the Faraday Society on December 11th in London a paper was read by Dr. A. C. C. Cumming on "Contributions to the Study of Strong Electrolytes." A curious point was noticed by the author when two cells containing the same solution, but of different concentrations, are joined by a third solution of the same substance. Whatever the strength of this third solution, the observed potential remained the same as when the two cells are directly connected with each other. This has not been recorded before, but could have been predicted from Nernst's theory.

Dr. Cumming also read, in abstract, a paper on "The Electrochemistry of Lead."

A paper by R. W. Vicarey on "Storage Batteries and Their Electrolytes" was read. The paper dealt chiefly with some of the problems involved in the manufacture of accumulators, particularly in relation to the effects of nitrogen and other impurities. The evils attributed to nitrogen, both after complete formation and in the latter stages of the forming process, were described in detail.

Alleged Electrolytic Deterioration of Water Mains in Richmond.

In Richmond, Va., the Virginia Passenger and Power Company and the municipality are engaged in a spirited contest over the vexed question of deterioration of buried water pipes by reason of escaping electric-railway current. Some of the best experts in the country have been in Richmond testifying for one side or the other, and included among them are A. M. Schoen of Atlanta, Ga., and Dabney H. Maury, Jr., of Peoria, Ill. The controversy does not involve past damage to the water mains of the city. That matter is pending in the federal court, where the city is suing for alleged electrolytic damages of $170,000, the amount said to be due up to several years ago, on the basis of a report made by Mr. Maury. The question now at issue is what shall be done to prevent further damage, and witnesses have been testifying as to whether the double overhead trolley or some other system is the best method to meet the situation.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER V. (*Concluded*).

Electric Wave Detectors.

Efforts were also made to determine whether the thermal effect had anything to do with the action of the cell, but the apparatus at hand was not sufficiently delicate to register any of the effects of heat. Dr. De Forest's careful and painstaking experiments with the electrolytic detector have apparently convinced him that if there is any heat effect manifested, that effect has nothing to do with the wave-responding action of the cell.

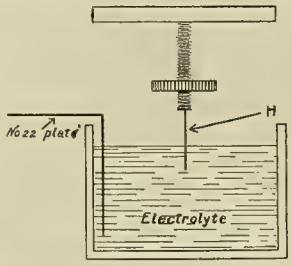


FIG. 35. ELECTROLYTIC RESPONDER USED BY DE FOREST.

He points out the pertinent fact that its action is quite unaffected by extremes of temperature, high or low. The form of responder used by De Forest in his investigations is illustrated in Fig. 35.

In view of the established fact that in electrochemical operations bright platinum electrodes are quickly polarized, Dr. De Forest assumes that the

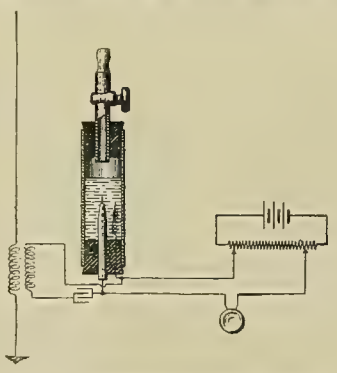


FIG. 36. FESSENDEN LIQUID BARRETER.

electrolytic cell operates by virtue of the breaking down of such polarization when subjected to the bombardment of Hertz waves. The aqueous solution used in this cell is preferably of the alkaline salts. The diameter of the anode determines the depth to which it should be immersed in the electrolyte. The greater the diameter the less should be the immersion. Mr. Frederick K. Vreeland and M. Reich agree with Dr. De Forest that the action is essentially electrolytic, while Schloemilch is undecided whether the cell operates by virtue of its polarization capacity or its ohmic resistance.

Dr. J. E. Ives recently carried on a series of

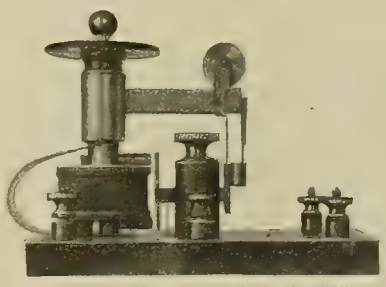


FIG. 37. FESSENDEN RECEIVER COMPLETE.

experiments with the De Forest responder with a view to ascertaining the cause of its action, and his deductions led him to believe that it operates by virtue of electrolytic action. Dr. Ives considers that, in view of the fact that the polarity is not reversible, the heat effect has nothing to do with its operation.

A diagram of the connection of the liquid barreter, as used by Fessenden, is shown in Fig. 36. The receiver consists of a glass tube containing a solution of nitric acid or caustic soda. A fine wire terminal is immersed in the solution. The oscillations to be detected and a constantly flowing current from a local source both flow through the constricted conducting fluid, and the oscillatory currents produce a change in the amount of current flowing through the local circuit. In connection with the detector, a high-resistance telephone receiver is used to receive the signals, and in order to increase the loudness of the signals so received, Professor Fessenden uses an atmospheric pressure of 40 pounds per square inch on the liquid. Fig. 37 shows a view of the Fessenden receiver complete, using the liquid barreter detector.

Among Mr. Marconi's later technical improvements there is a receiver known as a magnetic detector, which is used in place of, or in addition to, the filing coherer in the receiving circuit.

The development of this instrument was the outcome of experiments which determined the fact that electric waves have the property of reducing magnetic hysteresis. The detector, as constructed, consists of a small core of nickel or iron wires surrounded by a coil of fine insulated wire. This

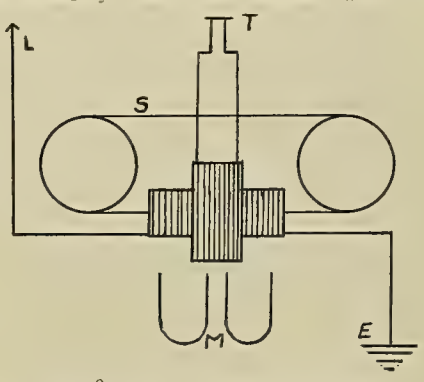


FIG. 38. MARCONI MAGNETIC DETECTOR.

coil is connected in series with the aerial wire, which gives the waves a direct metallic path through the coil.

The action of the wave is to reduce the residual magnetism in the coil, which change of magnetic state may be detected in different ways and reproduced mechanically. The usual method is to detect the received signals in a sensitive microphone.

Fig. 38 is a diagram of the magnetic detector. (S) is an endless cord of thin soft iron wires located in front of the poles of the magnet (M)

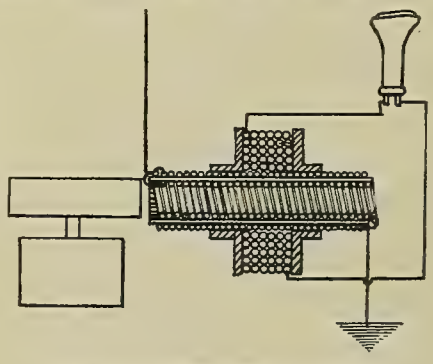


FIG. 39. DE FOREST MAGNETIC DETECTOR.

and there traversing a coil of insulated copper wire connected with the aerial (L) and with the earth (E). On this coil a secondary coil is wound, to which the telephone receiver (T) is connected.

Another detector of the same order is that due to Rutherford. Part of the wire composing the resonator circuit is coiled around a magnetized steel needle. The received oscillations affect the magnetism of the needle, thereby causing the deflection of a second magnetic needle suspended close by, the movements of which may be observed by means of a mirror and telescope.

In the Marconi detector the endless core is moved mechanically through the coil. A test of the device shows that the increase of induction is detected at or near a cyclic extreme. The moving core distorts the field in the direction of motion, the telephone responding more clearly to signals received when the field is nearing, but not up to, the cyclic extreme.

Dr. De Forest has also invented a magnetic detector, United States patent No. 772,878. This

detector is shown in section in Fig. 39, and consists of a magnetizable shell, and a demagnetizing coil both within and without the shell, one coil to be connected with the aerial wire or antenna, and the other coil with the earth.

The De Forest company, in some of its long-distance installations, uses a thermo-electric detector of which the sensitive element is carborundum, the compound of carbon and silicon. This substance is of extreme hardness, on the order of the precious stones, and has limited conductivity. It is stated that the carborundum receiver is perfectly constant in action and is unaffected by jarring or vibration. The compound is used in the same way as metal filings are used in the ordinary coherer, by placing particles between electrodes in a glass tube in such a manner that the mechanical pressure may be regulated.

In the development of any new electrical device the inventor finds himself limited in resource to the already established knowledge regarding the action of electric currents. Many wonderful inventions, however, consist simply of new applications of effects long since observed. Among the various effects of an electric current are magnetic attraction, electrolytic action, electrostatic action,

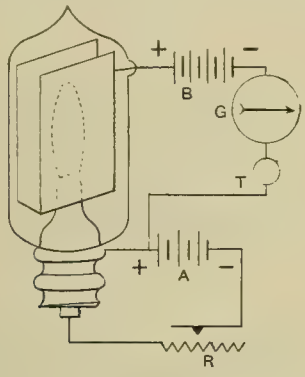


FIG. 40. ELECTRIC CIRCUITS OF AUDION.

thermal action, etc. In the making of electric-wave detectors the trend of experimentation at the present time seems to favor thermo-electric devices. If Professor Fessenden's hypothesis of the action of the barretter is correct, that instrument is thermo-electric.

Investigations conducted by Dr. L. W. Austin of the National Bureau of Standards during the year 1906 have resulted in the development of a detector made up of thermo-electric elements, the conductors being brought into contact with great pressure. The device is satisfactorily operative without a local electromotive force.

Dr. Lee De Forest recently announced the introduction of a detector known as the audion. The history of the development of this instrument is very interesting. In the year 1900 Dr. De Forest, while conducting experiments at the Armour Institute, Chicago, noticed one evening that the Welsbach burner used in his room for lighting purposes was peculiarly affected when the small Hertz wave generator was operated. The coil used was quite small, giving a one-sixteenth-inch spark, and was located 20 feet from the gas burner.

It was observed that the operation of the coil was accompanied by an increase of light in the room, and by altering the volume of air supply of the Welsbach burner the increase of light produced by the spark would amount to several candlepower. At first Dr. De Forest was quite elated with his discovery, but, as he remarked five years later, "Alas for the over-sanguine spirits of the young investigator!" It was found that when the burner was subjected to true Hertz radiations—that is, from a screened source—there was no response, thus indicating that the phenomenon was simply an acoustic effect.

It was then found that a smart clap of the hands, or the operation of a small tapper electric bell in the vicinity of the burner, caused similar variations in the volume of light given out. It had simply been the sharp crack of the coil spark which had affected the flame through the medium of sound waves in air. Although disappointed, Dr. De Forest was impressed with the evident fact that in the flame around the incandescent gas mantle there existed matter in an extremely mobile and tenuous state, responsive to heat and sound waves, in sensitiveness more delicate than any arrangement of liquid or material matter, and the thought uppermost in his mind was, "Why should it not, in some phase or fashion, respond to Hertz radiation also?"

For a time Dr. De Forest was occupied with other matters, but two or three years later he took the matter in hand in earnest, with the result that the audion, the flame detector, was produced.

Fig. 40 shows a diagram of the circuits of the type of audion exhibited by Dr. De Forest at the time his paper was read before the American Institute of Electrical Engineers in October last. A form of incandescent lamp is used, having a low-voltage filament of carbon. The circuit connections include a local battery (B), galvanometer (G), telephone receiver (T), adjustable voltage battery (A), and rheostat (R).

In the exhausted globe are fixed two platinum wings parallel to the plane of the filament, and distant from the latter about two millimeters. The battery (B) is situated between the platinum wings and the positive end of the lamp filament. As a result of the electrification induced in the neighborhood of the filament, a positive leakage discharge current passes from platinum to filament through the gas.

The important factors governing the satisfactory operation of the detector are temperature, nature of filament, degree of pressure on the gas, shape and size of platinum plates, and distance of separation between filament and wings. An increase of temperature of the filament results in an increase of the conductivity of the gas. The responsive capability of the device is due to momentary alterations in the specific inductive capacity of the gas when subjected to the effects of Hertz waves.

The subject of wave detectors will again be taken up in a later chapter, when we consider them in connection with the other component parts of practical wireless systems.

[To be continued.]

Northwestern Electrical Convention.

Arrangements are about completed for the annual meeting of the Northwestern Electrical Association in the Coliseum, Chicago, next week, January 16th, 17th and 18th. A very good meeting and a large attendance is expected. Besides enjoying the meeting, members are offered the opportunity to attend the electrical show. The following excellent programme has been prepared:

WEDNESDAY, JANUARY 16TH, 10 A. M.

Roll-call; reading of minutes.
President's address.
Secretary-treasurer's report; appointment of committees; applications for membership; reports of committees; miscellaneous business.

WEDNESDAY AFTERNOON.

Paper, "Enthusiasm," by George E. Legler.
Paper, "Profitable Co-operation," by J. Robert Crouse.
Paper, "Waterpowers of Wisconsin," by Ernst Gonzenbach.

WEDNESDAY EVENING.

Electrical show; theater parties.

THURSDAY, JANUARY 17TH, 9:30 A. M.

Paper, "Some Characteristics of Alternating-current Motors in Which the Central-station Man is Vitally Interested," by C. W. Bergenthal.
Paper, "Producer-gas Power," by Professor Richter.
Paper, "Outline Lighting," by Homer Honeywell.

THURSDAY AFTERNOON.

Paper, "Some Phases of Smaller Central-station Management," by H. H. Scott.
Paper, "Uniform System of Accounting for Small Companies," by Fred W. Insull.
Paper, "Some Points on Illuminating Engineering for the Small Central Station," by J. R. Cravath.

THURSDAY EVENING.

Illuminating Engineering Society.

FRIDAY MORNING, JANUARY 18TH.

Paper, "The Trend of Improvement in the Design and Operation of Boiler Plants," by A. Bement.
Paper, "Warrantable Expense for Meter Testing," by O. J. Bushnell.
Paper, "Premiums to Employes," by Ernst Gonzenbach.
Report of nominating committee.

Mr. Harold Almert of Chicago is president and Mr. B. C. Adams, Lincoln, Neb., secretary. Members are requested to invite their friends to attend.

The Northwestern Lumber Company will erect a new power plant at Eau Claire, Wis., to cost $90,000.

Combined Heating and Lighting System of Canton, Ohio.

Among the combined heating and lighting systems of the Middle West which have sprung up within the last three years that of the Merchants' Heat, Light and Power Company of Canton, Ohio, stands out prominently as an example of the opportunities in a combined heating and lighting plant for even small companies, when judiciously managed. The beautiful and progressive little city of Canton, with a population of some 40,000, was, from both an engineering and commercial viewpoint, a particularly favorable place for the location of such a plant. Owing to an inadequacy of water, a condensing plant would have been impracticable, therefore the use of the exhaust steam for city heating affords economies which invite the careful attention of other companies similarly situated.

The company began business in April, 1905, as the successor of the Citizens' Heat and Light Company, which was originally organized to supply heat and light to a large new hotel. The hotel corporation became insolvent and the newly formed company acquired its franchise for a heating line and lighting system through the principal sections of the town. Within the last few months it has constructed a system under the central section of the city and has additional franchise for five miles of street.

The heating system was designed for 250,000 square feet of radiating surface, with provision for increasing to 500,000. At the present time the connected heating load is 100,000 square feet. The charge for heating is 31½ cents per square foot of radiating surface for seven months, or 60 cents on the basis of 1,000 pounds of water by condensation. The company is building up a large lighting load.

Steam is supplied by three 250-horsepower Stirling water-tube boilers fitted with Roney stokers and arranged in a battery and a half, with provision for an additional unit. The engine equipment consists of two Russell cross-compound non-condensing engines, each of 375-horsepower capacity, 200 revolutions. Each engine is direct-connected to a 250-kilowatt two-phase 2,300-volt National alternator, made by the National Brake and Electric Company of Milwaukee. These machines carry the entire lighting load.

These alternators have frames of cast-iron with sole-plate extensions for supporting them on the engine foundation. Soft sheet-steel laminations are dovetailed within the frame, so as to form slots for receiving the windings. These laminations are carefully japanned, to reduce core losses to a low value and also insulate them from each other, and are very rigidly supported between end plates at such intervals as are ample to insure fine ventilation. The armature windings are composed of strap-wound coils, insulated with sheet material of highest mechanical strength and dielectric properties. The completed coils are wrapped with linen tape and repeatedly dipped in a vat of special insulating compound.

The fields of the generators are wound with copper ribbon in edgewise fashion, thus exposing every turn of the coil to the air and giving a compact, rigid and practically indestructible coil. A special feature of the machines is the use of widely separated pole pieces, which construction requires a spider of large diameter, and prevents crowding of the coils; thus the coils have a large radiating surface. The bearings of the machines are babbitt-lined and are made with a sufficient number of grooves and oil rings to give uniform lubrication. The collector rings are built up on a separate skeleton-type spider. They are cast-iron and fitted with carbon brushes, so that wear and attention are reduced to a minimum. The generators are excited with a current from 110-volt exciters, which are belted to the shafts of the engines.

Electric Motors for the Equipment of a Tube Mill.

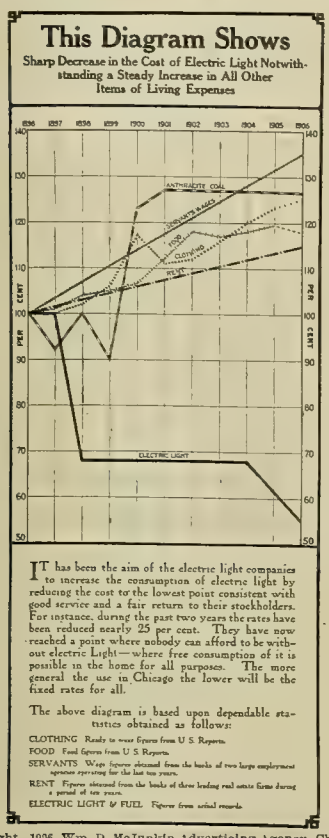
The Seamless Tube Company of America, which is affiliated with the Pittsburg Steel Company and whose works are situated at Monessen, Pa., has recently purchased four 300-horsepower Allis-Chalmers compound-wound non-reversible direct-current motors. One motor will be connected by gears to a 20-inch two-high mill for rolling tubes. One will be direct connected to a mill for piercing steel billets and two will be connected by gearing to cold-draw benches for cold-drawing tubes.

The invasion of steel works and rolling mills by electric power has been revolutionary. It is doubtful if 10 years ago the most sanguine friends of this means of power transmission would have predicted the common adoption in so short a space of time of electric power for driving heavy rolling mills. The line of improvement in this class of machinery which has done more than any other to encourage its adoption in mill operation has been that of developing a high torque at starting. Thus far the use of electricity has reached no limit in iron and steel-works operation. Its more recent success, in driving the heaviest rolling mill, leaves no field unconquered.

A Striking Central-station "Ad."

At this time of the year statistics are appearing in newspapers and journals, and everyone finds some points that are of interest. Comparative statistics in the form of curves are especially interesting, for it is usually easier to appreciate the progress of the subjects dealt with when they are represented as plotted lines than when they are in the form of figures.

As an advertisement the Chicago Edison Company has brought forth a comparison of the cost of electric lighting in Chicago and items of living



Copyright, 1906, Wm. D. McJunkin Advertising Agency, Chicago.

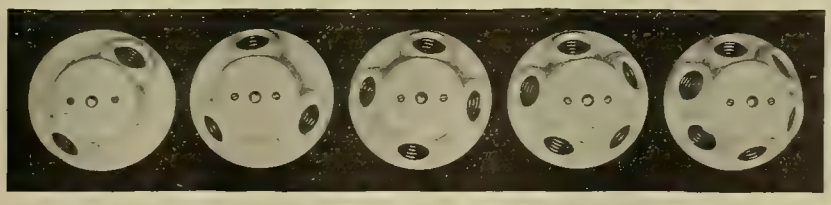
expenses, a reproduction of which is given. The "ad" appears in this form in the Chicago daily newspapers, and in the street and elevated railway cars it appears reproduced in eight colors and with the width of the diagram greater than the height. The idea was originated by Mr. John F. Gilchrist of the Edison Company and it certainly makes a good impression upon the reader.

The Harter Cluster.

The incandescent lamp cluster illustrated here has many commendable features. It is molded in one piece and is therefore strong and substantial.

THE HARTER CLUSTER.

All metal parts are pure copper and are insulated and held in place by being cast into the body of the cluster. The body which surrounds the metal parts is cast of opal glass. It is thus apparent that the whole device is weatherproof, never tarnishes and is easily cleaned. The clusters are adapted for series or multiple operation, and are made for attachment to three-eighths or one-half-inch pipe, shade holders for either size being supplied. These clusters take little time to install and do not require insulating joints. A Hart switch or any pendant switch may be used without changing cluster. Bodies are cast for two, three, four, five or six lamps, as shown. The device is made by Harter & Co., 146 Fifth Avenue, Chicago, and is indorsed by the underwriters.



HARTER CLUSTERS FOR TWO TO SIX LAMPS.

The Status of the Electric Automobile.

In an article in the January Review of Reviews Harry B. Haines considers the automobile as it appeals to the average man. He has this to say of the electric type:

"The advocates of the electric car make these claims: Minimum care required for maximum service, noiseless running, clean lines, compactness, safety, and freedom from vibration. Electrics have no reciprocating parts, permitting the use of antifriction bearings throughout, and thus one gets greater results from smaller horsepower. There is nothing to freeze, burn or explode; one can start at a second's notice; there is no waste of material when not running; a single lever controls the power and another steers. The electric car is the easiest for a lady to drive, and there is increased durability resulting from the absence of machinery working at high speed.

"The disadvantages of the electric lie in the fact that its mileage is painfully limited; it is likely to be put out of business and beyond temporary repair by the touching of two wires in a short-circuit; it requires too much time to recharge batteries. There is no doubting the fact, however, that if a battery is ever perfected that will give a radius of 100 miles or more, the electric will come to be not only one of the most popular types of horseless vehicles, but 'the' most popular one. And even at present, it should be added, if one can afford the considerable expense of one's own charging plant, the electric has delightful possibilities within a moderate radius from home."

While the danger of short-circuiting is exaggerated, this comparison is interesting as coming from an apparently disinterested source.

Chicago Street-railway Situation.

A traction ordinance for the Chicago City Railway Company, complete in every detail, and another ordinance for the Chicago Union Traction Company, covering every point in controversy between the city and that corporation, was scheduled to be reported to the council committee on local transportation this week. Prospects seem to be good for completing the negotiations soon.

The Chicago City Railroad Company, in all respects with the exception of one word like its parent, the Chicago City Railway Company, has been incorporated and will be named in the Chicago City Railway Company's ordinance as the concern which will invade the North Side in case the Union Traction Company does not fulfill the terms and conditions of its ordinance for that division.

Mayor Dunne still insists on a referendum vote on the ordinance before the council attempts to take final action. He had a message before the aldermen at the last meeting asking them to support his view, but his request was turned down by a vote of 40 to 26, showing that the aldermen are opposed to further delay. Popular sentiment seems to be about four to one against delaying a settlement until the spring election.

A Government Telephone Traffic Manager Suggested.

The Secretary of the Treasury has taken occasion to call the attention of Congress to the matter of the telephone service furnished for the government officials in buildings under the control of his department. The present system, under which the service is paid for from appropriations or funds under the charge of the various bureaus or offices to which officials are attached, is by its very nature somewhat cumbersome, and it is believed that a different method, if adopted, would result in material benefit to the government.

It is the opinion of the secretary that the best and most economical results can only be obtained by placing the entire service under the control of some one official of the government. This would render it practicable to install private branch exchanges in all the larger buildings, which would furnish direct intercommunication between the various officials and also give them connections through the central exchange with outside telephones at less cost than is now paid. At the present time a large number of the smaller buildings have no telephone service, although it is needed. It is estimated that the appropriation needed for the change would be $165,618.

Indiana Telephone Items

The Farmers' Metropolitan Telephone Company has filed articles of incorporation and proposes to build in Palmyra and throughout Harrison County. The company will soon be in the market for equipment and material. A. N. Wolf is among the directors.

The Grammar Telephone Company of Grammar has purchased the Burnsville Telephone Company and will merge and operate the two systems under one management.

The Independent telephone companies operating in Indiana report an aggregate of 182,180 subscribers, which is an increase of 37,150 over those reported in 1905.

A. J. Bowser of Lake County, a member of the Legislature, has prepared a bill to make telephone companies common carriers and place them under the jurisdiction of the railroad commission.

The Richmond Home Telephone Company has increased its capital stock from $150,000 to $400,000. The company is building a new exchange and otherwise improving its plant.

Rate increases are announced as a general policy of a large number of telephone companies in Indiana.

The new Woodruff branch of the Central Union Telephone Company's Indianapolis exchange has been cut over and already about 1,000 lines are working through the new board. The board is designed for 3,000 immediate capacity, but will accommodate 9,600 lines ultimately. Every accessory to the exchange is of the latest design and has been installed in the most careful manner for permanent service. The exchange is housed in a substantial brick building in a district likely to extend rapidly eastward. Work is also going forward on the permanent Prospect exchange to serve the southeastern portion of the city. The north exchange is also being rebuilt and in the meantime work on the new general headquarters building goes on steadily.

Promoters of the Citizens' Independent Telephone Company of Evansville announce that they will ask the City Council for a franchise early this month. They say if the franchise is granted, work on the plant will start at once, and will be in operation in September. The system will cost $600,000.

The Cumberland Telephone Company has notified patrons in Petersburg, Pike County, that hereafter free service will be denied in Gibson and Dubois counties.

At a recent meeting of the directors of the Monroeville Home Telephone Company the following-named officers were elected: President, Samuel E. Mentzer; vice-president, Joseph Clemm; secretary-treasurer, G. E. Spake. It was decided to make some extensions and install some new equipments to the plant.

The Noble County Telephone Company at Albion has decided to install a new switchboard.

The wires of the Monticello Telephone Company became crossed with an electric-light wire and burned out the switchboard and destroyed the service on the 3d inst. The company is in the market for a new switchboard. S.

Ohio Telephone Notes.

It is reported that the Cincinnati and Suburban Bell Telephone Company will increase its capital stock from $5,000,000 to $8,000,000 within a short time. There is now outstanding $4,978,000 of the present stock. It is further said that $500,000 of the new stock will be issued in March and the remainder will be held in the treasury to be issued from time to time as needed.

The Cleveland Telephone Company, Cleveland, reports 30,232 subscribers on November 30th, a gain of over 25 per cent. within the last year. The company has planned some important improvements and will build a large addition to its main building, having purchased the land some time ago.

The Tuscarawas County Telephone Company has announced an advance in rates at Canal Dover from $24 to $30 for business service and from $12 to $18 for residence telephones. It is said that an attempt will be made to hold the company to the rates named in its franchise. The courts have decided, however, that a city or village council cannot make a contract as to rates. C.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has paid its gross-earnings tax to the state treasurer of Minnesota, the amount paid being $1,209,711.50, on the basis of three per cent. of the earnings.

The Board of Fire Commissioners of St. Paul has taken up the burying of telephone and other wires in the downtown district.

The Royal League recently instituted Blue Bell Council No. 260 in Minneapolis, consisting of 102 officers and employes of the Northwestern Telephone Exchange Company.

The December issue of the directory of the

Northwestern Telephone Exchange Company for Minneapolis and St. Paul shows a total of 37,000 subscribers in the two cities. Five months ago the total was 31,000. Four years ago the edition contained but 18,000, showing an increase of over 100 per cent. in four years.

The Dakota Central Telephone Company of Aberdeen, S. D., has secured an arrangement with the Northwestern Telephone Exchange Company for a two-minute rate for toll connections with the Twin Cities.

The Sebeka Telephone Company of Sebeka, Minn., has filed articles of incorporation with a capital stock of $10,000.

The Dayton (Iowa) Mutual Telephone Company has been incorporated with a capital of $25,000.

The Eden Mutual Telephone Company has filed articles of incorporation, and will build a telephone line near Odebolt, Iowa; capital, $5,000.

R.

Canadian Telephone News.

The public works department of the Alberta government is making arrangements for the construction of a public telephone line between Edmonton and Lloydminster, approximately 175 miles. Specifications have been completed, the men required for the work chosen and the government is now calling for tenders for the material required. Starting from Edmonton the route chosen for the trunk line follows the general direction of the Canadian Northern Railroad. Every town on the line between Edmonton and Lloydminster will be connected with the system, and later on inland towns will be connected by branch lines. The construction and material of the new line will be of the very best. Construction will be commenced as soon as the weather permits. About the time work commences on these lines both the Manitoba and Saskatchewan governments will also commence building government-owned long-distance lines.

In discussing the government's telephone policy, R. P. Roblin, premier of Manitoba, made the following statement to your representative: "The Manitoba government considers it to be its duty to construct long-distance telephone lines as quickly as possible. In the spring we will commence construction southward from Winnipeg to the international boundary where we will connect with the Twin City system, thereby getting communication with the South. As soon as this line has been started we will build to Portage la Prairie, and from there build branch lines southwest, due west and northwest. We expect to build at least 1,000 miles of long-distance telephone line before this time next year, and the department of public works is now preparing a list of the necessary materials. The local exchanges will be governed by the local conditions, but those who do not use the telephones will not contribute one cent to their cost; they will be self-supporting from the start; nothing will be added to the general taxes.

"We expect to give the people telephones for less than one-half the prices now charged by the Bell company and our long-distance charges will be less than half the rates now in vogue. As rapidly as possible we will cover the province with a network of long-distance lines."

R.

To Pass on Merits of Chicago Telephone Franchises.

To facilitate further work on the proposed telephone franchises presented by the Chicago Telephone Company and the Manufacturers' Telephone Company the Chicago City Council committee on gas, oil and electric light has engaged three experts to do the technical work in passing upon the respective merits of the proposed franchises. The men selected are Prof. Dugald C. Jackson of Madison, Wis.; George W. Wilder of Chicago, and W. H. Crumb, general superintendent of the Pittsburg and Allegheny Telephone Company. Each probably will receive $50 a day as compensation. Prof. H. E. Clifford of the Massachusetts Institute of Technology may be asked to make a report as to the cost of constructing and maintaining a telephone plant.

Telephonic Eavesdroppers Asked to Provide Battery Renewals.

The proprietors of the telephone exchanges at Pine Island and Oronoco, Minn., have given notice to their subscribers that the practice of listening-in on a party-line exhausts the individual batteries of the instrument and that the company will hereafter furnish only one set of batteries a year. Persons who exhaust their batteries "listening-in" on conversations will have to renew their own batteries.

It is reported that the Commonwealth Power Company will build a dam and make other improvements in Kalamazoo, Mich., during the coming year. The estimated cost of the improvements planned is $100,000.

Telephone Controversy in Boston.

By a vote of 11 to two the Boston aldermen have passed the order granting a franchise to the Metropolitan Home Telephone Company, notwithstanding Mayor Fitzgerald's veto. As the corporation counsel has ruled that the aldermen cannot legally grant this franchise, the mayor has instructed Wire Commissioner Kennedy and Superintendent of Streets Doyle to reject all the company's applications to open the streets and lay conduits for underground wires. When the question of passing the order over the mayor's veto came up before the aldermen, the two members who sustained the veto tried to get it assigned or laid on the table, and one of them made a long speech against the granting of the franchise, in which he said that it could be sold at public auction for $500,000, yet the aldermen were "ready to grant it for nothing to a company whose president was a professional organizer and the directors were two elevator boys." He said that the men interested in the company knew absolutely nothing about the telephone business. The motion for delaying action was based on the Bell company's statement that the figures regarding the Bell rates in western cities were wrong as given by the representatives of the new company.

The mayor's action in instructing the city officials not to permit the company to open the streets, will undoubtedly result in litigation, although, under the law, the superintendent of streets need not grant any permits between November 15th and April 15th. If the company desires to build pole lines, it will have to get a location for each pole from the aldermen, and the mayor declares he will veto any such order that comes before him.

GENERAL TELEPHONE NEWS.

The Arkansas Valley Telephone Company of Dodge City, Kan., has been incorporated with a capital stock of $60,000.

The Montana Independent Telephone Company has secured a site in Helena and will erect a new exchange to cost $25,000.

The Scottsville Telephone Company of Scottsville, Ky., has been incorporated with a capital stock of $25,000. E. H. Reynolds of Scottsville is interested.

The Shelby County Telephone Company has been incorporated in Shelbyville, Ky., with a capital stock of $120,000 by J. and B. A. Thomas of Shelbyville, and a number of others.

N. M. Gilmore of Union City, Ind., has succeeded C. E. Lee as manager of the Central Union Telephone Company at Portland, Ind. Mr. Lee is going to Anderson, Ind., for similar service.

Norton Rogers, local manager of the Central Union Telephone Company at Marion, Ind., was killed in the fatal railroad wreck at Washington, D. C., on New Years Day. Mr. Rogers was an experienced and capable telephone man.

The new Independent Telephone Company is preparing to open offices in the Bee Building at Omaha, Neb., where the company will have its headquarters until the new exchange building is completed. Active operations on the new system will be started in a few days.

John R. Allen of Minneapolis has been appointed local manager of the exchange at St. Cloud, Minn., of the Northwestern Telephone Exchange Company, succeeding J. W. Howatt, who is promoted to district manager, with headquarters at Wadena, Minn.

The Chicago Telephone Company's December report shows 1,443 new telephones were installed in the city and 801 in the country, making a total increase of 2,244. The company on January 1st had 170,833 telephones in service, 123,177 in the city and 47,656 in the country.

The Cairo Home Telephone Company and the Central Home Telephone Company of Cairo, Ill., will consolidate and operate under the name of the Home Telephone Company. Much new equipment will be purchased, and a new building erected. Hal R. Aisthorpe will be president.

The Newburg Telephone Company of Newburg, N. Y., has been incorporated with a capital stock of $150,000 for the purpose of operating lines in Orange, Rockland, Ulster, Dutchess, Putnam and Westchester counties. Henry J. Prince, Howard Hendrickson and others are the incorporators.

C. P. Wainman, vice-president and general manager of the Northwestern Telephone Exchange Company, Minneapolis, has been relieved of his duties as general manager and will devote his time to the work incumbent upon the vice-president, particularly with reference to questions of telephone policy. C. M. Mauseau, assistant general manager, has been made general manager, and will attend to the details of management of the company in Minnesota and the Dakotas.

CORRESPONDENCE.

Continental Europe.

Paris, December 24.—Quite a number of interesting electrical devices were to be seen at the Paris Automobile Show. Among these is an electrolytic apparatus brought out by De Faria for converting alternating to direct current. It is based on the principle that when a current is passed between an aluminum and a lead electrode, the current passes easily when the aluminum is the cathode, but it is cut off when it acts as the anode, owing to the instantaneous formation of a film of alumina, which gives a high resistance to the current. By properly designing the apparatus, a circulation is kept up in the liquid which prevents polarization or overheating. Among the main uses of such a device are the charging of storage batteries, working of induction coils, arc lamps and motors and galvanoplastic work.

Another new apparatus, known as the "Universelle," consists of a small dynamo which is mounted so as to be run by the engine of an automobile, and it charges a few cells of storage battery. In this way the car has a source of current which can be utilized in a variety of ways, especially for starting up the engine without the use of a starting handle, by making the dynamo work as a motor on the battery. Ignition current for the motor is also furnished, and another point is the electric lighting of the inside of the car as well as the headlights. A rather original idea is to put the field resistance coil inside the hand-steering wheel, so that it is heated up, and the chauffeur is not chilled by the cold metal. The expense of the apparatus, which is a small one and not much larger than an ordinary magneto, is about made up by the absence of the latter, as well as extra spark coils, acetylene or oil lamps, etc., and it is quite easy to fit it on the car. The dynamo weighs about 60 pounds.

Among the electric automobiles at the show, the "Electromotion" system, designed by Balachowsky and Caire, was noted. It has the advantage of a greater simplicity than most others, as the motors have no gearing whatever, but are mounted within the rear wheels, using a direct drive upon these. Each motor gives about five horsepower, and it is of a round form, contained in an enclosed casing, which is about half the diameter of the wheel, and forms the hub. One point to be observed is the arrangement of the commutator, which is of the drum type, with the segments placed around the inner surface, with six brushes placed in a revolving brush-holder passing upon it. In these cars the controller is replaced by a simple speed-changing contact drum, contained in a small aluminum box, and it gives six speeds by operating a lever, with absence of sparking. An electric cab for public use is now running on trial in Berlin, and it is expected to introduce it soon in Paris and elsewhere.

Stationary gasoline engines, mounted with small dynamos, are among the features of the show, and many of the leading automobile firms have gone into the manufacture of such groups. A number of new types have also appeared this year. Some of the engines are built to run upon crude oil, which gives them an increased application. Gas engines of the usual horizontal type, together with their producers, were also to be seen in the large annex at the Invalides. The Cazes explosion engine of the automobile type is built to run upon crude oil, and I noted a compact generating group having a two-cylinder upright engine mounted on the same base with a 12-kilowatt dynamo. Such groups are built up to 20 horsepower. The same firm builds a gasoline single-cylinder engine coupled to a small generator.

A method of mounting a dynamo group upon a floating support is brought out by the Delieuvin firm, and is claimed to have many advantages. Instead of having to build a well leveled masonry or cement foundation, they use a cubical sheet-iron tank in which is placed a hollow metal float. Upon the latter is mounted the small motor-dynamo set upon a wooden platform. Springs hold the float in place and adjust it. This obviates the installation of a separate water-cooling tank for the motor, and the exhaust pipe of the motor is made to run underneath the water, so as to avoid noise from this source. Such a foundation gives an almost entire absence of jarring, which will be appreciated.

A. de C.

Dominion of Canada.

Ottawa, January 5.—In 1905 the gross receipts of all the electric systems operating in Canada amounted to $9,367,125, as compared with $8,453,609 in the year previous, being an increase of $913,516. While it is not yet possible to give any correct estimate for the year just closed, there can be no doubt that the percentage of increase of gross and net earnings will be greater than that of 1905.

Canadian shareholders of Rio (Brazil) are not overburdened with news, but official information is being supplied to the English holders. One set of transmission lines is completed from Rio

dos Lagos to the power station in the outskirts of the city. The company expects to commence regular commercial distribution of current, generated by waterpower, from the advance station at Rio dos Lagos, about the 15th of March.

The Dominion government has received an offer from the De Forest company to install a wireless system to get over the treacherous gap in the Yukon line, between Ashcroft, B. C., and Teslin Lake, which has been the chief source of interruption in the telegraph service of the Yukon district during the winter months. The company offers to maintain communication over this gap for $50,000 a year, in addition to an allowance of $50,000 for cost of installation. The company also offers to cut the present telegraph rates in two. The present charge for messages from Ashcroft to Dawson is $3 for 10 words, and 20 cents for each additional word. The press rate on the government line is three cents a word for a minimum of 100 words.

The Dominion government has decided to put an export duty on electric power. A bill is to be introduced providing that no company can export power out of Ontario without a license. These licenses will be granted under regulations by the government. The government will reserve the power to place an export duty on power with a provision that any company that is supplying Canadian consumers with power at reasonable prices may be relieved from paying this export duty. At present there are a couple of Niagara power companies that export all they produce to Buffalo. In the future they will have to supply a certain percentage to Canadian consumers or face an export duty which will be practically prohibitive.

It is possible that the power-producing plant which the Montreal Light, Heat and Power Company is erecting some five miles from Vaudreuil Station will be completed early next fall. This Soulanges Canal development will add about 15,000 horsepower to the company's electric supply. The canal which the company is now cutting is 2,800 feet long from where it receives the surplus water of the Soulanges to where it delivers to the St. Lawrence. Plans were prepared by Mr. McLea Walbank and ground was broken in May last and work continued all summer. The canal is 160 feet wide at the bottom. The banks are 27 feet high, and being lined to a good depth with reinforced concrete, the sides are absolutely water-tight. The important part of the whole work, however, is the reinforced concrete dam, built across the lower end of the canal. The walls are a mass of concrete, in some places 79 feet deep by 155 feet wide, pierced by tunnels which will carry the water to and fro. On the dam proper, which is covered in and crossed by a macadamized road, making the machinery quite invisible, the power house will be constructed. The head of water provided for by the plans will give 50 feet, while 5,350 horsepower will be provided by each of the three units. This Soulanges development comes second in importance to that of Chambly. A. V. W.

New England.

Boston, January 5.—The New England Electric Cab Company is to occupy a building to be erected at Nos. 169 to 173 Huntington Avenue, Boston. The building will be three stories high and will probably be completed by March.

The Cook Electric Company of Greenfield, Mass., has been incorporated. It has a capital of $3,000 and Charles L. Cook, Elisha H. Brewster and Lorrin D. Newhall are the incorporators. The company does a general installation business.

A Superior Court jury disagreed in the suit of Hall Curtis et al. vs. the Boston Elevated Railway Company, in which the plaintiffs sued for $100,000 on account of injury done to their property by the construction and operation of the elevated road.

The Massachusetts Gas and Electric Light Commission has held a hearing on the Quincy Electric Light and Power Company's petition for approval of an issue of new capital stock amounting to $50,000. There was no opposition to the granting of the petition. The company's present capital is $150,000, and it has a floating debt of $100,000, which it will reduce by the proceeds of the new stock, if issued.

The Boston and Northern Street Railway Company reports for the year ended September 30th: Gross earnings, $4,412,036; operating expenses, $2,802,001; net earnings, $1,610,035; other income, $14,072; charges, $944,705; dividends, $537,160; surplus, $142,211; passengers carried, 88,849,762; car miles run, 16,467,651; average number of employes, 2,582.

An electrically heated air bath has been placed in the research chemical laboratory of the Worcester Polytechnic Institute. The department of physics of the institute has obtained a motor-generator to be used for charging the storage battery, running the projection lanterns, and in work where constant direct current is required. It was furnished by the Fort Wayne Electric Works.

The Bar Harbor and Union River Power Company has completed plans for a hydro-electric plant with an initial capacity of 2,500 horsepower at Ellsworth, Me., and it will be arranged so that the power can be raised to 20,000 horsepower. A power transmission line will be built from this plant to Mt. Desert Island, and the electric-light and power systems in Ellsworth will be rebuilt.

The Electrical Switch Plate Company of Hartford, Conn., has been incorporated with a capital of $50,000, and it was incorporated by John Alexander, William H. Miller, Daniel H. Judd and Francis H. Peabody of Hartford, and Oscar E. Joos of New Haven, Conn. The company will make a switch plate patented by John Alexander, and other electrical specialties. B.

New York.

New York City, January 5.—The electrification of the New York, New Haven and Hartford railroad between Woodlawn and Stanford is rapidly nearing completion. The work of placing the overhead wires in position will probably be finished by the 10th of the month, and the motors will be placed in operation as soon as the Harlem division of the New York Central lines is equipped with the third-rail system, which, it is said, will be not later than February 1st. The overhead wires between Mount Vernon and Woodlawn Junction, where the New Haven and Harlem roads merge—a distance of probably two miles—are being placed, and when this is completed the line will be practically ready for the operation of electric motors south to Woodlawn and to Grand Central Station as soon as the Central's system is completed.

The project for a cheap electric cab service for New York city to supersede the expensive and somewhat antiquated system now in use has again come to the surface. Paul LaCroix, the representative of a French automobile manufacturing concern, has during the past month been actively engaged in the promotion of a company here for the purpose of providing electric cabs and hansoms (which, he says, are to be of splendid design and perfect comfort) to convey passengers to different parts of the city at a rate of about 50 cents a mile. This service will be somewhat similar to that now in operation in London and Paris, with such changes as local conditions may require.

One of the New York dailies had a long and interesting telephonic conversation with its representative, who was with a demonstrating party on a train between Northville and Canellton, Ky. The new application is the invention of Dr. A. D. Ford of Louisville. The train was running at the rate of 20 miles an hour, but not the slightest difficulty was found in maintaining an extended conversation. In fact the service seemed to be as good as the ordinary local service. The dream of a telephone booth in every car, placing every traveler within instant communication with home or business connections, is not altogether a new one. The threshing out of the many difficulties that had to be overcome before the dream could be a reality has taken some time, but they are being steadily swept away, and the time is probably not far distant when a practical system of communication with moving trains will be solved and a telephone booth in a railroad car will be as familiar an object as the sign on the street.

Justice Burr of the Supreme Court has just handed down a decision in the suit of the Edison Electric Illuminating Company against the city, which, as far as it goes, is a substantial victory for the company. The court holds that the plaintiff in the first and the second clauses of action must establish the fair and reasonable value of the commodity furnished to the city, while in the third cause of action he decides that the company is entitled to recover the full contract price agreed upon between the lighting company and the city officials. In this third cause of action the plaintiff laid claim to the sum of $616,125.21 for furnishing light, heat and power to the city between March 16, 1904, and March 15, 1905. This sum, the court says, the company is entitled to in full.

Suits to recover upward of $3,600,000 from lighting companies may be brought by the city as the result of a decision just handed down by the Appellate Division of Brooklyn in the case of the Armour Packing Company against the Edison Electric Illuminating Company of that borough. The Armour company showed that it was paying more than certain other consumers, and said that it was entitled to receive the difference. The contention of the Edison company that the payments made by the Armour company were pursuant to a written contract, was not sustained by the court. "Both reason and authority," says the decision, "sustain the plaintiff's contention that the defendant, engaged in public service, may not discriminate against it in favor of others in charges for the same service and under the same conditions." It is said that there is a difference of from 40 to 50 per cent. in prices charged to the city as compared with those charged to individuals, and the amount paid the lighting companies by the city for the last six years aggregates approximately the sum of $9,000,000. Upon this the city may be entitled to receive from 40 to 50 per cent., or, in other words, at least $3,600,000. It is likely that the matter will go to the Court of Appeals.

A rapid and wholly unexpected movement in copper that did not originate in Wall Street took place last Thursday. The operation was successfully conducted by a gang of wire thieves who lifted about a thousand feet of copper wire from the poles of the New York and New Jersey Telephone Company on the Merrick Road. The loss was not discovered until the following morning, when the company found itself short of copper to the amount mentioned.

The American Society of Mechanical Engineers and the American Institute of Mining Engineers have taken formal possession of their new and luxurious quarters in the Engineers' Building, just erected at 25-35 West Thirty-ninth Street. It cannot be said that they have actually moved in yet, as the libraries of both associations still remain at the old rooms, but they expect that before the middle of the month they will be fully established and have everything running in tip-top order. The American Society of Mechanical Engineers has issued a notice of a meeting to be held in the main auditorium of the new building on Tuesday, January 8th. As this will be the first meeting amid the new surroundings, invitations have been extended to the members of the American Institute of Mining Engineers and of the American Institute of Electrical Engineers to be present. The meeting will be addressed by Fredreck P. Fish, president of the American Telephone and Telegraph Company on the subject "The Ethics of Trade Secrets in Relation to the Patent System." The American Institute of Electrical Engineers seems to have a lingering affection for its present quarters, and has as yet made no change either in the executive or library departments; it has not been thought wise to separate the two departments even temporarily. The Institute is quietly making preparations for a general moving and expects that February 1st will find it fully installed in the rooms in the Engineers' Building, where, with enlarged facilities and closer association with kindred associations, the society may extend its efforts into new fields of usefulness. D. E. P.

Southeastern States.

Charlotte, N. C., January 5.—The town of Rocky Mount, N. C., has decided to offer a franchise for an electric railway. Several applications have been made. The successful bidders must pay a property tax during the first five years; a tax of six per cent. on gross receipts for the next 10 years, and a nine per cent. tax on gross receipts afterward, the term of the franchise to be 50 years.

Experts have given the opinion that the large dam at the Buckhorn Shoals on Cape Fear River, built for electrical development, will have to be taken down entirely on account of defective work, which it is claimed renders the dam useless.

The Southern Power Company, in carrying out plans to develop more power at Rock Creek on the Catawba River, is extending its railroad from Fort Lawn, S. C., to the point indicated, from Great Falls. There is said to be more available power between Rock Creek and Fishing Creek, about 15 miles apart, than in any similar distance along any stream, there being, according to estimate, 65,000 horsepower within the designated 15 miles. The plant at Rock Creek will be completed by January 1, 1908.

Green River Falls, near Zirconia, N. C., have been bought by S. B. Tanner of Henrietta, N. C., and associates, according to a recent report, and will be developed electrically.

The Asheville (N. C.) Rapid Transit Company has been organized to take over the Asheville Loop Line, to run to Burnsville, three miles from the terminus of the city lines. Charles E. Van Bibber of Walden, Mass., is interested, and the authorized capital is $500,000.

Three routes have been surveyed for the Atlanta, Griffin and Macon electric railway, and plans have been perfected for the purchase of the equipment. The road is to be built by the Georgia Construction Company and will be one of the longest electric lines in the South.

The scope of the project to develop power along the Muscle Shoals may be greatly increased if Congress shall grant certain amendments to its recent act, to permit the creation of slack water to inundate the canal.

The recently projected $10,000,000 Public Service Corporation of South Carolina has filed with the Business League of Abbeville a map of the proposed system of electric railways, the most extensive perhaps in the South. The map shows lines originating at Charleston, thence to Columbia, where two branches start, one to Greenville, entirely across the state, passing through Abbeville, thence from Greenville to Spartanburg, and back to Columbia, about 300 miles of track. It is also said that a line may be built to Charlotte, N. C.

The White City Electric Light, Heat and Power Company has filed articles of incorporation in Kentucky, with $300,000 capital. R. D. Bakrow, C. C. McClarty, John M. Sharp and others are the incorporators.

The Tidewater Development Company has secured a general franchise in North Birmingham

and has also completed the detailed route, as desired by the company for the new electric railway, work on which will be started, it is believed, in the near future.

Electric lights for the famous Luray caverns near Luray, Va., are now assured, according to reports from Luray, which state that the Luray dam has been completed in the Shenandoah River at a cost of $62,000 and will generate sufficient power to light the town of Luray and the Luray caverns. L.

Ohio.

Cleveland, January 5.—The local street-railway war in Cleveland has taken the form of a legal battle now. So many injunctions have been issued against the low-fare companies that they will hardly be able to proceed further until some of them are decided. The most important, of course, is in the Supreme Court at Washington and involves the Central Avenue franchise, but, however that may be decided, several in the lower courts will have to be gotten out of the way before much can be done.

Specifications have been prepared by Superintendent M. M. Reid of the municipal lighting plant at Columbus for an additional 1,000-kilowatt generator and the appliances that accompany it, and they have been approved by the Board of Public Safety. It is said that the plant is now loaded to its capacity and there is danger of a breakdown at any time.

The office of the De Forest Wireless Telegraph Company at Cleveland has been closed and will probably not be reopened until the Poulsen invention is ready for use. It is asserted that the office did not pay because there are so few inland plants.

According to reports the Columbus Railway and Light Company took in 60,000,000 fares during the year of 1906, including the transfers. The receipts were approximately $1,540,000, making the average fare with transfers 2.6 cents, and, without considering the transfers, a little less than 4 cents. The company sells seven tickets for a quarter, but the cash fares brought the average up somewhat.

The Toledo Railways and Light Company has increased the wages of conductors and motormen 2 cents an hour, making the rate for the first-year men 20 cents; second-year, 21 cents; third-year, 22 cents, and fourth-year and thereafter, 23 cents.

The old lines of the Toledo Heating and Lighting Company, Toledo, are being reconstructed by the merger company and are being placed high enough so that the shade trees will not interfere with them. Recently several of them have been crippled by coming into contact with trees when they were wet from rains.

H. R. Allensworth of Columbus has invented a system of wireless telegraphy and is working now to establish stations in that city and at Toledo. His system has not been patented and he is yet experimenting upon some parts of it, although it has been tested and found to work well, it is said.

The city solicitor of Youngstown has prepared an ordinance granting renewal of franchise and extensions of certain lines on condition that the company reduce the fare to 5 cents cash, six tickets for a quarter, 13 tickets for 50 cents, and 27 for $1 until the receipts reach $1,250,000, after which another reduction is to be made to seven tickets for a quarter, 14 for 50 cents, and 28 for $1, children under six years old to be carried free, and from that age to 16 at 16 tickets for 50 cents and 33 for $1. In addition the city is to have the privilege of purchasing the lines after January 1, 1922, or to withdraw the grant that has been made.

Although the Cleveland Electric Illuminating Company has contracted to furnish arc lights for the streets of the city at $1.80 less than the 1905 price, the Board of Public Service is arranging to extend the service of the municipal plant in Brooklyn to include a large portion of the West Side. At present there are 223 lights on the circuit, but orders have been received that will shortly increase that number to 500, it is said. The idea of the city authorities is to try out the municipal plant, and if they find that they can supply the city as cheaply as it is being done by a private company, the plant will be enlarged to meet the requirements. Server Springborn said that they believe the service can be had at $60 a lamp.

The plant of the New York and Ohio Incandescent Lamp Company of Niles will be doubled in capacity through the purchase of the buildings formerly occupied by the Ohio Automobile Company. This company has found its business growing at such a rate that more space was needed at once.

The company recently incorporated to take over the assets of the old Miami and Erie Canal Transportation Company is now endeavoring to secure the deposit of all the bonds with it. The new company has a capital stock of $200,000, and the amount of the bonds issued by the old company is $2,000,000. In lieu of the bonds, the holders are offered one share of stock of the new company for each bond of $1,000. It is supposed that the company is planning to get matters in readiness and hold the bonds to take advantage of the rights which the company may have under the franchise granted by the state several years ago. O. M. C.

Michigan.

Grand Rapids, January 6.—Governor Warner has put in his message and the Legislature is considering further restrictions in the way of state supervision of electric railways. Several representatives regard the street-railway supervision clause of the Governor's message as pointing the way to state control instead of local franchises.

The Houghton County Electric Light Company has ordered a Curtis steam turbine and the machine will be installed in the plant at Houghton by October 1, 1907.

Beginning with the January bills there will be a reduction in the rates for electric lighting of the Detroit Edison Company. The reduction is in the method of arriving at the basis of the house-lighting charges. At present one bedroom is generally deducted; hereafter three bedrooms will be deducted. The company figures on a basis of two units per room. Deducting three bedrooms is equivalent to reducing the maximum amount of electricity that must be used at 16 cents per unit by six units. If a household has only two bedrooms, four units per month are deducted. If only one bedroom, two units. No household, however, is permitted to drop below a minimum total of six units per month in the basis of charges. The company has 7,887 household consumers and the reduction will affect between 5,000 and 6,000. It means a reduction of about $30,000 based on the estimate of next year's business.

Suttons Bay now has an electric-light plant.

The Grand Rapids-Muskegon Electric Company is delivering power into this city without a franchise. W. A. Foote, the head of the company, says it needs no franchise because its wires come into the city over its private right-of-way. The company is selling power to the Grand Rapids and Indiana railroad shops. The wires are strung over the Grand Rapids and Indiana right-of-way. Several factories are taking power from the Muskegon company, but these factories are reached over private rights-of-way. The interurbans are also customers of the Muskegon company, but they are supplied from without the city limits. If the city buys the power of the company it, too, must provide the right-of-way to its plant. An effort may be made to compel the company to get a franchise.

Kalamazoo city officials favor granting the Michigan United Railways a new franchise to be operative 30 years and to replace the one now in force, and its mayor opposes any municipal-ownership clause. If granted the company will at once bond for extensive improvements. L. W. B.

Indiana.

Indianapolis, January 5.—The opening of the Indianapolis and Cincinnati traction line between Shelbyville and Greensburg that was to have been celebrated January 1st has been postponed until February 1st. This postponement was due to the inability to secure necessary material to complete the small link remaining to be closed.

In addition to the bill prepared to be introduced in the Legislature for a one-cent-a-mile rate for interurban traffic another bill has been prepared providing for the compulsory building of interurban waiting rooms in all cities of the state of over 25,000 population; also a bill providing for the adequate heating of the vestibule on all electric cars occupied by motormen.

It is reported from what is deemed a reliable source that Chicago capitalists have purchased and will soon take over the Columbus Street Railway and Light Company, now owned by John S. Crump. It is said to be the purpose of the purchasers to incorporate a new company with a capital stock of $300,000 to take charge of the property, while a new power and heating plant may be erected soon.

Charles T. Mordock, manager of the Terre Haute Traction and Light Company, is having serious trouble with the authorities in relation to a city ordinance regulating street-railway service. The ordinance in question went into effect the first day of the month. A lawsuit will test the power of a City Council to make such regulation. The company's franchise says the council may require service that is reasonable, and is furnished in cities of like population, etc. The company says it is a physical impossibility to comply with the ordinance as to a faster schedule—eight minutes throughout the day—except in the evening, when it is to be six minutes. As a result of the controversy the city has refused to pay the company for lighting the streets. This is partly due, however, to a claim that the candlepower is not up to stipulation. The whole trouble regarding the public service of transportation and street lighting is to be fought out in the courts.

The City Council of Peru has turned down the proposition of the Electric Light Company for the purchase of the plant by the city. The City Council is opposed to municipal ownership of the light plant and stands ready to grant a franchise to any responsible company to light the city. The contract with the present company has expired.

The City Council of Kokomo has passed an ordinance providing for the securing of bids for the installation of a fire and police alarm system. S. S.

Illinois.

Peoria, January 5.—The commissioner of public works of this city has advertised for bids for lighting the city, calling for not less than 770 arc lights on all-night and every night schedule for one, two and five years from February 1, 1907. Bids will be received till 12 o'clock noon January 21st.

The Monmouth Gas and Electric Company has announced a reduction of 25 per cent. on electric-light rates for the new year, with a further discount of 10 per cent. for cash.

The Princeton Light and Power Company of Princeton has been incorporated, capital $25,000, to furnish public utilities. Incorporators are F. C. Duncan, H. E. Chubbuck and Cairo A. Trimble.

A new utilities company has been organized in Springfield and is getting plans ready for the building of a plant. A petition will be presented to the council for a franchise. John H. Brinkerhoff states that they will furnish light and heat.

John Finley, formerly manager of the Peoria Street Railways, has returned from a two-month trip to Panama and Cuba. Mr. Finley has decided to remain in Peoria, and may become connected with the Illinois Traction Company.

The Peoria Light Company, a company recently formed under New Jersey laws, is a holding company for the Peoria Gas and Electric Company. The organization of the Peoria Gas and Electric Company still remains in force and will continue under the laws of Illinois. The new company issues stock in the sum of $5,000,000, one-half of which will be used for the improvement of the Peoria property and the remainder to take up the old indebtedness of the company.

Judge Humphrey, in the United States Circuit Court at Springfield, has ordered the sale of the Peoria and Pekin Terminal Railway for the benefit of the bondholders, under the decree of foreclosure entered two weeks ago. The court ordered the master in chancery to set the date of sale, which will probably be February 15th. The price set by the court is $600,000.

President McKinley and some of the directors of the Illinois Traction Company, while in St. Louis a few days ago, considered the advisability of building a bridge of their own over the Mississippi. They now run to the river at Venice and have an ordinance pending in the St. Louis council. Besides, they have purchased property valued at $800,000 for terminals. They now have ferry contracts arranged by which they can transport their cars across the river till the bridge is built. The electric line between Princeton and Seneca now owned by this company will be made a part of the Peoria-Chicago line, building from Peoria to Joliet. Not counting the Peoria-Bloomington line, the company has spent $2,250,000 during the last year on the various properties.

Much depends upon the decision of the State Railway and Warehouse Commission. The property owners on South Washington Street have asked an opinion from the commission on the question of compulsion of steam roads to accept and deliver cars to interurban lines. Two companies are asking franchises on this street, and the organization of property owners controls the majority of frontage, and until this question is settled will not sign for either company.

The Peoria Gas and Electric Company has accepted the franchise recently granted it by the Common Council and has sent the city clerk a check for $13,252.92 as settlement of claims in the suit which was pending between the company and the city.

The Illinois Traction Company is about to inaugurate the new sleeping-car service between Bloomington and St. Louis. Two cars will be run, the "Decatur" and "Springfield." Both are large modern sleepers and are well equipped. The rate will be $1. The company has finished another portable sub-station, and it has been put in service. V. N.

Northwestern States.

Minneapolis, January 5.—The Twin City Rapid Transit Company has announced that it will build extensions to its Lake Minnetonka line in the spring. The line will be extended from Excelsior to Birch Bluff, a distance of about two miles. The company has also purchased the railroad from Manitou to Tonka Bay, and will convert it into an electric line. The total cost of the extensions will be $60,000.

Active steps are being taken by the proposed electric line from Gilmanton, Wis., to La Crosse, Wis., and Winona, Minn., and it will probably be extended to Eau Claire, Wis. The cost of con-

struction is estimated at $8,000 a mile. C. J. Sund of Gilmanton is one of the leading promoters.

F. M. Mills of Benton Harbor, Mich., has announced that he is purchasing material for the new street-railway system for which he will be granted a franchise at Sioux Falls, S. D.

Aug. Carlson has been appointed superintendent of the electric-light plant at Morris, Minn.

F. E. Baker of Oskaloosa has purchased the electric-light plant at Pella, Iowa, for $12,000.

Reports are current that the Badger waterpower, at Kaukauna, Wis., is to be utilized next spring in the operation of a large electric plant, which will furnish power for one of the new interurbans to enter Kaukauna. R.

Mexico.

Mexico City, January 2.—An enormous amount of American capital has been invested in electrical enterprises in Mexico during the last year. While a group of Canadian capitalists take the lead in this character of investment in the matter of the size of the enterprises which they are establishing, American investors have outstripped all others in point of numbers. Many of the best paying mines of Mexico are owned by Americans, and it is in these that electrical installations have been made. Americans are also taking the lead in the development of the waterpowers of Mexico. In the mountainous regions of this country there are many waterfalls which afford ideal locations for hydro-electric plants. The electrical supply houses in Mexico City, Monterey and other towns of the republic all report an unusually large business during the last year.

The Pinguico Mines Company of Guanajuato will install 50 additional motors in its mines and mill. The mines of this company were equipped some time ago with electric hoists and electric pumps. This company, as well as all of the other leading mining companies operating in the Guanajuato district, obtain electric power from the Guanajuato Electric Light and Power Company. The transmission lines of this company run to the Guanajuato district from El Duro, where its hydro-electric plant is located. In addition to furnishing the numerous mines with electric power, the company also furnishes power for operating electric tram lines for handling the ore between the various mines and mills. The introduction of electricity into the Guanajuato district has cheapened to a marked degree the cost of mining operations and has greatly increased the ore output.

The Negociation Minera de Maravillas y Anexas, which operates large mines in the Pachuca district, has just installed a large electric double-drum hoist. It is operated by a 225-horsepower hoisting motor.

Compania Industrial de Guadalajara is preparing to build a transmission line from its power plant at Las Juntas to the Etzarlan mining district, state of Jalisco. It is estimated that the line will cost about $200,000.

Electric plants for pumping water for irrigation purposes are being installed in different parts of Mexico. A large number of electric pumps are being installed near Ocatlan, state of Jalisco, by the Lake Chapala Agriculture and Improvement Company. An electric irrigation plant is also being installed on the Castillo hacienda in the state of Jalisco.

Compania Agricola y Fuerza Electrica of Santa Rosalia, state of Chihuahua, will soon let the contract for the installation of a hydro-electric plant on the Conchos River, near Santa Rosalia. The waterpower is expected to develop about 3,500 horsepower. This power will be transmitted to the cities of Chihuahua, Parral, Jiminez and Santa Rosalia. Paul C. Ginther of Santa Rosalia is largely interested in the proposed enterprise.

Max H. Lange, an American engineer of Mexico City, will install a large hydro-electric plant on the Azul River in the state of Guerrero. The plant will be located near the town of Cololtipa. Transmission lines will be built to the city of Chilpancingo and other towns and industrial centers in the state.

The street-railway system in San Luis Potosi has been sold to Jose Dominguez for $250,000. Mr. Dominguez will extend the system and will convert it from mule to electric traction.

The electric street-railway system of Torreon and the interurban electric line which runs between Torreon and Lerdo have been purchased by the Torreon and Leredo Electric Tramways Company. The system is to be extended and otherwise improved by the new company, which has increased its capital stock $100,000 for the purpose.

A company of Mexican capitalists has been formed for the purpose of constructing a system of electric railways in Parral. Rodolfo Valles is president of the company, which has a capital stock of $110,000. The contract for its construction will be let as soon as the surveys are finished.

J. C. Dillert of San Francisco has been investigating the situation at Mazatlan with a view of constructing a system of electric street railways. It is reported that the Harriman interests are back of the project. It is planned to have the new system finished and ready for operation by the time the extension of the Southern Pacific Railroad is completed to Mazatlan. W. D. H.

Pacific Slope.

San Francisco, January 3.—The threatened strike of the members of Local Union No. 6, composed of the members of the Inside Wiremen's Union, who had demanded $6 for an eight-hour day in place of $5 a day, came off as scheduled on January 2d. As many of the electrical contractors had already acceded to the terms of the men, there was not, however, so much interference with business as was expected by some. The strike is without the indorsement of the Building Trades Council and there is but little probability of it spreading to other trades.

The Oakland Traction Company is building 20 new 50-foot electric cars at its shops near its Yerba Buena power station on the outskirts of Oakland. They will be equipped with cross seats similar to those on the United Railroad's Ellis Street cars in this city. Twenty 55-foot suburban electric cars for the San Leandro and Haywards line will be built with steel frames. The company built 70 cars at its shops last year and is still short of rolling stock as the traffic is almost double what it was a year ago.

The Pacific Telephone and Telegraph Company has just been incorporated at Martinez, Cal., with a capital stock of $50,000,000, of which $32,000,000 is preferred and $18,000,000 common stock. This new company has taken over the Sunset Telephone and Telegraph Company and the Pacific States Telephone and Telegraph Company. All the California property of the Pacific States Company is acquired by purchase and the balance of the property of this company and all of the property of the Sunset Company are acquired on long leases. The lines acquired cover the entire coast including California, Oregon, Washington, Nevada, Idaho and Arizona. It is the intention of the company to issue $35,000,000 in five per cent. bonds, the proceeds from the sale of which will be devoted entirely to improvements and extensions of the system.

Reports are again current that the property owned by the Pacific Gas and Electric Company is to pass into the control of the Western Power Company, and these reports seem to receive credence in conservative quarters. According to these reports a syndicate, headed by President Edwin Hawley of the Western Power Company is negotiating for a large block of the common stock of the Pacific Gas and Electric Company held by N. W. Halsey & Co., of New York and San Francisco. When the deal is completed $20,000,000 out of a total of $24,000,000 of common stock will have changed hands carrying with it the control of the Pacific company.

The board of supervisors of Stanislaus County will receive bids at Modesto, Cal., till January 16th for the installing of an electric plant for pumping purposes at the county hospital.

The board of trustees of Compton, Cal., will receive bids up to February 19th for a franchise for the construction and operating of an electrical plant to furnish light and power in that town. It is understood that the franchise will be purchased by G. R. Fulton who, with his associates, purpose establishing a plant at a cost of $22,000.

Dr. J. Limm, of the Mexico-Chinese Bank of Torreon, Mex., has obtained a concession for the building and operating of another electrical street-car line in that city.

The Los Angeles Railway Company of Los Angeles, Cal., is preparing to extend its present Stephenson Avenue line up Indiana Street to Fifth Street. The new line is to be in operation within one month.

E. Bartlett Webster, president of the Bartlett Estate Company, has asked the San Diego, Cal., council to have a franchise framed and offered for sale for an electric street railway either on El Cajon Avenue or on University Boulevard from Thirtieth Street to the east line of the city limits.

L. B. Wickersham, of Albany, Ore., has filed a notice of the appropriation of 120,000 miners inches of water from the north fork of the Santiam River, between Linn and Marion counties, for the purpose of developing electric power.

The city trustees of Berkeley, Cal., have finally accepted the bid of the Home Telephone Company of $47,000 for a telephone franchise in that city. A.

PERSONAL.

S. E. Leonard has been appointed superintendent of the new Denver district of the Western Union Telegraph Company.

John Stone Draper, a prominent resident of Oak Park, a suburb of Chicago, died on January 6th at his home. Mr. Draper built the first line of telegraph between Chicago and Milwaukee in the late '50's.

The following-named gentlemen will be the presidents of some of the sections at this year's meeting of the British Association at Leicester: A (Mathematics and Physics), Prof. A. E. H. Love, F. R. S.; B (Chemistry), Prof. A. Smithells, F. R. S.; G (Engineering), Prof. Silvanus P. Thompson, F. R. S.; L (Educational Science), Sir Philip Magnus.

Harry Wherland has resigned from his position as superintendent of the Spokane Traction Company. Mr. Wherland has been with the company since its inception, three years ago, and has had an active part in its development.

Mr. D. McNicol of the Postal Telegraph-cable Company has been transferred from Butte, Mont., to Salt Lake City, where he is local manager. Mr. McNicol is the author of the serial on "Wireless or Radio-telegraphy" now appearing in the Western Electrician.

J. W. Duntley, president of the Chicago Pneumatic Tool Company, sailed on January 7th for Europe to close up a number of new contracts for the company. He will return in time to attend the annual meeting of stockholders, which will be held on February 12th.

Edward R. Grier, who has been assistant manager of the Bryant Electric Company for a number of years, has just been elected vice-president of the Ajax Line Material Company of Chicago. Mr. Grier will maintain his location in the Postal Telegraph Building at New York looking after the eastern sales of the Ajax toggle-bolts and street-lighting specialties.

Upon the proposal of the Duke of Aosta, under recommendation of Professor Matteucci of Mt. Vesuvius Observatory and the request of Minister of Foreign Affairs Tittoni, King Victor Emmanuel III. has conferred the cross of "cavaliere ufficiale of the crown of Italy" upon Frank A. Perret of New York for his conduct and services in the cause of humanity and science during the great eruption of Vesuvius in April last. Mr. Perret was nominated by the University of Naples in 1905 as honorary assistant of the Royal Vesuvius Observatory, and with Prof. Matteucci and two others remained at his post throughout the terrific eruption of the past year, making invaluable observations and photographs. This is a special honor, as the title of "cavaliere ufficiale" is rarely conferred upon one man who has not already been decorated as simple "cavaliere."

Governor Hughes of New York state has announced the appointment of Mr. William J. Clark of New York as a delegate from that state to the national convention for the extension of the foreign commerce of the United States, which will be held at Washington, D. C., beginning Monday, January 14, 1907. Mr. Clark is general manager of the foreign department of the General Electric Company. For many years he has been interested in and studied the conditions of foreign commerce, and this appointment is a flattering recognition. There are few men in the United States who understand the commercial conditions, past and present, better than Mr. Clark. His book, "Commercial Cuba," is recognized as an authority on the subject. He has been a delegate to many important commercial conventions, and in 1905 was a member of the United States delegation at the International Railroad Congress held at Washington.

ELECTRIC LIGHTING.

Lohrville, Iowa, contemplates installing an electric-light plant.

Pewaukee, Wis., has voted the issuance of bonds for the erection of an electric-light plant.

The Council of De Soto, Minn., has granted a franchise to authorize A. M. Gee to construct a plant for gas and electric lighting.

The municipal electric-light plant at Marquette, Mich., will be remodeled and a new station constructed at a cost of $97,000.

A franchise has been granted to T. F. Golden of Ingalls, Mich., to establish an electric-light system in Stevenson, Mich.

The Mt. Pleasant (Utah) Mill and Power Company has purchased the business of the Mt. Pleasant Electric Light Company.

The Hennessey Electric Power Company of Hennessey, Okla., has been granted a franchise to establish an electric-light plant in that town.

The Home Light, Heat and Power Company of Pittsburg, Kan., has purchased the light and power business of the Pittsburg Railway and Light Company.

An election will be held at New Hampton, Ia., to vote on the question of issuing $18,000 in bonds for constructing a combination light and water plant.

A company has been organized in Brownsville, Texas, with a capital stock of $75,000, for the purpose of establishing an electric lighting plant. F. Champion is secretary.

The Kentucky Electric Company of Louisville has secured a site, 147 by 100 feet, for the location of a new power plant. Machinery and other material will be bought soon for the big plant, which will cover the greater part of the ground purchased.

The Monmouth (Ill.) Gas and Electric Company has announced a reduction of 25 per cent.

in the rates on electricity for lighting and power in that city for the new year.

The Palestine Electric Light Company will erect a new light and ice plant in Palestine, Texas, which will cost about $100,000.

A new electric-light company has petitioned the Council of Springfield, Ill., for franchise to furnish power for commercial purposes and for the residence district of that city.

The Columbiana Light and Power Company of Salem, Ohio, has been incorporated with a capital stock of $10,000 by C. C. Owens, Thomas N. Kirby, H. T. Clark and others.

The Merchants' Light, Heat and Power Company of Montreal, Que., has been chartered for the purpose of producing and furnishing light and power. R. R. DuTremblay is attorney.

The Lake Charles Ice, Light and Water Company of Lake Charles, La., has increased its capital stock from $100,000 to $150,000. Improvements are to be made in the light plant.

The Plankington Light and Power Company has been incorporated in Milwaukee, Wis., by W. W. Plankington, H. O. Upson and others. Application has been made for lighting streets in the Fourth Ward in Milwaukee.

The Texico Water and Light Company of Texico, N. M., has been incorporated, with a capital of $10,000, for the purpose of establishing a light plant and water system. R. Reagan and Ed. T. Massey are incorporators.

The Muskogee Gas and Electric Company of Oklahoma City and Muskogee, I. T., has been incorporated with a capital stock of $1,500,000. O. L. Avey and H. B. Carson and others, all of Oklahoma City, are the incorporators.

ELECTRIC RAILWAYS.

The suburban division of the electric railway in Lansing, Mich., will be improved and extended.

The City Council of Philadelphia, Pa., has granted a franchise to the Philadelphia Rapid Transit Company to extend its line through Lansdowne and Cardington.

The Town Council of Glencoe, Ill., passed an ordinance on January 3d giving a right-of-way through the town to the Chicago and Milwaukee Electric Railway. The franchise is perpetual.

The Rapid City (S. D.) Traction Company has been incorporated with a capital stock of $10,000 for the purpose of building a power plant on Rapid Creek at a cost of $250,000. F. N. Blockhart can be addressed.

It is now possible to travel from Boston, Mass., to Concord, N. H., a distance of 75 miles, by trolley. The first of the year the Goffs Falls, Litchfield and Hudson electric railway was opened and this line fills the last gap in the trolley connection.

The Geneva, Waterloo and Seneca Falls and Cayhuga Lake Traction Company in New York state has increased its capital stock from $450,000 to $1,000,000. The company proposes to issue bonds and extend the present line across Cayhuga Lake to Cayhuga Village, N. Y.

The 92 street railways operating in Massachusetts earned gross for the fiscal year ending September 30, 1906, $33,955,447, and net, $8,199,561. Of the entire 92 companies operating, only 29 paid dividends. The number of miles operated was 3,307.2 and 17,134 employes were required.

The Buffalo and Lake Erie Traction Company and the Erie Rapid Transit Company have filed a certificate of consolidation, under the title of the former company. The capital is $6,750,000, and the principal office is located in Buffalo. The directors are Louis B. Grant, W. J. Bagnell of Brooklyn, Joseph B. Mayer, Charles H. Werner and James A. Byrne of New York.

The Washington, Baltimore and Annapolis electric railway expects to institute a 75-minute schedule between Baltimore and the capital. The company will not build a power plant in Baltimore at present, on account of the fact that several are being built along the Susquehanna River. A contract has recently been made with the Potomac Electric Power Company of Washington to supply current to the first-named concern, and it is said that the hydro-electric companies will be able to furnish current more cheaply than can be had by steam generators.

Consul C. B. Harris of Nagasaki reports that the early construction of three electric railways in the northern portion of the Japanese Island of Kyushu is under contemplation. The first, to be built from Moji to Kokura, a distance of eight miles, estimated cost $350,000; the second, from Moji to Yawata, 12 miles in length, at a cost of $500,000, and the third, one of 23 miles, between the important towns of Fukuoka and Kokura, at an estimated cost of $1,250,000 gold. A light steam railway is also projected. Mr. Harris suggests that American electric and railway-supply houses send their catalogues, in the English language to the mayors and chambers of commerce of the cities of Nagasaki, Moji, Fukuoka, Kokura and Kumamoto, with the request that the catalogues be handed to the projectors of the lines under contemplation.

POWER TRANSMISSION.

Senator Clapp has introduced a bill to authorize the secretary of the interior to reserve for power sites all lands adjacent to falls and rapids in any stream within an Indian reservation before the surplus lands of the reservations are opened for settlement, the power sites to be disposed of to the highest bidder, either on sealed bids or at public auction.

The Southern Power Company of Charlotte, N. C., is securing estimates for a large water-power development, and is seeking figures on machinery that will approximate $350,000 in value. This will be used at the Ninty-nine Islands on Broad River and at Rocky Creek station on the Catawba River, an equal amount of machinery having already been purchased to supply the two stations named, together with the contemplated purchase mentioned.

The Kern River Power Plant No. 1 of the Edison Electric Company of Los Angeles is to have the gate valves on the 28-inch water gates controlling the hydro-electric equipment there operated by Allis-Chalmers vertical-shaft motors and gearing. The Kern River plants and transmission lines are well-known examples of the western type of power plant, feeding a 60,000-volt transmission line from a 25,000-horsepower station over a distance of 125 miles to Los Angeles.

It is stated that another large electrical development by English and Canadian capital is being inaugurated in Mexico. Mr. Frank Thompson and W. F. Tye, C. E., have just returned to Montreal from Mexico where they have been on behalf of the Canada Electric Syndicate. This syndicate is composed of a number of Canadian and English men, who already own and control several properties in Mexico, as well as elsewhere. Confidence in Canada and Canadian enterprise has been greatly enhanced by the large developments so successfully carried out by the Mexican Light and Power Company of Montreal.

PUBLICATIONS.

An illustrated list of fittings which have received the approval of the Underwriters' National Electrical Association has recently been published by the Electrocraft Publishing Company of Detroit, Mich. The list sells at 50 cents and should prove of value to users of electrical supplies.

The Chase-Shawmut Company of Newburyport, Mass., is distributing its new bulletin No. 36. This is a 12-page pamphlet in which is listed all of the company's lines of fuses and fuse fittings. The new N. E. C. single-pole barrier porcelain bases, the double and three-pole 100-ampere N. E. C. porcelains and the Shawmut extended terminal fuse are listed, among other things.

Mr. J. H. Smith announces that he has purchased the Electrical Age—a monthly electrical magazine in New York—formerly directed by Louis Cassier, deceased. The offices have been removed from the Cassier publication offices at 3 West Twenty-ninth Street, and the paper will henceforth be issued from 45 East Forty-second Street. Mr. Smith was formerly connected with The Electric Journal of Pittsburg.

The H. T. Paiste Company of Philadelphia has issued bulletin No. 38, describing and giving the prices of its well-known electric-light supplies. The bulletin is dated December and bears on its front cover, appropriately, a handsome colored picture of Santa Claus walking along a modern city road under an arc light. The bulletin is well illustrated throughout.

SOCIETIES AND SCHOOLS.

The Electric Club and the Civil Engineers' Club of Cleveland have removed from No. 1200 Schofield Building to No. 718 Caxton Building.

The proceedings of the twelfth annual meeting of the Ohio Electric Light Association, which was held at Put-in-Bay Island, Lake Erie, Ohio, August 21, 22 and 23, 1906, have just been published. The collection of the addresses and the several papers with their illustrations in one cloth-bound volume makes an interesting work. D. L. Gaskill of Greenville, Ohio, is the secretary of the association.

TELEGRAPH.

An ingenious telegraph code is said to have been devised by Walter Cook of Boston, Lincolnshire, England, which, he asserts, will reduce the world's telegraph bills by three-quarters. "I can save 75 cents on the dollar," said Mr. Cooke, according to a London dispatch. "As I have coded the alphabets, as well as words, my code applies to any language. It may be used for newspaper messages, stock-exchange quotations, racing news and anything you require. In my system words do not stand for set phrases. Fractions and figures are expressed easily and simply in it. Laffan's agency has already adopted one of my codes for intricate quotations."

The Interstate Commerce Commission has announced that the employes of telegraph companies who are engaged in the construction or repair of telegraph wires may be granted free transportation by the railroads. The privilege is limited to those working on wires along the line of the railroad.

Announcement has been made that a cable will soon be laid between New York and Colon, touching Cuba, under the joint direction of the Central and South American Telegraph Company and the Mexican Telegraph Company. Surveys are now being made by the steamer Mexican. The contractor, the Cable Telegraph Maintenance Company of London, will lay the cable. It will be 2,200 miles in length and will cost $1,220,281. It is expected the cable will touch at Baracoa, Cuba, but this is subject to change. It will not be landed in Jamaica nor on any other West India island. From every point of view the connecting of New York and Colon in this manner is considered of the highest importance. With control of the Panama Canal zone by this government the new cable will be a necessary link of communication. Its value to the commercial world will be in shortening the time of transmission of messages between New York and South American countries.

MISCELLANEOUS.

To compel railways of the United States to adopt the telegraphic block system in the operation of trains, the size and location of the blocks to be regulated by the Interstate Commerce Commission, is the provision of a bill introduced into Congress by Representative Hardwick. It also provides for the examination by the commission of all telegraph operators for the dispatching of trains. The commission would also be empowered to prescribe reasonable hours of labor for all operators and limit their compensation.

The United States Civil Service Commission announces an examination on January 29-30, 1907, in various cities throughout the country, to secure eligibles from which to make certification to fill four vacancies in the position of miscellaneous piecework computer in the Naval Observatory at Washington, D. C., and similar vacancies as they may occur in that observatory. The department states that miscellaneous computers are paid by the hour and earn from $800 to $1,000 per annum. Promotions are made from this grade without further examination to the grade of computer, at $1,200 per annum, as vacancies occur.

TRADE NEWS.

Bids will be received in Winnipeg, Man., January 14th for a 750-kilowatt electric generating plant. Specifications can be seen at the office of the city engineer, H. N. Rutton.

The Otto Gas Engine Works has recently moved its New York offices and is now located at 136-138 Liberty Street, in that city. A display is made of the various types of the well-known Otto engines and also of dynamos, motors and pumps.

The Willard Storage Battery Company of Cleveland, Ohio, has opened a permanent office at Room 1525, First National Bank Building, Chicago, where it will take care of its western automobile battery work and western train lighting work.

The Commercial Battery Company of Chicago, Ill., has been incorporated with a capital of $50,000, for the purpose of manufacturing and dealing in electrical appliances. Emil C. Wetten and Hobart J. Campbell are the incorporators.

Sealed proposals will be received for the erection of a power plant and electric elevators for the new mess hall and dormitory building at the Soldiers' Home, Washington, D. C. Information can be had on application to John Steven Sewell, constructing engineer.

The employes of the Chicago branch of John A. Roebling's Sons Company, numbering 21, were guests at the annual banquet of that firm held on January 3d at the Chicago Athletic Club. A. B. Conover, manager of the local office, was toastmaster and Karl G. Roebling was guest of honor.

The Minneapolis Steel and Machinery Company has recently opened an office at 1300 West Eleventh Street, Kansas City, Mo., under the management of Mr. Louis Bendit, for the sale of its Munzel gas engine and suction-gas producer. All persons in Kansas City or vicinity interested in gas engine and producers are asked to communicate with Mr. Bendit.

The Washington Portland Cement Company of Baker, Wash., some time ago let contracts for the equipment of one of the most modern cement mills in the country. The machinery both for power and cement making will be built by the Allis-Chalmers Company. Hydraulic turbines will furnish power to operate the generators, which, in turn, will supply current for a full complement of motors, direct-coupled to the crushers, kilns, rolls,

screens, etc., which are used in the process of cement manufacture.

The National Battery Company of Chicago, located at 271 Michigan Avenue, has been opened by Mr. George S. Berger, who has been associated with the storage-battery business in Chicago for many years. A complete stock of electric vehicle and sparking battery parts will be carried, so that prompt repairs and renewals can be made of any standard sized battery, as well as any National battery. The National Battery Company's sales offices at 450 Old Colony Building will be, as heretofore, under the management of Mr. Bertram Smith.

The International Electric Meter Company, Chicago, is issuing one of the handsomest calendars of the season. A 12½ by 16-inch highly calendered card carries, along with an unobtrusive calendar, a steel engraving of a beautifully draped female figure, bearing aloft the International meter. The whole effect is chaste and attractive, yet withal remarkably striking, and will prove an excellent advertisement for the International company, as the figure standing out against a black background constantly attracts attention. The International company has progressed steadily during the last year, and the sale of the company's instruments is rapidly increasing. The International company feels much gratified by the trade's appreciation of its product, especially as evidenced by the increased favor with which the instruments are meeting on the part of the jobbers.

The Babcock & Wilcox Company has bought from the Stirling Consolidated Boiler Company, as of December 31, 1906, its American property and interests, including all accounts and bills receivable, and has assumed its obligations and will execute its orders and contracts for boilers and appurtenances for installation and use in the United States. The plants thus purchased will be operated in the future by the Babcock & Wilcox Company under the name and style of "The Babcox & Wilcox Company (Stirling Department)", and will be operated under the direct charge and management of the same gentlemen who have operated the Stirling Consolidated Boiler Company. The gentlemen who have been connected with the Stirling Consolidated Boiler Company in its sales department will be associated with the Babcock & Wilcox Company in similar capacities. The Babcock & Wilcox Company (Stirling Department) will manufacture the Stirling, Aultman & Taylor and Cahall water-tube boilers and appurtenances heretofore manufactured by the Stirling Consolidated Boiler Company.

BUSINESS.

Among the recent sales secured by the Crocker-Wheeler Company of Ampere, N. J., during the last few weeks, the following large machines have been ordered by some of the largest machine tool and motor users in the United States: National Tube Company, McKeesport, Pa., one 340-horsepower, four 125-horsepower, six 15-horsepower and one 175-horsepower motors; American Printing Company, Fall River, Mass., one 75-horsepower motor; American Wood Working Machinery Company, Rochester, N. Y., two 32-horsepower, one 13-horsepower and one 10-horsepower motors; International Silver Company, Bridgeport, Conn., 11 motors aggregating 162 horsepower; Union Rolling Mills, Cleveland, Ohio, one 100-kilowatt generator; Peoria Stone and Marble Works, Peoria, Ill., one 200-kilowatt generator; Ford Morocco Company, Wilmington, Del., one 100-horsepower motor; Union Gas and Electric Company, Cincinnati, Ohio, three 35-horsepower motors; Bethlehem Steel Company, one 150-horsepower motor; Schlather Brewing Company, Cleveland, Ohio, two 25-horsepower motors; Ellsworth Coal Company, Ellsworth, Pa., one 50-horsepower and one 15-horsepower motors; Stone Printing Company, Roanoke, Va., 49 motors ranging from one-fourth to 100 horsepower.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 1, 1907.

839,815. Manufacture of Elements for Batteries or Electrolytic Apparatus. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed May 9, 1904.

A body having holes therein is formed and baked, and then a portion of it is separated from the remainder so as to form a furrowed plate or plates.

839,816. Electrochemical Apparatus. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed March 9, 1905.

A number of diaphragms are disposed in an envelope to form fluid-containing means increasing downwardly in cross-sectional area.

839,817. Coupling for Battery Elements. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed January 22, 1906.

A device fixed to a plate is engaged and held by a second device. The devices are forced one within the other and held in close relation by the plate.

839,830. Telephone Hook Switch. George D. Foster, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed July 26, 1904.

The switch lever is so constructed that it may be removed from the switch-containing box through the escutcheon without opening the box.

839,841. Scale Recorder. Franklin B. Hays, Indianapolis, Ind. Application filed July 30, 1906.

A clockwork actuates means feeding a recording strip, an electrically controlled detent intermittently permitting the action of the clock work. Electromagnetic means controlled by the detent intermittently clasp and release the recording strip.

839,860. Tide Motor. Joseph E. Lemyre, Manchester, N. H. Application filed December 27, 1905.

The tide water entering tidal basins is used to operate electricity generating apparatus. The power is stored in accumulators.

839,869. Electric Lamp. Frederick Muschenheim, New York, N. Y. Application filed September 8, 1906.

A design for an electric lamp in which an upright hollow post supports a downward projecting socket which has a reflector attached.

839,873. Fire-alarm and Watch-service System. Judson McFell, Chicago, Ill. Application filed December 12, 1905.

A transmitter is adapted and arranged to transmit a watch signal and to transmit a different signal for fire alarms, and means are provided for automatically connecting the transmitter with one signal-receiving instrument when transmitting a watch signal and with another signal-receiving instrument when transmitting a fire signal.

839,888. Stencil-perforating Device. Samuel Pryor, Utica, N. Y. Application filed February 15, 1905.

An electric motor operates a perforating needle which projects through a tracing point.

839,910. Telephone System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 12, 1902.

A cutoff relay when operated connects one side of the line with one contact of a jack. A supervisory relay associated with the cord circuit is adapted to be connected in shunt with the line relay during the time when a connection is established. The cutoff relay is also operated when a connection is made.

839,928. Electric Heating Attachment for Hot-water Bags. Charles Van Dyke Hill, St. Louis, Mo. Application filed February 23, 1906.

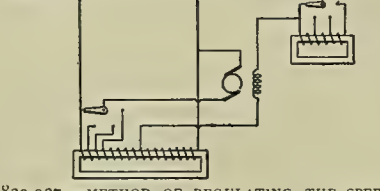
A tube having a resistance bar is secured in a stopper-shell for rubber hot-water bags. Wires lead from the resistance to an outside source of electric supply.

839,935. Phase-adjusting Means for Alternating-current Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1905.

Automatically adjusted means exterior to the motor alter the phase relations of the supply current to bring the currents in the armature and field magnet of the motor approximately into phase with each other.

839,936. Phase-adjusting Apparatus. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1905.

Similar to the preceding, the means for altering the phase consists of varying the amount of impedance in the field circuit.



NO. 839,937.—METHOD OF REGULATING THE SPEED OF ELECTRIC MOTORS.

839,937. Method of Regulating the Speed of Electric Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1905.

The speed of an alternating-current motor, having different phase currents impressed on field magnets and armature is varied by varying the electromotive force applied to the field magnet by varying the impedance of the field circuit. (See cut.)

839,958. Regulator for Alternating-current Motors. Clarence Renshaw, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1905.

A transformer is connected to one phase of the supply current and supplies the armature. The field magnet is connected to the other phase. A winding connected in series with the field winding is located in the magnetic field of the transformer.

839,983. Electric Furnace. William H. Bristol, New York, N. Y. Application filed August 6, 1906.

A fused quartz receptacle forms the heating chamber and is surrounded by an electric-heating coil. A refractory nonconducting material encases the coil and chamber.

839,984. Thermo-electric Generator. William H. Bristol, New York, N. Y. Application filed December 2, 1905.

The primary elements are of platinum and an alloy of platinum with 10 per cent. of rhodium forming a couple. The secondary elements are of nickel-steel alloy and of iron and are respectively connected to and form secondary couples intermediate of the hot and cold end of the generator. Means independent of the elements are adapted to compensate for the effects of the secondary couples.

839,985. Thermo-electric Generator. William H. Bristol, New York, N. Y. Application filed December 26, 1905.

A supplementary couple is separate and distinct from the primary couple and in series therewith. The hot end of one couple is located in close proximity to the cold end of the other.

840,001. Method of Regulating Alternating-current Motors. Benjamin G. Lamme, Pittsburg, Pa., and Clarence Renshaw, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1905.

A method of maintaining approximately constant phase relations between the currents in two circuits consists in varying the phase relations of the applied electromotive forces approximately in accordance with the variations in the amount of current traversing one of the circuits.

840,002. Duplex Telegraph. Joseph W. Larish, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed August 29, 1906.

Means are provided at one station for throwing on the line current impulses of uniform polarity and two different potentials. At a second station is a relay having two coils of different resistance, the smaller coil located in the main line and the larger coil in an artificial line. Means are provided for including main and artificial lines in series with the coils and for short-circuiting the artificial line and its coil.

840,005. Testing Device. Asa M. Mattice, Milwaukee, Wis., assignor to the Allis-Chalmers Company, Milwaukee, Wis. Application filed January 11, 1906.

To test the extent of wear of journals of a motor an indicating device is inserted through an opening in the motor casing. A collar limits the movement through the casing. If the journals are worn beyond a predetermined amount the contacts will not touch the journal when the device is inserted an exact distance.

840,013. Controlling Electric Power-distributing Systems. Joseph L. Routin, Lyon, France. Application filed September 2, 1904.

An auxiliary generator comprising an indicator carries two oppositely active windings, one of which is in series with the principal current. There is a tension regulator for the other winding and a motor is connected to be operated by the auxiliary generator and to operate the speed governor and the tension regulator. (See cut on next page.)

840,014. Electrical Plug Receptacle. Frank J. Russell, New York, N. Y. Application filed February 13, 1906.

The base-section and cap-section have a telescopic non-rotative engagement. The cap-section also has an insulating bottom portion covering the base-section, and assembling connections are provided for the sections.

840,018. Apparatus for Searching of Sunken Bodies. Max von Schoultz, St. Petersburg, Russia. Application filed May 18, 1899.

Magnets are used attached to cables and are to be lowered by the cable into the water.

840,028. Lightning Arrester. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 30, 1903.

Two lightning arresters are mounted on a base, each comprising a series of independent metallic parts separated by spark-gaps. There is a metallic connection between an intermediate metallic part of one arrester and a corresponding metallic part of the other arrester.

840,036. Lightning-arrester Connection. Edward A. Baldwin, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 8, 1904.

In a polyphase transmission line resistance devices are connected across each phase and means are connected to the resistances providing a path to the ground. (See cut on next page.)

840,044. Method of Electrically Heating Materials. Clarence L. Collins, 2d, Niagara Falls, N. Y. Application filed December 1, 1905.

The heating resistance is granular and of high resistance with intermediate portion of lower resistance, the material to be heated being placed between the high and low resistances.

840,051. Tape-punching Register. John L. Du Frane, Oakland, Cal. Application filed April 12, 1906.

A lever operated by an armature bar puts a spring under tension. The spring operates a tape-feeding mechanism and an electromagnetically operated punch for perforating the tape.

840,060. Heating Attachment for Hot-water Bags. Charles Van Dyke Hill, St. Louis, Mo. Application filed November 15, 1905.

An electric heating coil extends inwardly from the stopper. Insulating blocks in the stopper carry the terminals of the heating coil. (See cut on next page.)

840,068. Panel Board for Electrical Distribution. Edward N. Lake, Chicago, Ill. Application filed July 24, 1905.

Terminals for meters are mounted on the slab and interspersed with terminals for load circuits.

840,069. Telephone Transmitter. Alfred Larson, Buffalo, N. Y. Application filed January 23, 1906.

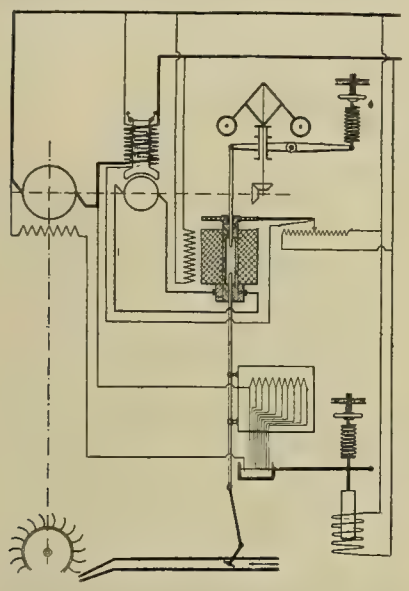
A resilient ring has an opening within and an enlarged periphery rests on the diaphragm, and a second diaphragm of tinfoil is placed over the ring to exclude moisture.

840,087. Contact Shoe for Electric Railways. Henry C. Pealow, Batavia, Ill. Application filed November 9, 1905.

The contact surface of each of a pair of oppositely mounted shoes has a contour conforming to one side and a portion of the top of the rail. Spring mechanism produces a constant engagement of the shoes with the rail.

840,095. Automatic Signal. Judson Shoecraft, Eskridge, Kan. Application filed April 20, 1906.

For railway block systems a signaling device naturally in "danger" position is held in "clear" position by the operation of a motor. The motor circuit is controlled in multiple by the armatures of relays in that block.



NO. 840,013. APPARATUS FOR CONTROLLING ELECTRICAL POWER DISTRIBUTING SYSTEMS.

840,102. Means for Cleaning or Manipulating Electric-light Globes. Carl D. Bates, Chicago, Ill. Application filed April 24, 1905.

Two relatively moving jaws are adapted to close on the light bulb by a pressure applied by the bulb when it is inserted.

840,120. Electrical Typewriter Selecting and Operating Means. George W. Donning, East Orange, N. J., assignor to Harry T. Ambrose, Orange, N. J. Application filed May 27, 1903.

The universal power bar has actuating means. Selective devices are associated with the several movable members and a selective operating device is provided for each member constructed successively to complete the ciriuit from the source of electric energy to energize the corresponding selective device and then to switch the current to energize the power-bar-actuating means.

840,121. Electrical Typewriter. George W. Donning, East Orange, N. J., assignor to Harry T. Ambrose, Orange, N. J. Application filed May 27, 1903.

An electromagnet actuates the operating bar which impinges on the operating levers. Key levers during their movement position the operating levers. A further movement of the key levers makes a circuit and a further movement again breaks it.

840,129. Hoisting Machine. Arthur E. Handy, Providence, R. I., assignor to the Rhode Island Elevator and Machine Company, Providence, R. I. Application filed March 27, 1906.

Friction rolls driven by an electric motor drive a drum. Means, including a lever, move to operatively connect the rolls to the drum. The motor may be started slowly and subsequently accelerated.

840,135. Signal Apparatus. W. Britton Lane, Evanston, Ill. Application filed July 25, 1906.

A high-resistance electromagnet and a low-resistance electromagnet are connected with one block, a track battery normally energizing the magnets. A local signal-controlling battery is connected with an adjacent block and forms therewith a local partial circuit. A pole-changer controls the circuit of the signal-controlling battery and is controlled by both of the electromagnets. A train-carried signal mechanism has a partial circuit adapted to complete the local partial circuit as the train passes over the same.

840,150. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 16, 1901.

A core constituting a single magnetic circuit is combined with a winding consisting of multiply connected sets of coils located on different parts of the core. Each set consists of an inner coil on one part of the core in series with an outer coil on another part of the core.

840,159. Electrical Signaling Apparatus. John D. Peachey, East Orange, N. J. Application filed January 10, 1903.

A police and fire-signaling apparatus has a switch which is adapted to hold one circuit closed while another is being used.

840,163. Controlling Means for Fluid Reservoirs. Jacob L. Schureman, Chicago, Ill. Application filed January 16, 1906.

Electrodes are attached to a pressure indicator and move with it. At the limit of movement contacts are provided for closing the circuit through the electrodes.

840,182. Pendent Switch. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 3, 1903.

The novel points are the shape of the connecting pieces.

840,186. Motor-starting Rheostat. Paul H. Zimmer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 28, 1905.

The controlling member has a bias to the starting position. Electrically controlled means are provided for closing an auxiliary circuit around the arm when the latter is moved to running position.

840,200. Switchboard-cord Reel. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

A spring-operated reel takes up the slack from telephone switchboard cords.

840,201. Electromagnetic Signal. Henry M. Crane, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed June 8, 1904.

On an annunciator drop the armature is pivoted at its center of gravity on the core of the electromagnet. A retractile spring connects the upper end of the armature with the plate. A stop carried by the upper end of the armature is adapted to abut against the magnet to limit the retractive movement of the armature. A target arm is pivoted to the plate and is normally held by the other end of the armature.

840,216. System of Electrical Distribution. Rudolf Hundhausen, Wilmersdorf, near Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed February 19, 1900.

For connecting three-wire systems with sub-circuits, plugs have their ends enlarged so as to prevent their introduction simultaneously into adjacent sockets.

840,222. Arc-light Carbon. August Kufferath, Beuel, near Bonn, Germany, assignor to L. C. Marquart, Beuel, near Bonn, Germany. Application filed March 30, 1906.

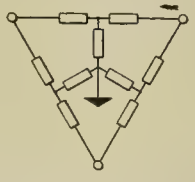
Arc-light carbons for the production of a powerful actinic light are characterized by the fact that there is added to the carbon one-half per cent. of a metallic combination, which consists of equal parts by weight of yttrium nitrate and lead nitrate.

840,256. Thermostatic Apparatus. Karl Rostel, Monessen, Pa. Application filed March 30, 1906.

Mechanism is actuated by a float which is itself actuated by the expansion and contraction of air within a receptacle. The mechanism completes an electrical circuit to sound an alarm.

840,327. Electric Switch. Edward M. Hewlett and Theodore E. Button, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed May 28, 1904.

An iron-clad operating magnet is secured to a base. Supporting frames for movable contacts carry fixed contacts at their upper ends. The movable contacts are pivoted to the magnet frame at their lower ends.



NO. 840,036.—LIGHTNING-ARRESTER CONNECTION.

840,335. Electric Water-purifying and Filtering Apparatus. Jacob A. Hyle, Altoona, Pa., assignor of one-half to Frederick Hesser and one-fourth to D. A. Reagan, Altoona, Pa. Application filed April 3, 1906.

The inlet pipe for the water purifier has a contracted discharge and contains an electrolytic cell composed of longitudinally extending pipes, end disks and a corrugated plate surrounding the pipes. Electric connections are provided for the plate and disk.

840,336. Insulator. Alfred Johnson, Quincy, Ill. Application filed February 7, 1906.

A reversible seat-block having a number of faces is provided with grooves of different sizes to receive a conductor, and a clamping-cap is secured to the base and adapted to clamp the conductor within one of the grooves in the reversible seat-block.

840,375. Alarm for Automatic Fire Extinguishers. Frank H. Rice, Chicago, Ill., assignor to the Automatic Fire Protection Company. Application filed July 30, 1904.

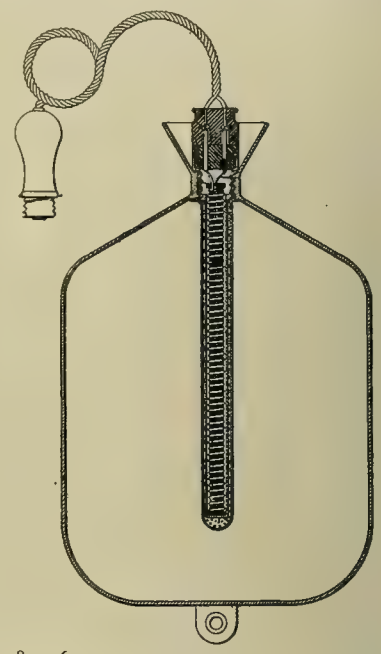
An electrically operated alarm is caused to operate by a current passing through a circuit which includes contacts which are caused to make and break by the movement of the valve.

840,397. Music-recording Device. Alfred J. Swing and Karl A. Graner, Cincinnati, Ohio, assignors to said Swing, John Sofge and Edward Gardner, Cincinnati, Ohio. Application filed February 20, 1905.

A series of electromagnets are arranged in superimposed relation above a strip of paper. Spring-pressed levers have marking means extending beyond a support underlying the magnets. Inking rollers are normally engaged by the marking means.

840,428. Electrical Signaling System. Edward R. Brodton, Atlanta, Ga., assignor of one-twentieth to G. W. Parrott, one-twentieth to E. H. Thornton, one-fortieth to T. D. Meador, one-fortieth to D. B. Carson, one-twentieth to T. A. Hammond, one-twentieth to E. M. Horine, one-twentieth to T. H. Egleston, one-twentieth to Charles A. Conklin, one-twentieth to R. E. Park, one-twentieth to D. U. O. Robertson, one-sixth to D. G. Jones and one-twentieth to H. C. Stockdell, Atlanta, Ga. Application filed September 3, 1904.

For train signaling a normally open circuit is carried by the locomotive. A normally closed circuit is also carried by the locomotive. A number of electromagnets are arranged in the circuit and means are arranged with relation to the track to shunt one of the electromagnets in the closed circuit whereby to close the open circuit.



NO. 840,060.—ELECTRIC HEATING ATTACHMENT FOR HOT-WATER BAGS.

840,432. Apparatus for Automatically Giving Alarm in Case of Burglary, etc. James Carter, Leytonstone, England. Application filed January 2, 1906.

Alarm-sounding whistles are operated by a motor which is in circuit with a battery. The circuit is adapted to be closed by an attempt at burglary. The arrangement causes the whistle to sound intermittently.

840,451. Commutator. Manes E. Fuld, Baltimore, Md. Application filed January 30, 1906.

A suitable body of nonconducting material is provided with longitudinal grooves in its surface, and metallic sections are each provided with an inwardly directed rib or flange engaging the groove whereby they are securely held in place.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 7, 1907:

418,678. Electric Switch for Motors. H. H. Blades, Detroit, Mich.
418,700. Secondary Battery. H. E. Dey, New York, N. Y.
418,701 and 418,702. Cut-out for Secondary Batteries. H. E. Dey, New York, N. Y.
418,703. Method of Forming Secondary-battery Plates. H. E. Dey, New York, N. Y.
418,704. Bracket for Supporting Electric Conductors. J. A. Duggan, Quincy, Mass.
418,748. Distribution of Electricity by Secondary Batteries. G. B. Prescott, Jr., Newark, N. J.
418,757 and 418,758. Electric Arc Lamp. C. E. Scribner, Chicago, Ill.
418,766. Support for Electric Conductors. J. B. Smith, Manchester, N. H.
418,778. District Telegraph Alarm Box. C. G. Armstrong, Englewood, and G. A. Harmount, Chicago, Ill.
418,837. Battery Carbon. C. G. Armstrong, Chicago, Ill.
418,843. Means for the Electrical Propulsion of Vehicles. D. E. Johnson, Atlanta, Ga.
418,853. Electric Motor or Generator. I. E. Storey, Boulder, Colo.
418,871. Electrical Indicating Apparatus. G. A. Holt, Oakland, Cal.
418,889. Electric Deep-sea Sounder. A. J. Cooper and E. E. Wigzell, London, England.
418,893. Electrically-propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
418,910. Electrical Signal-operating Device. C. A. Cox and J. F. Cox, Louisville, Ky.
418,911. Electric Heating Apparatus for Electric-railway Systems. M. W. Dewey, Syracuse, N. Y.
418,912. Method of Transforming and Utilizing Electrical Energy. M. W. Dewey, Syracuse, N. Y.
419,032. Method of Welding by Electricity. C. L. Coffin, Detroit, Mich.
419,033. Method of Electric Welding. C. L. Coffin, Detroit, Mich.
419,059. Electric Motor. H. B. Niles, Union Springs, N. Y.
419,068. Electro-mechanical Time Stamp. C. A. Randall, London, England.
419,094. Apparatus for Propelling Vehicles by Electricity. F. Wynne, Westminster, England.
419,166. Electromagnetic Transmitter. J. T. Williams, Mount Vernon, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XL. CHICAGO, JANUARY 19, 1907 No. 3

Second Annual Electrical Show Opened in Chicago.

With brilliant prospects the second annual Chicago Electrical Show was opened in the Coliseum on Monday night, January 14th. It will continue for two weeks, being open to the public every day from 10 a. m. to 11 p. m., except Sunday. On the opening night admittance was by invitation, the visitors constituting the guests of exhibitors and those directly interested in the Electrical Trades Exposition Company, which is conducting the show. The opening was entirely successful, although some of the exhibits and decorations were not completely finished, largely owing to delay caused by a misunderstanding with trades unions. Thousands of interested spectators thronged the aisles and galleries of the large building, and it was plainly evident that the general public is alive to the possibilities and advantages of electricity in its numerous applications. And the visitors were not disappointed. There is something at the show to interest any inclination, as almost every branch and department of the electrical arts and industries is represented.

To the student of electricity and electrical development the show offers not only an opportunity of observing the progress of the year, but also a glimpse of the probable trend of development for the future. To the layman it removes many of the mysteries of electricity and reveals the fact that electric current is being skillfully controlled and made to be one of the most economical, convenient and necessary servants of man in everyday life.

Even for blocks away the Coliseum gives evidence of activity within. The large electric sign over the entrance and the festoons of incandescent lamps leave no doubt as to the location of the show. Within, the picture is a striking one. The general illumination is, of course, not only abundant but effective, and when augmented by the lighting of the individual booths, many of them strikingly original, the whole scene becomes one of real brilliance.

The ceiling of the building is draped in orange and white bunting, and at the ends the bunting is artistically drawn to a semi-circle of purple and orange. Suspended from the center of the ceiling, the whole length of the building, are large groups of arc lights. Girders, posts and railings are lined with thousands of incandescent lamps. Added to this are the electric signs and lighting effects of the various exhibits, the recently developed flaming arcs and the mercury-vapor tubes being the ones to stand out most prominently. A general view of the exhibition, taken for the Western Electrician, is here shown. The picture taken from a corner of the gallery, does not do the spectacle justice. The photographic conditions were trying, and the camera was unequal to the task of representing the scene, with its lights, its colors, its shifting throngs, as it appeared to the eye.

Upon entering the building attention is first attracted by the many and varied electric signs, in themselves quite a show. Then the eye is caught by the central feature, a beautiful illuminated statue of "Electra," supported by the terrestrial globe, the whole resting on a well-designed base.

At the south end of the hall, above the level of the balcony, is a lamp-outlined figure of Jupiter on a black background. By means of a motor driven flasher arrangement (shown to spectators on the main floor) the figure is transformed into a dancing skeleton. It is shown in the large picture, the exposure being long enough to show several positions.

In the north balcony Ellery's Band furnishes excellent music. Upon tiring of inspecting the exhibits, visitors find it enjoyable to take a seat in the balcony, where they can listen to the music and watch the movements below.

The Electric Midway proved a great attraction on the opening night. A shipwreck scene, the aurora borealis and the like are produced by electrical means.

There are more than 100 exhibits, representing probably twice as many different electrical concerns. The exhibits of some of the larger companies occupy the central portion of the large hall. Several companies are exhibiting electrical cooking and household utensils, and the demonstrations given at these booths were especially attractive to the ladies present.

Chocolate fudges made by electricity, and dainty biscuits baked in electric ovens were handed out to the visitors, and the ladies were shown how easy it is to manipulate the electric chafing dish, broiler, curling iron, smoothing iron, and numberless other household utensils. Washing machines, sewing machines, coffee grinders, dishwashers, mangles and other motor-driven household utensils are shown in operation, also a large line of heavier motor-driven machines for all purposes. Among these are several printing presses, turning out literature pertaining to the show.

The various lamp companies have interesting exhibits, showing all the latest creations in illum-

The "dancing skeleton" at the farther end and the heavy temporary overhead leads needed for light and power may be noted.

A GENERAL VIEW OF THE CHICAGO ELECTRICAL SHOW ON THE OPENING NIGHT.

nants. One of the booths is displaying some of the new tungsten-filament incandescent lamps—the first public display of these lamps ever shown in this country. Tantalum lamps, new types of flaming arcs, new styles of shades and globes and other novelties are also shown.

Considerable of interest is to be found in the telephone exhibits, where the several companies are showing telephones, switchboards and accessories. Alderman Badenoch of the Chicago City Council, with his mind fixed on the local telephone situation, was seen on the opening night passing from one booth to another listening to the exhibitors explain the economies and advantages of their systems.

One of the most interesting and instructive features of the show is the high temperature electric furnace designed and built by C. H. Thordarson of Chicago. Mr. Thordarson also gives his interesting electrical demonstrations and experiments, as last year, and his space is one of the great centers of attraction.

Lighting throughout the Coliseum is largely by direct current. Current is taken from the Chicago Edison mains. To provide alternating current where needed for light and power a motor-generator set of 160 kilowatts capacity is located in the northeast corner of the main floor. The motor takes current from the street mains, the generator providing three-phase current on the four-wire system. Heavy temporary overhead leads are tapped for the various exhibit spaces. In the general view the lines of overhead service wires are easily distinguished. The electrical construction work is interesting and will be described later.

Exceptional care is manifest in the systematic arrangement of the exhibits, and much credit is due the management, under the direction of Mr. Homer E. Niesz, for the auspicious beginning of the 1907 show. During this week and next (the exhibition will be closed, unless some change is made, on January 26th) there will be many special features and conventions, as detailed in the Western Electrician last week, all of which, as well as the exhibits, will receive attention in future issues.

Large numbers of out-of-town visitors are drawn to Chicago by the show, and many were present on Monday and Tuesday. A few of them were F. H. Gale, General Electric Company, Schenectady; J. C. McQuiston, Westinghouse Companies, Pitts-

A GLIMPSE IN THE ELECTRICAL SHOW, SHOWING A COLUMN MADE OF GALVANIZED IRON AND COPPER TELEPHONE WIRE

burg; C. A. Tupper, Allis-Chalmers Company, Milwaukee; P. F. Lyons, National India Rubber Company, Bristol, R. I.; W. J. Grady, Faries Manufacturing Company, Decatur, Ill.; James M. B. Irvine, Electric Appliance Company, Los Angeles; T. A. Murphy, Lowell, Mich.; S. Glen Vinson, Ideal Electric and Manufacturing Company, Mansfield, Ohio; C. Robert Churchill, Electric Appliance Company, New Orleans; A. G. Mortimer, Canadian Electrical News, Toronto; S. E. Doane, National Electric Lamp Association, Cleveland; Albert J. Marshall and Charles A. Howe, Holophane Glass Company, New York city; Mr. Lockwood, Bryan-Marsh Company, New York city; Victor L. Crawford, W. N. Matthews & Bro., St. Louis; George Cutter, George Cutter Company, South Bend, Ind.; George W. Edge, St. Louis, Mo.; J. C. Fish, Shelby Electric Company, Shelby, Ohio; Bert Gallup, Hancock, Iowa; T. P. Gleason, Smiley & Gleason, St. Louis; Ainslie A. Gray,

"Electra" Surmounting the World.
CENTRAL DECORATIVE FEATURE OF ELECTRICAL SHOW.

Electrical Review, New York; W. S. Heger, Allis-Chalmers Company, Milwaukee; E. H. Heilstedt, Chicago Mica Company, Valparaiso, Ind.; E. V. Hennecke, Brilliant Electric Company, Cleveland; J. C. Henning, Milwaukee; C. H. Johnston, Curtis Advertising Company, Detroit, Mich.; James R. Kearney, W. N. Matthews & Bro., St. Louis; C. H. Keller, Union Electric Company, Dubuque, Iowa; W. H. Kilton, Mechanical Supply Company, Aurora, Ill.; E. S. King, Merrill Railway and Lighting Company, Merrill, Wis.; Ralph J. Lancaster, Cary, Ill.; F. L. Leitner, Duncan Electric Manufacturing Company, Lafayette, Ind.; C. L. Matthews, W. N. Matthews & Bro., St. Louis; Theo. Michel, Union Brass and Metal Manufacturing Company, St. Paul, Minn.; O. Morsman, Kellogg Switchboard and Supply Company, Grand Rapids, Mich.; R. S. Mueller, Kellogg Switchboard and Supply Company, Cleveland; G. M. Pott, Allentown, Pa.; W. L. Rideout, Gas Light Company, Oshkosh, Wis.; Frank B. Smiley, Smiley & Gleason, St. Louis; Messrs. Tucker, Virden Telephone Company, Virden, Ill.; H. A. Taylor, Mechanical Supply Company, Aurora, Ill.

Of course, the Chicago electrical men, many of them accompanied by ladies, were out in force. The Western Electrician booth contains a box for business cards, in which visitors are requested to drop their cards, so that their presence at the show may be recorded, and from this receptacle the following names of Chicago visitors were taken:

Ross D. Cummings, Bryan-Marsh Company; J. S. Delo, Consolidated Railway, Electric Lighting and Equipment Company; O. R. Erwin, Erwin & Co.; C. F. Ficht, I. X. L. Chemical Compound Works; E. D. Fuchs, Arthur Frantzen Company; Emil R. Hoffmann, mechanical expert; A. J. Holtz, electrical contractor; John E. Hosier, National Meter Company (gas-engine department); W. R. Irving, electrical contractor; Otto Rape; W. O. Jacobi; S. D. Rollins, Crane Company; A. C. Saxton, Consolidated Railways, Electric Lighting and Equipment Company; William M. Smith, Chicago Insulated Wire Company; S. T. Webber, Goodman Manufacturing Company; A. B. Weeks, American Instrument Company; J. W. Whitman, electrical contractor; Wallace B. Bosley; W. S. Bosley, mechanical designing; Alfred H. Cassidy, Electrochemical Engraving Company; Louis P. Conway, with W. J. Burns; H. C. Froelich, expert in lighting; Martin Gold; Edward Jones, electrician; J. Kaufman, electrical contractor; Francis Raymond, electrical specialties; P. R. Slocomb, Bryan-Marsh Company; T. R. Weldon, electrical engineer.

Northwestern Electrical Convention Opened at the Coliseum.

The fifteenth annual convention of the Northwestern Electrical Association was called to order by the president, Mr. Harold Almert of Chicago, at the Coliseum Annex, January 16th, at 11 a. m. There were present during the day about 50 members.

In his opening address the president called attention to the fact that the wave in favor of municipal ownership of public utilities was rapidly receding, and threatened little danger in the future. He said that no adverse legislation with regard to lighting companies in this section of the country had been reported, although there had been some agitation against street-railway companies, especially in Wisconsin. Electric-light and power securities are buoyant.

It was the expressed opinion of the National Electric Light Association, whose meeting the president attended, that the Northwestern Electrical Association was doing extraordinarily good work and occupied an important field. He said further that the present extremely high prices of materials prevent much rebuilding or extension. A revision of the constitution and by-laws of the association should be had. The association is in very good condition.

The secretary-treasurer presented his report and showed that the association is on a self-sustaining basis. Mr. John H. Harding of Laporte, Ind., was appointed on the membership committee.

The president appointed as a nominating committee Irving P. Lord of Waupaca, Wis., John H. Harding of Laporte, Ind., and Frederick W. Insull of Chicago. A recess was then taken until 2 p. m.

The convention was again called to order at 2:15 p. m. by the president. Oliver J. Bushnell of Chicago read a paper on "Warrantable Expense for Meter Testing." He called attention to the superiority of the diamond jewel over the sapphire, the importance of using only the very best meters, the economic value of such tests, and said that present conditions demand that companies should give more attention to meter testing than is ordinarily done.

The paper was earnestly discussed, and the necessity of frequent testing emphasized, especially

This is shown merely as a popular novelty. But the motor is especially wound for slow speed, turning at 65 r. p. m.
ELECTRICALLY OPERATED "KICKING MACHINE" AT THE ELECTRICAL SHOW.

from an economic standpoint. Central stations suffer much loss of current which is not registered because the meters are slow, due to faulty construction, or because old, second-hand, imperfect, rebuilt machines are used.

Mr. J. Robert Crouse of the Co-operative Electrical Development Association of Cleveland read a paper on "Profitable Co-operation." His remarks were listened to with much interest, as the subject is an important one.

A paper on the electrical possibilities of Wisconsin waterpowers was read by Mr. Ernst Gonzenbach. The speaker discussed the great waterpower possibilities of eight Wisconsin rivers, and stated that it was rare indeed to find natural conditions as favorable for profitable development as is afforded by these streams. He suggested that the association could well afford to appoint a committee for the purpose of securing co-operation

toward obtaining for its members the benefit of these enormous powers now running to waste.

The paper was discussed at considerable length, and the importance of giving waterpower companies in Wisconsin the right to condemn under the law of eminent domain was urged. The president stated that the United States Geological Survey, in document 156, gave surveys of all waterpowers in the northern part of Wisconsin. The report for the southern part of the state will be out later.

Adjournment was taken until 9:30 a. m. on January 17th. A detailed report of the convention will appear in the Western Electrician next week.

A Carborundum Responder for Radio-telegraphy.

Supplementing the serial article on "Wireless or Radio-telegraphy," by Mr. D. McNicol, now appearing in the Western Electrician, it is of interest to note that a patent has been recently issued on a new system for the detection of Hertzian waves.

The patent was issued to Henry H. C. Dunwoody of Washington, D. C., on December 4, 1906 (applied for, March 23, 1906), and the principal feature is the use of non-metallic crystalline material as a wave-responsive device. In practice the inventor states that he has generally used a

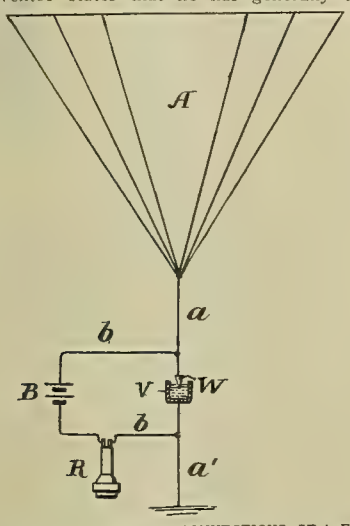


FIG. 1. DIAGRAM SHOWING CONNECTIONS OF A FORM OF CARBORUNDUM WAVE-RESPONSIVE DEVICE.

mass or body comprising crystalline silicide of carbon or carborundum.

The material may be in any desired shape or size, and is generally in the form of a concrete mass or body of crystals, which are composed of carbon and silicon in a chemical combination forming what is chemically known as a "carbide" of silicon, or silicide or carborundum. It is a highly refractory material, extremely hard and a relatively poor conductor of electricity.

This wave-responsive material may be utilized

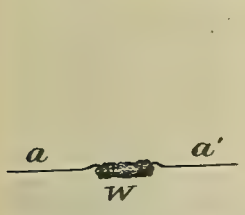


Fig. 2. One Form of Carborundum Wave Detector.

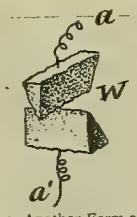


Fig. 3. Another Form of Carborundum Wave Detector.

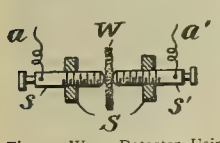


Fig. 4. Wave Detector Using Thin Plate of Carborundum between Adjusting Screws.

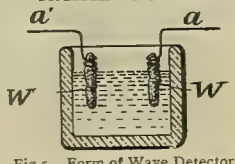


Fig 5. Form of Wave Detector Using Carborundum Points in an Electrolyte.

A CARBORUNDUM RESPONDER FOR RADIO-TELEGRAPHY.

in various forms and connected in the circuit of the signal-receiving apparatus in various ways.

In the drawings, (A) represents an aerial receiving conductor or wave collector or antenna, which acts as the "collector." This conductor is connected to a conductor (a) having a ground terminal (a'). The wave-responsive device (W) is interposed between the aerial conductor and the ground.

In Fig. 1 the conductors (b) (b) form a branch circuit which includes a battery (B) and an ordinary telephone receiver (R) in series. This branch circuit is connected to the conductors (a) (a') at opposite sides of the wave-responsive device.

The wave-responsive device may be used in many different forms, and the accompanying views show some of the more interesting.

In Fig. 2 the ends of the conductors (a) (a') are secured by being twisted or bound tightly around the ends of the body of carborundum, so that a portion of it is included in the circuit.

In Fig. 3 the edges of two pieces of the crystalline material are placed in contact and supported in this relation. They are included in the circuit

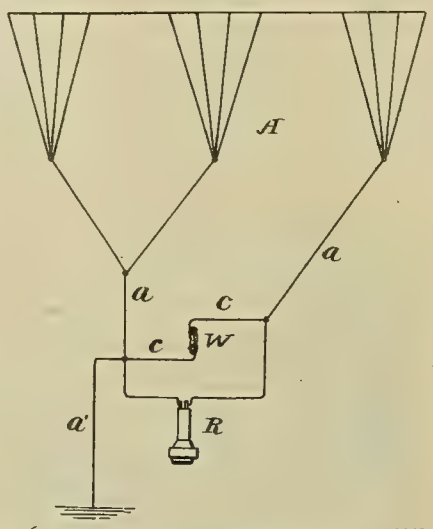


FIG. 6. DIAGRAM SHOWING CONNECTIONS OF A FORM OF CARBORUNDUM WAVE-REPONSIVE DEVICE WITHOUT LOCAL BATTERY.

so that the electric current must pass the point of contact.

In Fig. 4 a thin plate or mass of carborundum is supported between two adjusting screws (s) (s') and connected in the circuit so that the current passes from one adjusting screw through the carborundum to the other adjusting screw.

A somewhat different arrangement is shown in Fig. 5, in which an electrolyte is used, such as mercury, or an acid or alkaline fluid. Two pointed masses of wave-responsive material are immersed in the liquid and are so connected that the current must pass through one mass into the electrolyte and out through the other mass.

The inventor asserts that these and many other forms are operative as wave-responsive devices.

With the arrangement shown in Fig. 6, the inventor says that he has received signals sent several hundred miles from the receiving station. In this arrangement (A) are the aerial collectors, (a) (a) are conductors, (a') is the ground conductor and (c) (c) a circuit including the wave-responsive device (W). (R) is a telephone receiver which is connected by a shunt circuit bridging the device (W). It will be noticed that no battery or independent source of electric current is used.

New Chicago Traction Ordinances Reported to City Council.

The traction ordinances planned for the future operation of the Chicago City Railway Company and the Chicago Union Traction Company have been completed by the local transportation committee of the Chicago City Council, and the committee by a vote of 9 to 3 reported the ordinances to the council near midnight on Monday, January 14th. On Tuesday night the ordinances were taken up at an adjourned meeting of the City Council and put over to the next meeting, under the rules, to give time for publication. Then the council went on record as opposed to further delay in the settlement programme and a resolution was passed detailing the form of petition to be used in asking for a referendum.

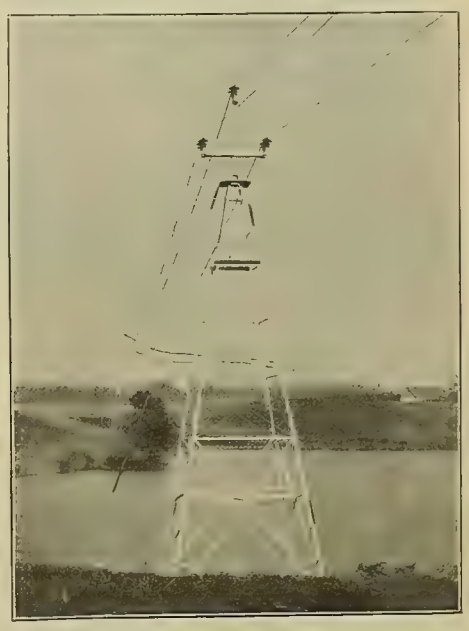
By a vote of 54 to 12 at the meeting of Tuesday night the aldermen passed the Foreman resolution, recommended by the committee on local transportation, providing that a petition asking a referendum on the ordinances be circulated by the mayor, heads of departments and members of the council. If 86,000 voters sign the petition before February 2d it is proposed that the council pass the ordinances, to take effect provided a majority of the voters approve the settlement at the April election. One hundred thousand copies of the petition are to be distributed.

If the petition does not receive the necessary number of signatures it will be taken for granted that the people prefer an immediate settlement to referendum delay, and the programme then will be to pass the ordinances at once, the work of rehabilitation to begin immediately thereafter. The earliest date on which the aldermen can pass the ordinances is February 4th.

If a referendum is had the City Council's action means that citizens will vote "yes" or "no" on the following question: "Proposed Question of Public Policy.—For the approval of ordinances substantially in the form of the pending ordinances reported to the City Council of the city of Chicago on January 15, A. D. 1907, authorizing the Chicago City Railway Company and the Chicago Railways Company, respectively, to construct, maintain and operate street railways in said city, and providing further for the purchase thereof by the said city or its licensee."

The Taylors Falls Hydro-electric Development.

As shown by previous illustrated articles in the Western Electrician (October 28, 1905, and October 20, 1906) the waterpower development on the St. Croix River at Taylors Falls, Wisconsin, about 40 miles northeast of Minneapolis, is one of the most important in the Middle West. The water power developed at St. Anthony's Falls, on the Missisippi, has for many years been insufficient to meet the increasing demands of Minneapolis. The



TRANSMISSION LINE FROM TAYLORS FALLS, WIS., CROSSING LEEDHOLM LAKE.

great growth of this city and its manufacturing industries have led to the necessity of developing additional cheap power. This need has been supplied by Stone & Webster in their development at Taylors Falls, and by means of high-tension electric transmission the power is being delivered to Minneapolis, supplying the growing needs of the Minneapolis General Electric Company. The installed capacity of the plant is 12,000 horsepower, but later this is to be increased to 24,000 horsepower.

In addition to details already given in relation to this plant, the following data of the transmission line will be of interest:

The line, after leaving the station tower, immediately crosses the river to a steel tower on the Minnesota side, making a span of about 500 feet, and runs over its own right-of-way to the outskirts of Minneapolis, a distance of some 43 miles.

This right-of-way is 60 feet wide. The line construction consists of both selected cedar poles and steel towers. There is a space of seven feet between any two of the wires. Locke three-piece insulators weighing 23 pounds each are used, together with steel pins. The conductors are No. 0000 standard copper.

Transpositions of wires occur every 3½ miles, a spiral of one-third of a turn being made at every such interval.

A private telephone circuit covers the entire length of the line, with stations at regular intervals where the patrol may report to station.

At the Minneapolis end of the transmission the line enters the sub-station from a steel tower and is stepped down, through nine banks of three water-cooled transformers each, to 13,000 volts. The capacity of this station is 8,100 kilowatts, the

building being of brick, steel and concrete construction.

From this sub-station the service runs, at 13,000 volts, overhead through the more open section of the city, and when well within the city limits is carried underground at the same voltage to the distributing station of the Minneapolis General Electric Company.

The old local station, which is being maintained as a reserve, contains a 1,500-kilowatt Curtis steam-turbine unit, three-phase, 60-cycle, 2,300-volt, as well as 2,360 horsepower in three turbine waterwheel units.

Automatic Switch for Regulating Water Supply in Reservoirs.

An ingenious automatic switch mechanism which is especially adapted to be used in connection with a reservoir of a water-supply system, has recently been invented by Augustus C. Durdin, Jr., of Chicago, who has obtained a patent.

The object of the invention is to provide a

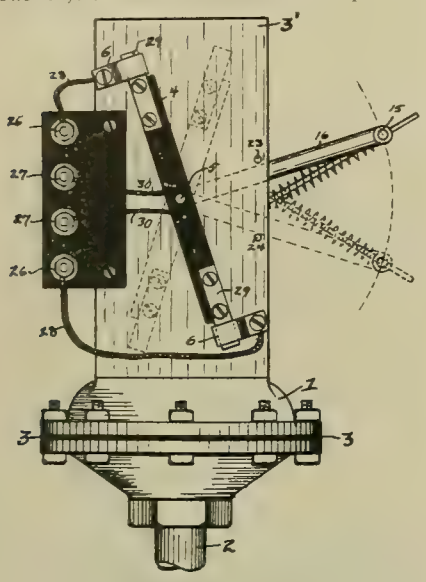


FIG. 1. FRONT VIEW OF AUTOMATIC SWITCH MECHANISM.

simple and efficient switch to be used either upon or in connection with a water reservoir, into which water is forced under pneumatic pressure by a force pump, driven by an electric motor. The construction of the switch is such that when the water and air in the reservoir have reached a predetermined pressure, the electric circuit communicating between the generator and the motor will be automatically opened. When the water in the reservoir has been partially exhausted the motor circuit will be automatically established again, and in this way the water in the reservoir will be automatically kept at a predetermined height.

The construction of the apparatus is shown in the drawings, of which Fig. 1 represents a front view, Fig. 2 a top view and Fig. 3 a rear view, partly broken away to show the interior.

Referring to the drawings, (1) represents a diaphragm chamber which may be connected directly with the water reservoir or the pipes leading to or from the same by the duct (2). When the pressure in the reservoir is increased or diminished, the diaphragm will be raised or lowered and the motion is communicated to a switch mechanism.

In the type of device illustrated the switch mechanism is supported directly upon the diaphragm chamber and the supporting standard (3') is cast integrally with the upper side of the diaphragm chamber. The switch bar (4) is pivotally supported at its center from the standard (3') on the bolt (5), and is adapted to contact at its respective ends with the terminals (6) (6), when in the position shown in Fig. 1, so that the electric circuit is closed between the generator and motor.

When the desired predetermined pressure has been reached in the reservoir the switch will be reversed and thrown from the position shown to that indicated by the dotted lines, thus cutting off the supply of current from the motor until the water supply is partly exhausted, when the switch will again operate to cause the motor to operate.

In this way the pressure in the reservoir will be automatically maintained.

Motion is communicated from the diaphragm (3) to the switch bar (4) in one direction as the pressure in the reservoir is raised through the diaphragm plate (7), reciprocating rod (8), pivot (9), lever (10), pivot (11), reciprocating bar (12), pivot (13), link (14), trunnion (15), lever (16) and lever-supporting pivot (5). The lever-supporting pivot (5) extends laterally through the standard (3') and serves as a support for the switch bar (4), which is rigidly fixed to the front end of the pivot.

When the pressure in the diaphragm chamber has diminished, the diaphragm is forced in the opposite direction by the recoil of the spiral spring (17), and the movement of all the parts is reversed, and the circuit is closed, as previously described.

The spiral spring (17) surrounds the reciprocating rod (8) and is interposed between the nut (18), which has screw-threaded bearings (19), on the rod, and the stationary bracket (20), which is rigidly fixed to or formed integrally with the standard (3'). The bracket (20) also serves the further purpose of a guide bearing for the upper end of the rod (8). Thus it will be obvious that

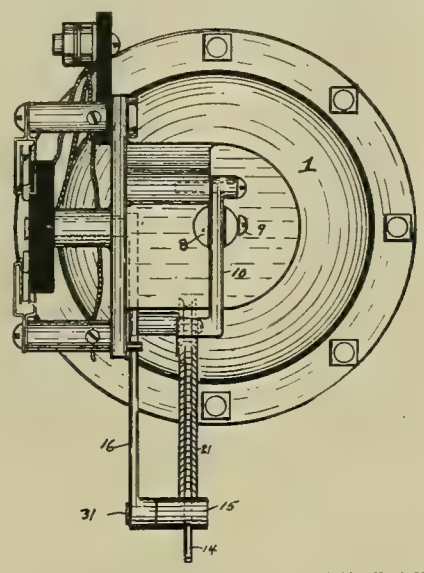


FIG. 2. TOP VIEW OF AUTOMATIC SWITCH MECHANISM.

when the diaphragm (3) is forced upwardly by the pressure from the reservoir, the spiral spring (17) will be compressed, and when the pressure in the reservoir is diminished the diaphragm will be forced downwardly by the recoil of the spring. It will also be obvious that the tension of the spring may be increased by turning the nut (18) toward and against the spring and diminished by turning the nut in the opposite direction. In this way the device may be adjusted so as to act when the water in the reservoir has reached any predetermined pressure desired.

As an example of the method of operating the device, if the elevation to which the water is being forced is such that 50 pounds pressure in the reservoir is required to carry the water to the desired elevation, the nut (18) will be turned

AUDITORIUM OF NEW YORK EDISON COMPANY.

toward the spring until the tension of the spring will require a pressure of 50 pounds to the square inch in the diaphragm chamber before the switch mechanism will be moved. When, however, a less pressure will serve the purpose for raising the water to the desired elevation, the nut (18) will be turned in the opposite direction upon the rod (8), and in this way the tension of the spring is diminished and the switch mechanism will be actuated by a less pressure. Thus, by turning the nut (18) upwardly and downwardly upon the supporting rod, the apparatus may be adjusted so as to actuate the switch mechanism, as stated, at any desired predetermined pressure.

Assembly Rooms of New York Edison Company.

Like other industrial concerns, the larger central-station companies now engage to a considerable extent in welfare work—that is, provision for the comfort, well-being and welfare of employes. The New York Edison Company has made arrangements of this nature on an unusually generous scale, as may be judged by the accompanying pictures, which, with the following comment, are reproduced from the December Proceedings of the American Institute of Electrical Engineers.

"The trustees of the United Engineering Society have decided that the assembly halls of the new Engineers' Building will be available for use in January. It appears probable, therefore, that the New York meeting announced for December 28, 1906, will be the last held in the auditorium of

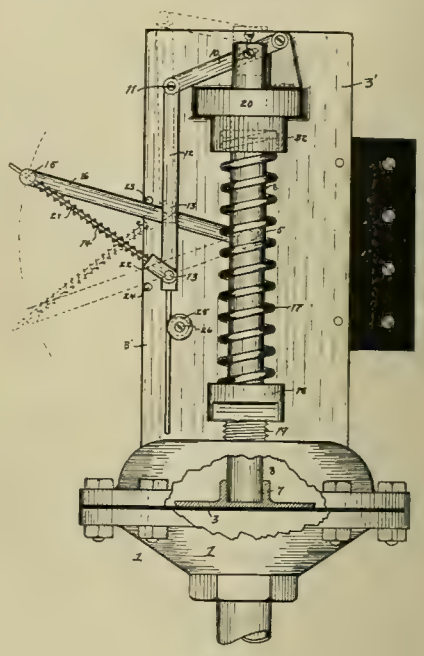


FIG. 3. REAR VIEW, PARTLY BROKEN AWAY, OF AUTOMATIC SWITCH MECHANISM.

the New York Edison Company at 44 West Twenty-seventh Street.

"Early in 1905 the use of this hall was offered to the Institute pending the completion of the new building, and it has proved entirely satisfactory. While it has been well filled on many occasions, it has never been uncomfortably crowded. Every possible convenience necessary for the proper conduct of meetings has been provided, and the attendants have been willing and courteous. The law committee has also held many meetings in the auditorium, and when meetings of other societies have conflicted, the reading room and library on the floor below have been available.

"These courtesies have been heartily appreciated, as the lack of suitable meeting places in New York is one of the difficulties encountered by many or-

LIBRARY AND READING ROOM OF NEW YORK EDISON COMPANY.

ganizations. The illustrations will give to those who have had no opportunity to attend the meetings a very good idea of the liberal provision made by the New York Edison Company for the benefit of its employes, as the two floors are especially devoted to welfare work."

About $2,000,000 will be expended in 1907 in a steam plant at Ross Park, near Spokane, for generating 30,000 horsepower to supplement the company's electric plants in Spokane and Post Falls, Idaho. The building will be of fireproof material. The plant will be ready for operation next August.

Canadian Niagara Power for Buffalo.

By Frank C. Perkins.

There is considerable interest at the present time in the subject of taxation or duty on electric power brought to cities in the United States from Canada. Naturally the proposition is not looked upon with favor by the power companies doing business on the Niagara Frontier, or by the manufacturers in Western New York.

The accompanying illustrations show two of the towers under construction on the Canadian side of Niagara River at Fort Erie, owned by the Canadian Niagara Falls Power Company, and the tower and transformer sub-station on the bank of Niagara River on the American side at Buffalo, owned by the Cataract Power and Conduit Company.

The cable tower noted in Fig. 1 is located on the hill at Fort Erie, and supports the transmission conductors of the power line connecting with the power house of the Canadian Niagara Falls Power Company in Victoria Park, Niagara Falls, Ontario, the cables passing from this tower on the Fort Erie hill to the high tower shown in Fig. 2 on the Canadian bank of Niagara River. The span across the river from this tower to the tower above the transformer sub-station on the American side (shown in Fig. 3) is 2,200 feet long, the height of the latter tower being 200 feet above the river, while the one on the Canadian side is 210 feet above the Niagara River.

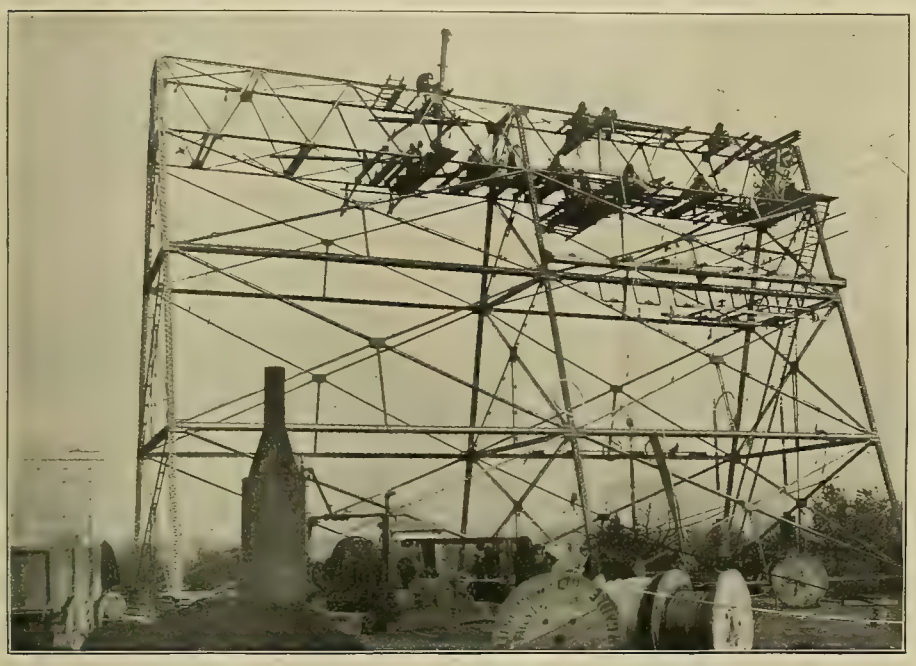


FIG. 1. CABLE TOWER FOR POWER TRANSMISSION ACROSS NIAGARA RIVER, LOCATED ON FORT ERIE HILL, CANADIAN SIDE.

There are nine cables of aluminum conducting the current at 22,000 volts from the Falls to the step-down transformers in the sub-station of the Cataract Power and Conduit Company. This sub-station (Fig. 3) is about 60 feet wide and 160 feet in length, constructed of pressed brick with stone trimmings. It has a capacity for step-down transformers of 4,000 horsepower capacity each, 12 in number, making a total output of 48,000 horsepower.

Located at the side of the building, the tower extends 150 feet above the ground, the building being about 50 feet above the level of Niagara River, giving a total height of the tower above the river level of about 200 feet, as above stated.

At the present time about half of the transformers have been installed, having a capacity of about 24,000 horsepower. This will practically double the capacity of the Cataract Power and Conduit Company, which is now delivering power from the Falls over the transmission lines on the American side of the river, generated at power houses No. 1 and No. 2 of the Niagara Falls Power Company.

The first span from the sub-station on the American side at Buffalo, across the river to the first tower on the Canadian side at Fort Erie, is 2,200 feet, while the next span is 1,600 feet long to the next tower (that shown in Fig. 1) on high ground at Fort Erie, where the regular Canadian transmission line continues along the bank of the river to the Canadian power station.

The step-down transformers in the sub-station lower the pressure from 22,000 volts, used on the transmission line overhead from the Falls, to 11,000 volts, which is the pressure employed for underground distribution service for power in the city of Buffalo. The underground cables conduct the current at this pressure to various sub-stations located in various sections of the city of Buffalo by underground conduits, containing from four to 24 ducts. These sub-stations are owned by the Buffalo General Electric Company, by the International Railway and by the city of Buffalo for the municipal pumping station, the current being sold at 24-hour rates to these corporations by the Cataract Power and Conduit Company, the yearly charge being $25 per horsepower-year.

It is maintained that within a short time Buffalo will be using over 100,000 horsepower of Niagara current, supplied by the Niagara Falls power houses mentioned. The Ontario Power Company's power station is already connected with the Lackawanna steel plant, a sub-station having just been completed for taking 20,000 horsepower or more from that Canadian plant, which is also supplying current to Rochester and Syracuse.

Annual Inspection Trip of Electrical Students from Champaign.

The electrical department of the University of Illinois is making its annual inspection trip under the direction of Prof. Morgan Brooks, Prof. H. P. Wood and Mr. E. I. Wenger to Pontiac, Ill., Chicago and Grand Rapids, Mich., from January 14th to 20th. At Pontiac the party visited the single-phase railway of the Bloomington, Pontiac and Joliet Electric Railway Company. While in and near Chicago the visitors are scheduled to inspect the Illinois Steel Works, Electrical Show at the Coliseum, the high-tension system of the Economy Light and Power Company of Joliet, the Batavia plant of the Aurora, Elgin and Chicago electric railway, the Western Electric Company's manufacturing plants, the Chicago Telephone Company's Washington Street exchange, the Postal Telegraph Company's office and the Fisk Street station of the Commonwealth Electric Company. At Grand Rapids the party will study the 66,000-volt transmission system of the Grand Rapids-Muskegon Power Company by invitation of W. A. Foote, vice-president.

Employers and Employed Talk Things Over at Mrs. Palmer's House.

Of quite unusual interest was the meeting of representatives of labor and capital at the beautiful home of Mrs. Potter Palmer on the Lake Shore Drive, Chicago, on Saturday evening, January 12th. The conference was held under the auspices of the National Civic Federation and was attended by more than 600 persons. In a few days another meeting will be called to complete plans for organizing a branch in Chicago. According to the present plans, Chicago will become the central point from which the efforts of the National Civic Federation will be exerted throughout the central and middle western states. August Belmont of New York, William D. Mahon, international president of the Amalgamated Street Railway Employes, and others spoke, and the meeting was enthusiastic and harmonious. Among those present were Arthur D. Wheeler, A. S. Hibbard, Henry Shafer, William H. McKinlock, Bion J. Arnold and Francis W. Parker.

The Waterpower of Alabama.

It is reported that waterpower is used in 59 out of the 67 counties of the state of Alabama. Although most of the plants are small, they aggregate 33,000 horsepower. A strong impetus has been given to the power development of that state by the United States Geological Survey, which has for a number of years been making measurements of the amount of water flowing in the streams in order to obtain a safe basis for calculating the low-water volume at all seasons of the year.

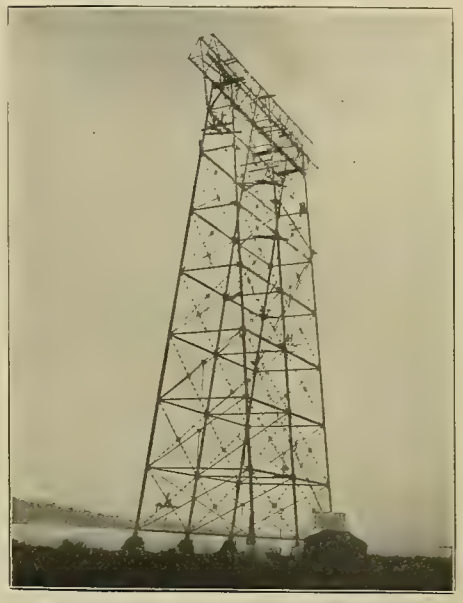


FIG. 2. HIGH CABLE TOWER ON CANADIAN BANK OF NIAGARA RIVER.

Most of the failures in attempts to utilize the natural power supplied from small rivers and mountain streams have come from lack of sufficient data of this kind, and as a result of the work of the Survey, the United States Weather Bureau and the State Geological Survey a large amount of information has been collected concerning the stream flow, rainfall and topography which is reliable and will be of great assistance in the development of the work.

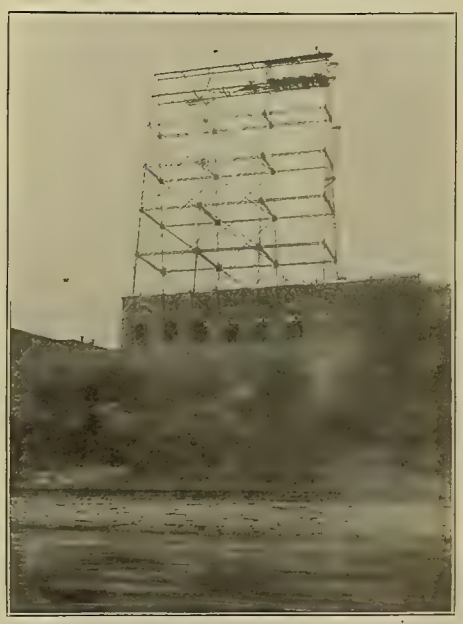


FIG. 3. CABLE TOWER AND TRANSFORMER SUB-STATION ON AMERICAN SIDE OF NIAGARA RIVER AT BUFFALO.

One of the results is the realization of the fact that even in the dry seasons there is about 200,000 horsepower available from the Tennessee, Coosa and Cahaba rivers alone.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Electrical Salesmen's Association (annual meeting), Grand Pacific Hotel, Chicago, January 24th, 2 p. m.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

TUNGSTEN-FILAMENT incandescent lamps are on public exhibition for the first time in the United States at the Chicago Electrical Show now in progress. The lamps thus exhibited are made in the United States by one of the great electrical manufacturing companies, and it is declared that they constitute the first batch of American-made tungsten lamps to be exhibited anywhere. A row of the lamps is installed on the ceiling of an exhibit booth, the adjacent rows being composed of tantalum lamps. The tungsten lamps shown are in large units (85 mean horizontal candlepower), the bulb being of the familiar pear shape. The light and appearance of the tungsten lamp is comparable to that of the tantalum lamp, five filaments being placed in series in each lamp. The great claim for the lamp, of course, is its remarkably high efficiency—1¼ watts per candle.

Another feature of the show of unusual scientific and technical interest is a high-temperature electric furnace of new design in which, it is said, small artificial jewels have been produced. Moissan produced artificial diamonds in France several years ago by using the electric furnace, but the process is one requiring great care and patience and has been only rarely demonstrated. At this writing the Chicago apparatus has not been shown in use, owing to some delay, but no doubt before these lines reach the eye of the reader it will be employed in daily demonstrations.

The Chicago Electrical Show has many attractions—technical, industrial and popular—and the opening days give promise of great success. This is pleasing, because the exhibition marks a distinct advance over that of last year, which was a highly creditable affair.

ON ANOTHER page Mr. Hibbard presents a brief statement of the case of the Chicago Telephone Company in the pending negotiations for a new telephone ordinance in the city of Chicago. He expresses himself temperately and is entitled to be heard, not only in fairness as representing one side of an important controversy, but because he has written an article which is intrinsically interesting.

There is no use in blinking at the fact that the Chicago Telephone Company has been, and probably is, unpopular in this city. Like many another public-service corporation, it has not always conducted its affairs wisely, if its object was to win and retain the good will and esteem of the people and their representatives, who grant the franchise without which it is impossible for it to do business. But times and methods change, and corporations operating under public franchises have been brought to see the necessity of giving the best service and a fair share of the profits (in one form or another) to their overlords—the communities which they serve. It is the general adoption of this policy which seems to have checked the dangerous municipal-ownership movement.

In view of the more intelligent appreciation of the situation which public-service companies now exhibit, the Chicago Telephone Company is entitled to a fair and candid hearing; and the same remark applies, of course, to the other applicants for the franchise. Mr. Hibbard's article is therefore timely.

The telephone-franchise question is one that bristles with difficulties. In the matter of measured-rate service, for instance, Mr. Hibbard makes a strong argument, but business men using the telephones will be apt to make emphatic objection to his plan, however logically correct it may be. We are glad to see that the committee of the City Council having the subject in charge has retained three telephone engineers or experts of standing to obtain the benefit of technical advice. The whole subject should be treated in a broad, intelligent, fair-minded spirit, with the idea of obtaining the best possible telephone service for Chicago (that is indispensable) at rates which shall be just to users, municipality and company alike.

PORTO RICO is a comparatively small island, being about 100 miles long from east to west and less than 40 miles wide from north to south. It is no wonder, therefore, that an effort is making, in the matter of electrical communication, to place increasing reliance on the telephone and to use the telegraph less exclusively. When the present commissioner of the interior for Porto Rico entered upon his duties it was found that the telegraphic system then in use was costing the island government about $20,000 annually; in other words, the excess of disbursements over receipts amounted to that sum. Upon investigation it was found that this was largely due to an unequal distribution of salaries and to the fact that operators in offices where the receipts were barely sufficient to pay for office rent were receiving salaries equal to those paid to operators of the large offices, where the receipts were fairly high. In reforming the service some unimportant offices have been discontinued altogether, while others, where the business was light, have been turned into telephone stations at a cost to the government of only $60 a year. The substitution has so far given satisfaction.

At the last session of the Legislature a bill was enacted appropriating the sum of $15,000 to supplement the insular telegraph system by means of telephone lines, and the work of establishing telephonic communication between the more important smaller towns and the nearest telegraph stations is now under way. Telegraph messages will be transmitted at the usual rate. This telephone system is proving a profitable investment to the Department of the Interior. It is the intention of the commissioner to install a long-distance telephone service between San Juan and Ponce and intermediate towns. This is much needed by the mercantile interests of the island and can be done at a comparatively small expense with the present plant. It will undoubtedly prove an additional source of revenue.

HOW SHALL we extend our foreign trade? That was the burden of inquiry at the national convention for the extension of foreign commerce just held in Washington at the call of the New York Board of Trade and Transportation. In considering this "how" Mr. James W. Van Cleave made some pertinent suggestions. He touched upon the necessity for the creation of a merchant marine; the need for the study of the requirements of foreign markets, especially those of South America; the improvement of the consular service, and the aid that is being afforded our manufacturers by the Department of Commerce and Labor.

More particularly Mr. Van Cleave called attention to the necessity for individual effort. Speaking of the necessity of studying requirements, he said that we Americans have been negligent of this in the past; we have been enjoying a feeling of superiority. We must learn that the world at large can teach us something that may be valuable to us. Egotism is as bad for a country as it is for an individual. Our resources are merely tools for those who know how to use them.

The speaker thought that we need more transportation facilities. He said that if we treated our waterways with the consideration that is accorded to them in European countries we would force down freight rates and open up our markets. Concerning tariff revision, he declared that such adjustment becomes necessary from time to time by reason of discovery, invention, and changes in fashion, and urged that Congress should appoint a non-partisan commission for the revision of the tariff, section by section. We must meet the conditions of foreign competition and make better goods. Manual training for boys is desirable, it was said, especially in view of the decline of the apprenticeship system.

Mr. Van Cleave strongly urged the necessity for industrial peace between employer and laborer, and stated that, more than foreign competition, we have to dread this fire from the rear to which we are at times subjected. Capital-and-labor relations should be established on a basis of equal and exact justice for all. The speaker also called attention to the need for irrigation in the West. Speaking of the regularity with which business panics have been encountered, he said that much could be done to avoid these calamities by the avoidance of all classes of extravagance, both in home and in manufacture.

Greater Water Flow for Drainage Canal Not Favored by International Commission.

Recommendation is made in the report of the International Waterways Commission, which has been completed and is now in Washington, D. C., that the government of the United States prohibit the diversion of more than 10,000 cubic feet of lake water per second for the Chicago Drainage Canal. The commission says that any greater diversion of water from Lake Michigan will injure the whole Great Lakes system. In view of the existing treaty relations, and in considering future treaty arrangements the commission says:

"The preservation of the levels of the Great Lakes is imperative. The interest of navigation in these waters is paramount, subject only to the right of use for domestic purposes, in which term is included necessary sanitary purposes. In our report of November 15, 1906, upon the application of the Minnesota Canal and Power Company to divert certain waters in Minnesota, we recommended among other things:

"'That any treaty which may be entered into should define the uses to which international waters may be put by this country without the necessity of adjustment in each instance, and we would respectfully suggest that such uses should be declared to be (A) uses for necessary domestic and sanitary purposes; (B) service of locks for navigation purposes; (C) the right to navigate.'

"A careful consideration of all circumstances leads us to the conclusion that the diversion of 10,000 cubic feet per second through the Chicago River will, with the proper treatment of sewage from areas now sparsely occupied, provide for all the population which will ever be tributary to that river, and that the amount named will therefore suffice for the sanitary purposes of the city for all time. Incidentally it will provide for the largest navigable waterway from Lake Michigan to the Mississippi River which has been considered by Congress."

Officials of the Sanitary District consider the report as absurd. President McCormick says that the report is uncalled for and wholly without the proper sphere of the commission's activities, as it was chosen for the purpose of inquiry into the practice of diverting the flow of water over the Niagara Falls and using it for power. He thinks the commission has not the authority to judge and further, that it has not given the Chicago question sufficient study to be able to make an equitable report.

The plan of the Sanitary District is to reverse the flow of the Calumet River, as has been done to the Chicago River. This would require the diversion of 14,000 cubic feet of water from the lake instead of the 10,000 now permitted. President McCormick is quoted as saying: "If we take 14,000 cubic feet of water from Lake Michigan every second, that will be just one-twenty-sixth of the smallest flow that ever passes from Lake Michigan to Lake Huron. That's as near as Chicago is coming to destroying Niagara." President McCormick and Chief Engineer Randolph have gone to Washington and personally asked Secretary Taft for a formal permission to reverse the flow of the Calumet River, thus ignoring the report.

Edward B. Ellicott, electrical engineer of the Sanitary District, says that if the report of the commission is adopted by the government it will not affect the carrying out of the electrical power development work now in progress on the Drainage Canal at Lockport. Mr. Ellicott also believes that the present limit of water diversion will be insufficient for future sanitary requirements of Chicago.

The International Waterways Commission consisted of Brigadier-general O. H. Ernst, chairman, and George Clinton and E. E. Haskell, members of the American section; George C. Gibbons, chairman, and W. F. King and Louis Coste, members of the Canadian section.

Electrical Salesmen's Association.

The second annual meeting of the Electrical Salesmen's Association will be held in Chicago on January 24th. Sessions will be held in the breakfast room of the Grand Pacific Hotel. The opening session will be a business meeting at 2 p. m., when committee reports will be heard, officers elected, etc.

A dinner will be enjoyed at 6:30 p. m., and the evening entertainment will include an array of speakers who are leaders in the art of selling goods at a profit. The following subjects will be considered: "The Sale of Specialties;" "Requirements of a Successful Salesman;" "Price as Compared with Quality as a Basis for the Sale of Electrical Goods;" "Salesmanship." All the speakers have made a life study of selling goods.

The evening will close with a general discussion of the subject: "Which is the More Important in the Sale of Electrical Goods—the 'House' or the 'Salesman?'" Three speakers have been engaged to represent the salesman's side. A public appeal has been made for speakers on the side of the "House." Following the opening speakers a general discussion will be invited. An instructive and entertaining evening is looked for.

It is imperative that the committee know in advance how many will be on hand. Members will please notify G. H. Erich, secretary, 358 Dearborn Street, Chicago, that they will attend the dinner.

New York Automobile Show.

The display of commercial and pleasure vehicles on exhibition at the automobile show, which opened at Madison Square Garden, on January 12th, far surpasses that of any previous year. The whole display has been arranged on a most elaborate and extensive scale.

Electric pleasure vehicles are on exhibition in the Café, at the Madison Square end of the Garden. Commercial vehicles practically fill the whole basement floor. The general decorative scheme of the Garden is that of a Swiss palace in autumn. The identity of the Garden has been entirely lost in the blazing glories of fall foliage on rustic bowers, nestling in the shadow of snowy peaks. The illusion is carried to the uttermost, and completed by huge paintings at the ends and sides of the Garden, adding a grand perspective of Alpine scenery. Heroic statues and sparkling fountains combine to form a beautiful setting for the exhibition. Every foot of available space has been utilized to accommodate the models of the 265 exhibitors, which includes the Association of Electrical Vehicle Manufacturers, but many interesting exhibits have been omitted for want of the necessary space.

In the electrical pleasure-vehicle division are Babcock, Fake, Columbia Buggy Company, Gallia, Pope-Waverly and Studebaker type. In the commercial-vehicle division are Columbia, General Vehicle Company, McCrea Motor Truck Company, Pope-Waverly and Studebaker machines. The cars are much more luxurious than heretofore, and it is predicted that the average selling price will be far higher than has obtained at any automobile show held in this country before.

One of the most interesting of the novelties to be seen is the new combination car of the Electric Vehicle Company, in which the power is furnished by a gasoline engine, but delivered to the wheels by an electric motor, thus eliminating the usual gear transmission. This car is propelled by a 40-45-horsepower four-cylinder gasoline engine, but in place of the ordinary friction clutch and transmission, an electric clutch and separate electric motor are used under electric control. On the high speed practically all the power of the engine is transmitted to the bevel-gear driving shaft, there being only three per cent. slip when the car is under full speed. This slip generates a current which is used to magnetize the clutch when the circuit is closed on itself, so that the armature is pulled around by magnetism and not by friction. At lower speed, when more driving effort is required, the magnetic clutch is allowed to slip to a greater extent by opening its circuit, and the current thus generated is passed through an electric motor, which helps propel the car at lower speeds. There are five forward and two reverse speeds and an electric brake. In outward appearance the car resembles the Mark XLIX. Columbia. In the larger cars the electric current is utilized in various ingenious ways. There are electric annunciators, electric lights inside and outside and electric cigar lighters.

Another type which attracts unusual attention is the new model 67 Pope-Waverly, a victoria phaeton, equipped with extremely efficient motors and the latest thing in control.

A removable coupé-top Chelsea is a novelty in that it is a car that can be easily converted from a covered carriage to an open summer vehicle.

The novelties and specialties are too numerous to be recited in a few words. In fact, it requires time to consider and digest the wonderful advances that have been made in electrics since the last exhibition.

In the Baker exhibition of electrics the new landaulet heads the list. The body design closely follows approved styles that have found favor abroad. The Baker brougham is a dignified example of what this style of car ought to be. In these vehicles especial attention has been given to distribution of weight. Accessibility to electrical parts is also a strong feature. The motor control and resistance box are located under the driver's footboard. The terminal wires are accessible at this point. The adoption of the Renault silent chain for use in the way of reduction of gear is a good point. It is the first application for the same use in this country.

Another model is the Baker Queen victoria, whose lines have been most artistically drawn out. It has been specially built for women who prefer to do their own driving. The Baker runabout embodies all the good mechanical features of the Queen victoria, but is built on more masculine lines. There is also a new design for inside-drive coupé. The bodies of these three models are interchangeable—a feature that would be appreicated by all users of electrics.

The Baker gentleman's road racer attracts unusual attention and it is built on racing lines. It has a long, rakish bonnet and a rumble seat; the steering wheel is tilted at an angle that implies its mission. It is equipped with 30 cells, which are located in front, under the head. The manufacturer lays claim to a speed of 40 miles an hour, with a wide radius on one battery charge.

A new ignition system providing for the use of a magneto or storage-battery coil, as desired, through one set of spark plugs, the invention of Robert Jardine, for the Royal motor car, is also an interesting feature of the exhibition.

Street Railway and Lighting Interests Organize Insurance Company.

Representatives of 27 large street-railway and lighting companies met in Cleveland, Ohio, on January 10th and organized the American Railway Insurance Company. Insurance on street and interurban railways and electric-light and power companies is to be placed in a company owned by the insured themselves. The plan is said to include some of the largest street-railway companies in the country.

A charter already secured for this company is to be followed by application for charters under the laws of Ohio for the Traction Mutual Insurance Company, the Electric Mutual Insurance Company and the Associated Railway Companies Insurance Company. Through these four companies it is proposed to handle practically all of the insurance on this class of property in the country.

A board of directors was elected as follows: H. E. Andrews, Cleveland (president); C. L. Andrews, New York; A. E. Akins, Cleveland; H. L. Clark, Philadelphia; Alex Dow, Detroit; H. A. Everett, Cleveland; G. L. Estabrook, Philadelphia; C. G. Goodrich, Minneapolis; J. C. Hutchins, Detroit; Walter Kernan, New York; R. E. Sheldon, Columbus, and J. H. Price, Samuel Scovil and H. N. Staats, Cleveland.

The companies represented at the final organization meeting are reported from Cleveland as follows: Metropolitan Railway Company, New York; Brooklyn Rapid Transit Company; Twin City Traction Company, Minneapolis and St. Paul; Cleveland Electric Railway Company; Rochester Railway Company; Syracuse Rapid Transit Company; Schenectady Railway Company; Rochester and Eastern Rapid Railway Company; Rome City Railway Company; Oneida Railway Company; Northern Ohio Traction and Light Company; Toledo Railway and Light Company; Canton-Akron Railway Company; Detroit United Railway Company; Bangor Railway and Light Company; East St. Louis and Suburban Railway Company; Alton, Granite and St. Louis Traction Company; Grand Rapids Railway Company; St. Joe Railway, Light, Heat and Power Company; Columbus Railway and Light Company; Lake Shore Electric Railway Company; Cleveland and Southwestern Traction Company; Cleveland, Paynesville and Eastern Railway Company; Detroit Edison Company; Cleveland Electric Illuminating Company, and the Interstate Railways Company, Philadelphia, Pa.

The railway and light companies expect to obtain their own insurance at actual cost, the cost being the actual losses paid, plus the expense of maintaining and operating the insurance companies. The traction and light interests involved expect to reduce the present cost of their insurance 50 per cent.

Indiana Electrical Contractors in Session.

The semi-annual meeting of the Electrical Contractors' Association of Indiana was held at the Grand Hotel, Indianapolis, on January 11th. W. H. Morton of Utica, N. Y., secretary of the National Electrical Contractors' Association of the United States, was the chief speaker. The chief topic of business was the preparation for securing the enactment of a law by the present Legislature for requiring a license for electricians. The members of the association say there are too many "screw-driver electricians," and that their employment is proving a great detriment to the proper and safe installation of electrical work. Under a license law, it is asserted, this class of incompetent workers could not obtain work, much less secure contracts. F. H. Cheyne of Indianapolis is president and C. C. Hatfield secretary of the Indiana association.

Earthquake in Jamaica Impairs Telegraphic Service.

The earthquake that visited Kingston, Jamaica, on January 14th prostrated land telegraph lines and severed all cable connection to that city for several days. Twenty-three hours after the disaster telegraph connection had been restored to within five miles of the city. Several messages were sent out from St. Thomas the following day; also Holland Bay, which is about 35 miles from Kingston. The cable connection of the Commercial Cable Company, between Jamaica and Bermuda, was broken. The Western Union cable connection between Kingston and Colon was put out of commission by the earthquake.

The Progress of Electricity on Steam Railroads in 1906.[1]

By Bion J. Arnold.

On a former occasion, in September, 1904, during the International Electrical Congress in St. Louis, at the joint meeting of the Institution of Electrical Engineers of Great Britain and the American Institute of Electrical Engineers, as retiring president of the latter body, I spoke upon the "Electrification of Steam Railroads," and it may be of interest to quote a few paragraphs from that speech, as the predictions made at that time seem to have been fairly closely followed since.

After having referred to the early struggles of the electrical engineer in attempting to introduce electric traction in street and interurban-railway service, and referring briefly to the large electrification schemes then under way, I said:

"That electricity will be generally used on our main railway terminals, and ultimately on our main through lines for passenger and freight service, I am convinced, but I do not anticipate that it will always be adopted on the ground of economy in operation, neither do I anticipate that it will come rapidly, nor through the voluntary acts of the owners of steam railroads, except in special instances.

"At first the terminals will be equipped for special reasons, due either to the voluntary act on the part of the terminal companies to effect economy in operation, or to public pressure brought to bear upon the owners through an increased demand on the part of the public for better service, on the grounds that the use of the steam locomotive is objectionable in our great cities.

"Those roads which run through populous countries will either build new roads, or acquire, for their own protection, those electric railroads already built and operating in competition with them, and utilize them as feeders to their through-line steam trains. Thus the steam-railroad companies will gradually become interested in electric railways and eventually become practically the real owners of them. With these roads operating as feeders to the main-line system and with the terminals thus equipped and the public educated to the advantages of riding in electrically equipped cars, the next step will logically be the electrical equipment of the trunk lines between the cities already having electrical terminals.

"Thus some favorably located trunk lines having a sufficient density of population will feel warranted in equipping electrically, and when this is once done the other roads running between the same competing points must, sooner or later, follow, in order to hold their passenger traffic.

"This may result in temporarily relegating some roads to freight service, so long as they operate exclusively by steam, but with the increased demand on the part of the public for better and cleaner service will come a corresponding increase in passenger revenue to the roads equipped for handling it until one road after another finds it advantageous to furnish an electric passenger service.

"With the terminals and main lines equipped electrically, and the desire on the part of the public for more prompt and effective freight service resembling that which is given by the steam roads in England and on the Continent, due to the great density of population, there will be developed a great high-class freight service conducted in light, swiftly moving electric trains, which can be quickly divided and distributed over the surface tracks of our smaller cities, or through underground systems similar to that which is now being built in Chicago. Such a system would soon prove indispensable to the public and a source of great profit to the roads, as it is now getting to be to many suburban railways.

"This class of freight service would prove so large a part of the freight traffic of a road that the operation of the through-freight traffic by steam locomotives, though at present cheaper, would in time, as cost of coal increases, grow less, until those roads operating an electric passenger service would ultimately use electricity exclusively."

Previous to that time the officials of the steam railroads of the country had paid but little attention to the subject of electricity, but were then beginning to realize the inroads that were being made upon their local traffic by the interurban roads. This caused the more progressive ones among them to begin to investigate carefully the claims of the advantages of electric traction, with the result that at that time there were either contemplated, or well under way, a number of important electrical installations, which could be credited to the favorable decisions of steam-railway officials.

Confirming the prediction which I then made, to the effect that the steam railroads would acquire the electric roads paralleling them, I call attention to the fact that, according to published reports, the New York Central Railroad Company has since then, in addition to completing, practically, its great electric terminal in New York city, either purchased outright, or acquired indirectly the controlling interest in most of the interurban roads paralleling its lines between Albany and Buffalo, and the New York, New Haven and Hartford road has recently acquired practically all the interurban roads which compete with it in its territory. The Erie road is, in addition to its preparation for the electrification of its terminals in the vicinity of Jersey City, now equipping 34 miles of track extending southeast of Buffalo, thus retaining traffic which might have been taken from it by the construction of competing interurban lines.

In like manner, the Pennsylvania Railroad system, in addition to the electrification of its great terminal system in the vicinity of New York, is gradually electrifying the Long Island Railroad system, which so effectually gridirons the island lying east of Manhattan Island, and known as Long Island.

The New York, New Haven and Hartford Railroad Company is also going to great expense in the electrification of its line from New York city to Stamford, Conn., a distance of 31 miles, with reasonable probability of gradual extension of electric traction over its system.

These few examples, together with the electrical operation of the great Simplon Tunnel, by means of which the traveler will be carried from Switzerland into Italy without the annoyance due to obnoxious gases emitted from the steam locomotive, I believe are sufficiently impressive to emphasize the correctness of the lines of development outlined by me in 1904, involving, as they do, an expenditure of approximately $100,000,000 for electrical equipment, and a collateral investment of some $300,000,000 more.

In addition to these general types, there are now under construction, or contemplated construction, many special installations adopted for various reasons, such, for instance, as the St. Clair Tunnel of the Grand Trunk Railway system, extending from Port Huron, Mich., to Sarnia, Ont., wherein steam locomotives will soon be abandoned and trains operated electrically.

The equipment of the Cascade division of the Great Northern Railway, over the Cascade Mountains, a distance of about 100 miles, although not yet definitely decided, is another notable example of the contemplated application of electricity to steam roads. This equipment would eliminate the use of steam locomotives now operating over a tortuous piece of road, and through a long and difficult tunnel.

Electrification is also contemplated upon a division of the Southern Pacific Railway, through the Sierra Nevada Mountains, for the purpose of eliminating the difficulties due to tunnel operation and of increasing the capacity of the road, which is now limited by the size of the present steam locomotives.

Thinking that a little more specific information regarding certain important installations that have been put in operation during the last year, or are now under construction, would be of interest, I will describe some of them briefly, attempting to bring out the principal points, and eliminating detail as far as practicable.

New York Central Terminal.

As is well known, the New York Central Railroad Company has been engaged in the electrification of its New York terminal for about four years, and has recently put into operation, for passenger service, interurban trains running between New York city and Yonkers, a distance of 14 miles, and is now introducing electric locomotives into the terminal service for operation of its through trains, between the Grand Central terminal and Groton, 35 miles, and to North White Plains, on the Harlem division, 29 miles from New York.

The installation will, when completed, consist of two power stations of 30,000 kilowatts each and eight sub-stations, which will supply and distribute electrical energy to about 400 miles of track within a radius of 40 miles from the city of New York. An experimental track for testing the locomotives designed for this special work was equipped by the New York Central and the General Electric companies, acting jointly, and upon this track experiments have been conducted for the last three years, with the result that the type of locomotive for through-train service which is now being introduced into actual work has, by a long series of experiments, proven itself capable of doing the work for which it is intended. Thirty-five of these machines are now ready for operation, and will be introduced as rapidly as men can be trained to operate them. Each locomotive weighs 100 tons, has a normal capacity of 2,200 horsepower and a maximum capacity of 3,000 horsepower, and will run at speeds varying from 40 to 80 miles an hour, depending upon the weight of the trains, which will vary from 250 to 900 tons. Two or more locomotives can be coupled together for heavy train service, and operated upon the multiple-unit system in the same manner as the cars.

Two hundred steel motor cars will soon be placed in service, each equipped with 400 horsepower of motor capacity, and so arranged that they can be run singly or in multiple, at will, on the multiple system, although some are now used as trailers without motor equipments. Each motor car is 60 feet long over all, weighs 53 tons, seats 60 passengers, and is designed to run at a maximum speed of 52 miles an hour.

One power house, in which has been installed 20,000 kilowatts in turbo-generators and the necessary auxiliaries, is now in service, and the energy is distributed to the trains by means of four sub-stations, in which are placed storage-battery auxiliaries for the purpose of regulating the load upon the power stations, and for reserve capacity in case of accident to any sub-station or power station. From the sub-stations the energy is distributed to the trains by means of secondary copper feeders and inverted, or under-contact, type of third rail.

By the adoption of electric traction the New York Central Railroad Company was enabled to abandon the use of steam locomotives in its Park Avenue tunnel, which has always been a source of annoyance to its patrons and of danger to the road. It has also been enabled to make extensive improvements in its terminal facilities, in the way of lowering its tracks, thereby making the viaducts leading from the western part of the city to the East Side available for team traffic, thus adding greatly to the value of East Side real estate. This condition of lowering the viaducts was imposed upon the company by the city of New York before the road could obtain permission to make the improvement. With this condition imposed upon it, however, the company saw fit to acquire a large amount of additional real estate on each side of the right-of-way, which permitted its engineers and architects to plan a much more comprehensive terminal than had been previously possible. This terminal station will cost approximately $15,000,000, when completed, and will be built upon the double-deck plan, the suburban trains entering it at the lower level and the express trains on the upper level. The introduction of electric traction into this terminal has made it practicable for the company to expend advantageously about $65,000,000 in these terminal improvements, about $15,000,000 of which was for the electric-traction portion of the equipment.

Pennsylvania Railroad Improvements in and Near New York City.

Other great improvements now planned or under construction, which are made possible by the introduction of electricity, will enable all other steam railroads in the vicinity of New York city to enter Manhattan Island. I shall speak first of the work of the Pennsylvania Railroad Company.

Beginning at Bergen Hill, in New Jersey, about 2.7 miles from the proposed New York city station, and almost directly in line with Thirty-third Street, on Manhattan Island, the plans of the Pennsylvana Railroad contemplate the construction of two tunnels, each 19 feet in diameter, parallel with each other, from Bergen Hill, through the Palisades, and under the Hudson River, thence under a portion of Manhattan Island, to the terminal station located between Thirty-second and Thirty-fourth streets and Seventh and Eighth avenues in New York city. From this terminal station eastward there will be four tunnels, each 23 feet in diameter, extending across the island under the East River to the terminal in Long Island City, where the tracks will come to the surface, and connect with the extensive yard contemplated by the Pennsylvania system at that point.

Through these tunnels, which are about 14,000 feet in length, will be operated, by electric locomotives, all passenger service entering New York city of the Pennsylvania Railroad, and probably a large amount of freight for the distribution yard at Long Island City. The suburban trains for interurban service passing through these tunnels will be operated on the multiple-unit system, and the electric locomotives will be, as in the case of the New York Central, similarly operated, when it is desired to couple them together.

Hudson and East River Tunnels.

For the purpose of enabling the interurban and other steam roads entering Jersey City to enter the city of New York, there are now being constructed two other systems of tunnels, one under the name of the Hudson and Manhattan Railroad, and the other under the name of the New York and New Jersey Railroad. The interests of both companies have been recently consolidated and now operate under the name of the former.

The two tunnels of the Hudson and Manhattan company extend from the foot of Exchange Place in Jersey City to a terminal at Church and Fulton streets on the Island of Manhattan, a distance of about 9,000 feet. The tunnels of the New York and New Jersey Railroad will extend from the foot of Fourteenth Street in Jersey City to Morton Street on Manhattan Island, a distance of about 5,000 feet.

It will be noticed that the tunnels of both of these companies are considerably smaller than those of the Pennsylvania company. They are constructed for the purpose of feeding the present subway of the Interborough company. Consequently all cars entering these tunnels will have to be of the special small and low design now used by the Interborough company. This is a misfortune, which it seems impossible now to over-

1. Presidential address delivered at the annual dinner of the Western Society of Engineers, Chicago, January 8, 1907.

come, as it will effectually prevent any of the through trains of the steam roads which now terminate at Jersey City entering Manhattan Island unless they come through tunnels of their own to be hereafter constructed.

In addition to the subways heretofore mentioned, to be used for the accommodation of steam-railway traffic, there are to be four additional tunnels constructed under the East River, two by the New York and Long Island Railroad Company at Forty-second Street and two under the direction of the Rapid Transit Commission from the present terminal of the Interborough subway at the Battery to Joralemon Street in Brooklyn, connecting with the subway under construction to the Flatbush terminal of the Long Island Railroad Company.

It will thus be seen that when the present tunnels which are now under construction are completed there will be six under the Hudson River and eight under the East River, or 14 in all.

While certain experimental electric locomotives have been built for operation in the Pennsylvania tunnel, and it is probable that the third-rail, direct-current method of propulsion will be used, I do not understand that the type of locomotive or system of propulsion has been absolutely decided upon, and therefore omit further details regarding the equipment of the Pennsylvania tunnel.

All cars which will operate through the tunnels of the Hudson and Manhattan company and the New York and New Jersey company will necessarily have to be of the type which will operate upon the direct-current third-rail, such as is used in the operation of the Interborough company's subway.

New York, New Haven and Hartford.

The decision of the New York Central Railroad Company to adopt electricity for its terminal necessitated similar action on the part of the New York, New Haven and Hartford Railroad, as the trains of the latter company enter the Grand Central Station over the tracks of the former company. The New York, New Haven and Hartford, not having taken up the subject until some two years after the decision of the New York Central was made, and having the benefit of the development in the state of the art, decided not to adopt the direct-current third-rail method of propulsion, but, on the contrary, adopted the single-phase overhead-contact method of train propulsion, and is now engaged in installing and getting ready for operation the most extensive and elaborate single-phase system yet attempted, the outcome of which is being watched with great interest by railroad men.

This company is at present installing electric traction on its system between Woodlawn, where its tracks join those of the New York Central, and Stamford, Conn., 33 miles from New York. Between Woodlawn and Stamford the road will be equipped with overhead-working conductor, operating with single-phase 25-cycle current at 11,000 volts. From this conductor the current will be collected by means of under-contact sliding shoes, transformed to a pressure of about 450 volts by the transformers carried upon the locomotives, and used in the motors as alternating current. Each locomotive will be designed to weigh 72 tons, has a nominal capacity of 1,000 horsepower, and is designed to make 26 miles to 45 miles an hour with trains varying from 200 tons to 250 tons. Several of these locomotives have been delivered and are now being tried out upon the experimental tracks of the company, and it is expected that they will go into practical service as soon as the overhead work and power-station equipment of the company can be completed.

The company will not at present use the multiple-unit system, but will operate its suburban trains by means of these electric locomotives, 30 of which have been ordered for this service. The system will be operated from the company's power station, generating single-phase current and having a capacity sufficient properly to operate the trains. The overhead construction is divided into sections, with suitable circuit-breakers at the end of each section, which will open automatically in case of a short-circuit or can be manually controlled by the towermen.

St. Clair River Tunnel.

In order to eliminate the present objections regarding the use of steam locomotives in the St. Clair tunnel of the Grand Trunk Railway system, extending between Port Huron, Mich., and Sarnia, Ont., the officials of that company decided a little over a year ago to adopt electrical propulsion. After due consideration, it was decided to adopt the single-phase method of propulsion. This system was adopted for several reasons, the principal one being the objection to the use of the third rail in the yard of the company at each end of the tunnel, which was quite extensive, and in which much switching had to be done in making up trains before entering the tunnel. The equipment will consist of six electric locomotives, weighing 120 tons each, having a normal capacity of 1,500 horsepower, capable of exerting a drawbar pull of 25,000 pounds at a speed of 10 miles per hour and a maximum speed for passenger-train service of 35 miles per hour.

The power station, which is now well under construction, will contain two 1,250-kilowatt turbo-generators, either one of which will be capable of operating the tunnel up to its full capacity, the other being held in reserve.

The decision to adopt single phase for this installation was made by the speaker some time prior to the decision of the New York, New Haven and Hartford company, and, like it, the working of this system in this class of service will be carefully watched.

Erie Railroad.

The Erie Railroad Company has a commission organized for the purpose of electrically equipping its lines running out of Jersey City, a total of about 250 miles, although it is contemplated that but 35 miles will be immediately equipped, viz., the division extending from Jersey City to Greenwood Lake. In addition to its suburban lines in the vicinity of Jersey City and its terminal, the road now has under construction 34 miles of single track, known as the Rochester Division. This division lies between Rochester, N. Y., and Avon, N. Y., with a branch between Avon and Mount Morris. The single-phase alternating-current system will be used, having a working pressure of 11,000 volts on the overhead conductor.

The energy will be secured from Niagara Falls at a pressure of 60,000 volts. Six passenger coaches, 54 feet long, and seating 56 people, will be placed in service, each car weighing about 50 tons, and equipped with four 100-horsepower motors. These cars will be capable of a maximum speed of from 45 to 50 miles an hour, and of hauling one trailer. While this extension of the Erie system is short, the company has under contemplation the electrical equipment of its entire suburban service surrounding Jersey City, which will involve an expenditure of some $15,000,000. Plans are now being formulated for this expenditure.

West Jersey and Seashore Branch of the Pennsylvania Road.

This is a recently electrified branch of the Pennsylvania from Camden, N. J., to Atlantic City, a distance of 65 miles. Equipment consists of a power house, eight sub-stations and 71 miles of duplicate high-tension line. The service is ultimately to consist of three-car express trains, running 60 miles an hour on a 15-minute headway, and local service at 10-minute intervals.

The equipment of this line was done in record-breaking time. The site for the power house was chosen January 17, 1906, and on July 1st two boilers were under steam with a turbine and auxiliaries running, and car service on the line.

In the sub-stations the line voltage is reduced and transformed from 33,000 volts three-phase to 650 volts direct current. Third-rail equipment was used of Pennsylvania Railroad standard dimensions. These dimensions will satisfactorily operate with equipment of the Long Island Railroad and the Interborough system of Manhattan Island. The rail is protected at stations and in yards. The cars for service on this line have a seating capacity of 58, are double vestibuled, and are well protected from fire risk. The cars are 55 feet 5½ inches long, and weigh, when fully equipped, 89,000 pounds, being heated and lighted electrically and equipped with hand brakes and quick-service air brakes.

Southern Pacific Railway, San Francisco.

The Southern Pacific Railway system is making active preparations to change about 20 miles of local steam line for electric-traction service. The line extends from the Ferry terminal to Alameda and Oakland. The generator station is at Alameda Point. The electrical equipment is built for 500 volts direct current, with overhead trolley and utilizing present tracks. A year has been allowed for this work to be completed, after which time the electrification of the lines may possibly be extended.

It is not the intention at present to do away with the steam locomotives, but these will be used to aid the electric service during the rush hours.

It is stated that an appropriation of about $1,250,000 has been made for this work.

West Shore Railroad.

An important piece of equipment for electrical operation is now under construction by the West Shore Railroad system between Utica and Syracuse, N. Y. The work in hand covers a distance of 44 miles, and the passenger schedule provides for limited trains in each direction, making the distance from terminal to terminal in one hour and 22 minutes.

In deciding upon the plans, the relative merits of alternating-current overhead equipment and third-rail direct-current equipment were carefully considered, and the decision to install the direct-current system was largely determined by the general flexibility of a third-rail equipment should it become desirable to make lateral extensions, install additions, sidetracks, etc.

Over certain sections of the line traffic conditions require that two additional tracks be built. These tracks will enable the passenger trains operated electrically at 55 and 45 miles an hour to avoid interference with freight trains operated by steam—fast freights with a schedule of about 25 miles an hour and local freights with a schedule of about 15 miles an hour.

Construction work was started on May 15th, and is well under way at the present time.

Electric power will be furnished by the Hudson River Electric Power Company, which will deliver three-phase 60,000-volt current at the railway company's sub-station seven miles west of Utica. The Hudson River company will, for the present, generate this current at its auxiliary steam plant in Utica, but upon the completion of its contemplated transmission lines current will very likely be taken from the hydro-electric plants owned by the company in the eastern part of the state. There will be four sub-stations, located about 10½ miles apart. These will be identical in construction, and each will be equipped with two 300-kilowatt rotaries and necessary apparatus for transforming 60,000-volt three-phase current to direct current for distribution to the rails at 600 volts.

The transmission-line towers will be of steel and similar in design to those built for the Niagara transmission for the Syracuse Rapid Transit Railroad Company. There will be 391 of these towers, with normal spacing of 480 feet. Most of the towers are 39 feet high, the highest being 63 feet.

The line conductors will be located at the vertices of an equilateral triangle seven feet on a side.

The third-rail construction is the Wilgus under-running protected type, this being the standard adopted by the New York Central. The rail is protected for the greater part of the distance by 1¼-inch wooden planks above the rail and on both sides, and part of the line has a rail protection of indurated fiber, three-sixteenths inch thick, molded to conform with the rail section.

The third rail is located between the parallel tracks, except where curves or other special conditions require it to be transferred to other sides of the track.

The company will operate 15 closed cars, 49 feet over the bumpers, each equipped with four 75-horsepower motors per car and multiple-unit control.

Spokane and Inland Railway Company.

This is a single-phase line between Spokane, Wash., and neighboring cities, having a total mileage of 114. The capital invested in the project is approximately $3,500,000. The service includes passenger, mail, express and carload freight. The power is purchased from the Washington Water Power Company and is delivered to the railway company as three-phase 60-cycle current to a frequency-changing station 10 miles south of Spokane. This station has four frequency-changers, each of nominal 1,000-horsepower capacity, which convert the current to 25-cycle 2,200-volt single-phase current.

For transmission to the sub-stations this 2,200-volt current is stepped up to 45,000 volts and transmitted to 15 sub-stations, where it is stepped down to 6,600 volts for direct connection to the trolley circuits.

The cars and locomotives operate on three different voltages at different parts of the line. In the country 6,600-volt alternating current is used and in the smaller towns 700-volt alternating current, while within the limits of Spokane 600-volt direct current is used. In the country and through the small towns a pantagraph under-running trolley is utilized, while in Spokane the ordinary under-running trolley wheel is used. The passage from the alternating-current to the direct-current system is done by operating a commutating switch, which makes all necessary connections, and by changing the trolley from the pantagraph to the wheel type.

The cars are equipped with four 100-horsepower alternating-current motors. The locomotive uses the same type of motors, but has a capacity of 150 horsepower each. Both the locomotives and coaches may be operated on the multiple-unit system. The locomotives are capable of handling seven standard freight cars, fully loaded, at 30 miles an hour, on level track. This locomotive weighs 49 tons and has a length over the bumpers of 29 feet.

European Work.

Some recent installations may be of interest. Progress is being made on the tunnel work under the Seine for additional lines to the Paris Metropolitan Railway.

The project for the tunnel under the English Channel, between Calais and Dover, has acquired a new interest and is a subject under much discussion. The proposed tunnels would be 18 feet in diameter, the submarine portion being 24 miles in length, with approach six miles in length, and, of course, would be operated electrically. This tunnel is designed to carry the rolling stock of the principal European railroad companies.

The new electric locomotive for use in the Simplon Tunnel is of special interest as showing the latest progress in the design of a locomotive for running upon high-voltage three-phase current. The locomotives are designed to allow two normal running speeds, which are obtained by the proper switching of the circuit. Power used is from 3,000-volt three-phase 15-cycle circuits and provides the two standard speeds of 25 and 40 miles an hour. The machines are designed to pull a total

load of 440 tons, including the locomotive itself, this condition to hold good even with reduction of line pressure as low as 2,700 volts. The principal dimensions of the locomotive are as follows: Length between buffers, 41 feet eight inches; diameter of the driving wheels, five feet six inches; total weight of locomotive, 68 tons, of which the mechanical part is 37 tons and the electrical outfit 31 tons. The capacity in normal running is 900 horsepower. The main controlling apparatus of the locomotive uses compressed air for operating the reversing and other switches.

A trolley is mounted on the roof at each end of the locomotive and works against the overhead wire, the design of this trolley being a special feature of this locomotive. The lower parts have the form of a parallelogram, which can be raised or lowered by air pressure. The upper arm, which carries the trolley contact, is made very short and light and has a limited motion to either side.

CONCLUSION.

From what has been said it can be seen that rapid progress is being made in the application of electricity to steam railroads. Some installations have been made on account of the economy in operation to be effected, and the increased earning capacity to be gained, while others have been made under public pressure.

With the completion of the work now under construction by the New York Central and the New York, New Haven and Hartford Railroad companies, the steam locomotive will disappear forever from the Island of Manhattan and its surrounding territory.

From an examination of the map of the business district of Chicago, bounded by Sixteenth Street, Halsted Street, Chicago Avenue and Lake Michigan, it will be seen that 23 per cent. of this area is occupied by the tracks of steam-railroad companies. In view of the present state of the art of electric railroading, the right to vitiate the air of our congested districts by the emission of large quantities of carbonic dioxide from the stacks of numerous locomotives is as questionable as the right to foul the air by the stenches from our stock yards. As there is now a possibility of the removal of these yards, is it unreasonable to hope that all of the steam-railroad companies, through the wise foresight of their officers, may help to purify and beautify the city, by assisting the general movement now under way by our progressive civic bodies for this purpose? In my judgment, at least one, and probably three, of the companies now operating in the city of Chicago can afford to undertake, and would profit by, the electrical operation of their suburban trains.

First Meeting of the Institute in New Building.

The two-hundred-and-thirteenth meeting of the American Institute of Electrical Engineers will be held in the Auditorium of the Engineers' Building, 33 West Thirty-ninth Street, New York, on Friday, January 25th, beginning at 8:15 p. m. The following paper will be presented by Messrs. Lewis B. Stillwell and Henry St. Clair Putnam: "Substitution of the Electric Motor for the Steam Locomotive."

The paper will include: (1) Presentation of certain facts established by experience in the operation of elevated, subway and interurban lines by electricity; (2) discussion of comparative cost of operation by steam and electricity applied to railways in operation, and including both passenger and freight service; (3) the importance of standardizing electric-railway practice; (4) the question of frequency in the operation of railways by alternating current.

Members of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the New York Railroad Club, and the Transportation Club are invited to attend this meeting.

COMMUNICATION.

Illuminating Engineering in Solicitor's Handbook.

To the Editor of the Western Electrician:

We have noticed with much interest the announcement of the Co-operative Electrical Development Association, offering $2,600 in prizes for material for a solicitor's handbook. Under Division 2, in the advance pamphlet sent out by the Association, we notice that section 1 is devoted to illuminating engineering. We wish to state, through the columns of your paper, that to any persons who desire to try for these prizes and wish information on the subject of illuminating engineering we shall be very glad to give assistance in every way possible, offering the services of our engineering department for this purpose.

V. R. LANSINGH,
Engineer of Holophane Glass Company.

New York, January 14, 1907.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER VI.

AERIAL CONDUCTORS.

Mr. Marconi early in his experiments deduced empirically a law governing the relationship between signaling distance and mast height, finding that, everything else being equal, the distance covered was proportional to the square of the height

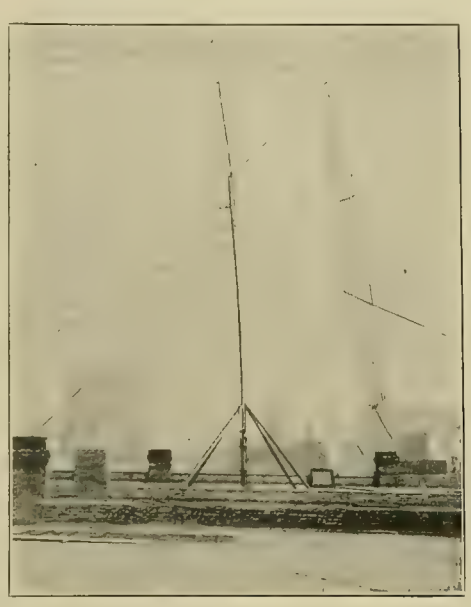


FIG. 41. MAST OF EXPERIMENTAL STATION IN DETROIT.

of the mast used. For example, if an aerial wire 80 feet high is, with a given set of instruments, found to be sufficiently elevated for signaling a distance of 20 miles, then an aerial of 160 feet high would be required for a distance of 80 miles, and so on. Later practice of the art of wireless telegraphy, however, has developed various situations where this law does not hold good.

Constant experimentation, carried on in different localities, has brought to light so many new facts concerning the propagation of electric waves that

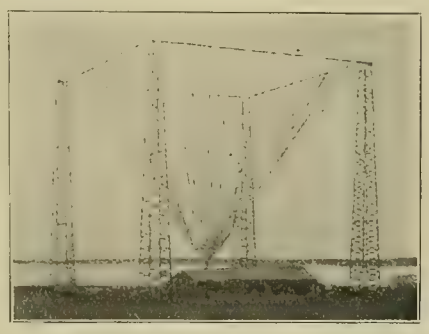


FIG. 42. MARCONI HIGH-POWER STATION AT SOUTH WALL FLEET, MASS.

the construction of aerial conductors has within the last few years become quite a science, and many different forms of aerials are used. As there is generally but one aerial used at each wireless station, the elevated conductor serves a dual purpose—that of sending out signals in the form of transverse vibrations in the ether and of receiving, or, rather, intercepting, similar signals transmitted from a distant station.

Among the principal forms of aerials used in successful practice are the following:

(a) Single-wire aerial.
(b) Parallel conductor, or fan type.
(c) Multiple quadrangular aerial.
(d) Multiple cylindrical aerial.
(e) Inverted pyramid aerial.
(f) Liquid aerial.
(g) Adjustable cylinder aerial.

Type (a) would simply refer to a single or stranded wire forming an individual conductor.

Type (b) refers to those aerials which have a number of parallel conductors which are at some point between the operating apparatus and the top of the mast, joined together and made into a single conductor.

Fig. 41 is an illustration of type (b) aerial. It is an experimental station on the roof of a building in Detroit, Mich.

The Marconi station at South Wallfleet, Mass., shown in Fig. 42, is of type (c) construction. This installation consists of four wooden standards, 210 feet high, arranged in a quadrangle. Extending downward from the top of the structure are 400 wires; in the form of an inverted pyramid. The upper terminals of these wires are thoroughly insulated from the earth, and the lower ends are joined into a single conductor of large diameter.

The original Marconi station erected at Poldhu, Cornwall, was of type (d) construction, but, as might have been expected, the first well-developed

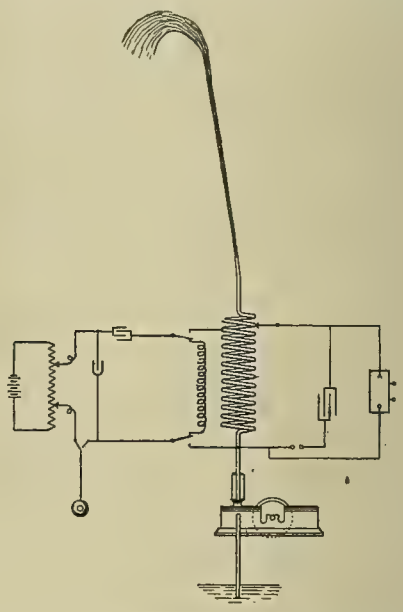


FIG. 43. FESSENDEN LIQUID AERIAL.

hurricane which came along after the structure was completed, made short work of its destruction, and when rebuilt the plant was given a more substantial and sightly design.

Type (f), liquid aerial, refers to the Fessenden arrangement for use on shipboard, to be resorted to for signaling purposes after the regular mast aerials have been shot away in action. Fig. 43 is an illustration.

An illustration of type (g) aerial is given in Fig. 44.

In practical installations it is of extreme im-

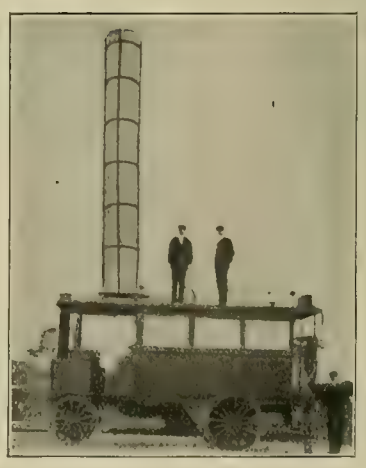


FIG. 44. MARCONI'S WIRELESS WAR CHARIOT.

portance that absolute insulation be maintained between the aerial conductor and the earth. Where such high-potential oscillatory currents are used, contact with insulating or semi-insulating substances which are connected with the earth directly or indirectly causes leakage, which seriously interferes with effective radiation.

It is advisable to have the aerial wires insulated, as this prevents wasteful dissipation of the energy,

NOTE.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

but does not interfere with or retard the radiation of electric waves.

Great care is invariably taken where the conductor enters or leaves the room or building in which the operating instruments are located. The ordinary telegraph method of running wires through porcelain tubes through window or door casings is not sufficient.

Fig. 45 shows the usual method employed in

FIG. 45. AERIAL CONDUCTOR PASSING THROUGH HOLE IN GLASS WINDOW.

wireless operations, showing the conductor brought through a hole made in the center of a plate-glass window. For the protection of the glass and of the insulation of the cable an ebonite or hard-rubber bushing is generally provided for the hole.

The material used, in most instances, for the conducting aerial wire, is copper. For experimental purposes other metals have been tried, such as aluminum, iron and steel. On account of its superior conductivity, copper is generally employed.

In relation to the material best suited to the purposes of aerial conductors and radiators, Mr. James Foster King, an American wireless-telegraph inventor, has recently carried on a series of quali-

FIG. 46. HEMP INSULATING LOOP.

tative experiments which indicate that metals having great magnetic inertia are preferable for radiators to aerials made up of metals having nothing more than low ohmic resistance in their favor. Mr. King's investigations led him to believe that by thinly plating a soft-iron reflector with a more perfect alternating conductor, such as tin, the great increase in conductivity of the surface layer will permit greater exciting current for a given charge to traverse the surface metal, and at the same time limits the appreciable current conduction to the reflecting surface of the aerial radiator.

A more perfect surface conduction takes place with a copper reflector which has been plated with

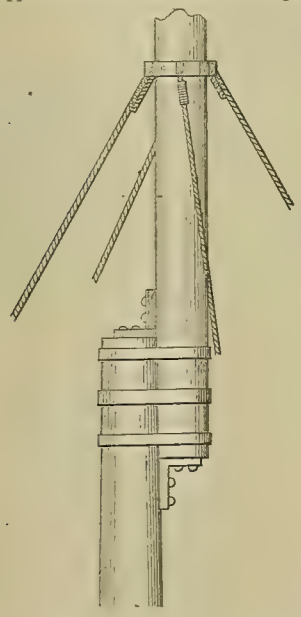


FIG. 47. MANNER OF FASTENING SECTIONS OF MAST.

silver, as it offers a greater resistance to high-velocity distortions. This being the case with a copper core, the further desirability of employing a magnetically rigid metal for the reflecting core, such as iron or steel, suggested to Mr. King that, regardless of the mode of application of charge, an iron core plated with a superior electromagnetically conducting metal, such as tin, would prove to be a most efficient radiator.

In short-distance signaling, where a single aerial conductor is to be used, it should be a stranded copper cable of No. 7-20 size, insulated with rubber and tape. This wire should be attached to the mast at intervals of six feet, by means of heavy porcelain insulators, such as are used to support the conductors of high-tension transmission lines. These insulators should hold the conductor at least six or eight inches away from the support at all points. Especial care should be taken where the conductor is brought through the window or wall of the operating room.

In order to test the conductor for insulation the sparking terminals of the transmitter should be separated to a distance where sparks cannot pass. One terminal of the transmitter being grounded, the end of the vertical wire is gradually brought near the other terminal of the coil. Should there be any appreciable sparking between the vertical wire and the knobs, the insulation is defective and should be thoroughly overhauled.

The mast should be a wooden one, but it may be stayed with the usual galvanized-iron wire. If there be a loop of hemp, such as that shown in Fig. 46, to insulate each stay from the ground, these loops should be well tarred or waxed, so

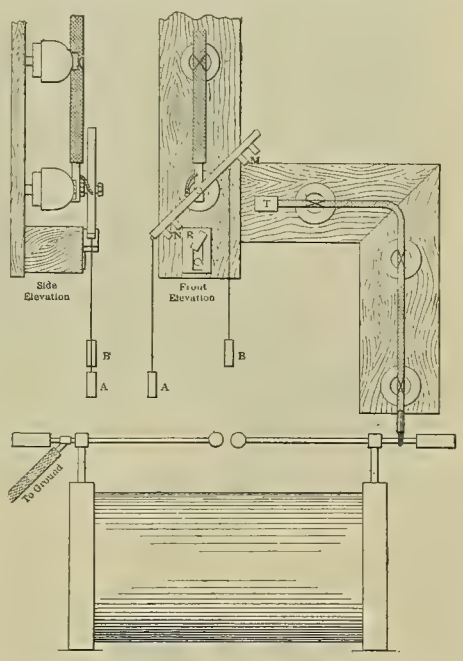


FIG. 48. DIAGRAM OF SWITCHING APPARATUS.

that they will not become conducting when subjected to rain. Instead of a loop of rope, an iron ring covered with tarred rope may be used, or a double porcelain knob "break," such as are used in electric and street-railway plants. These insulators should be near the ground end of the stay wire.

If impossible to provide a very tall mast, a number of shorter ones may be used, the lower end of all the conductors being connected together. Where the conditions are such that the mast has to be erected in a rocky location, a hole should be blasted out to a depth of one-sixth the length of the pole, and the mast set in with cement or concrete. If the mast is to be placed in clay soil or gravel, the hole should be dug to a depth of about one-fifth of the mast. The soil, when replaced, should be thoroughly rammed. In either case, the guy wires may be fastened securely to large stones buried in the earth.

High masts are generally made in several sections, fastened together, as shown in Fig. 47, by means of iron hoops and angles.

In an installation where only simplex operation is contemplated, the vertical conductor at each station serves for the receiver and transmitter. In order to fulfill these two functions a switch should be provided by means of which the conductor may be connected to receiver or transmitter, as required. A switch designed for this purpose is shown in Fig. 48. The lower end of the aerial is connected to an iron near each end of which is a small horseshoe magnet. When the cord (B) is pulled the long arm of the lever falls and the magnet (M) makes a contact and adheres to the iron plate (T), which is connected directly with the transformer coil, as shown. When the cord (A) is pulled the magnet (N) is drawn into contact with, and adheres to the iron block (R) which is electrically connected with the receiving instruments. The distance between (M) and (T), when (N) touches (R), must be slightly greater than the sparking distance of the coil used. If this switch is carefully constructed, it will serve its purpose admirably.

Another important feature of satisfactory operation is the ground connection, which should, preferably, be a water pipe, but if such is not available a hole should be dug in the earth to a depth where moisture is permanent, and a sack of coke placed in the bottom of the hole. A copper ground plate about 12 inches square should then be buried in the coke and the hole filled in with earth. The wire leading to the ground plate should be iron and uninsulated.

[*To be continued.*]

QUESTIONS AND ANSWERS.

The Question of Frequency.

A subscriber in Jackson, Mich., asks:

1. How much greater is the efficiency with 25-cycle rotary converters than with 60 cycles?

2. What are the difficulties that arise in operation with 60 cycles that do not trouble with 25 cycles?

ANSWERS.

1. The difference in efficiency between 25-cycle and 60-cycle rotary converters is usually not more than two or three per cent. The efficiency of a 60-cycle rotary can be made almost as good as a 25-cycle rotary, but ordinarily at some additional expense.

2. The difficulties that arise with 60-cycle rotaries are due to the very much larger number of poles and resultant difference in commutator design, particularly with rotaries delivering 500-volt direct current. Sixty-cycle rotaries delivering 250 volts have recently been improved considerably and are operating with reasonable success. Sixty-cycle rotaries delivering 500 volts can hardly be classed as desirable machines. Recently, however, there has been considerable development in this matter, and some manufacturers are willing to make very much better guarantees than they were a few years ago. However, for railway work particularly, the 25-cycle rotary will probably always have a more decided inherent advantage.

Induction Coil for Radio-telegraphy.

J. J. R., Chicago: I would like to ask several questions about induction coils adapted for wireless telegraphy. I have made an induction coil six inches long with ½-inch core to give a half-inch spark. I should have insulated the layers in the secondary, because it takes a high secondary voltage to force a spark across a half-inch air-gap. Now when I connect the condenser to the vibrator of the coil, I think the secondary current, instead of crossing the high-resistance air-gap, will cut through the secondary winding, which is of lower resistance. Kindly state whether the induction coil will do the work. The condenser I made consists of 50 sheets of tinfoil, two by four, insulated with 1-64-inch oil paper.

ANSWER.

It is probable that the difficulty, as the inquirer suggests, is due to the fact that he failed to insulate the layers in the secondary winding, with the result that when the secondary electromotive force exceeds a certain value the discharge takes place between the convolutions of the secondary winding instead of across the spark terminals. The effect of connecting the condenser across the vibrator is to increase the abruptness of the break in the primary current, and thus increase the electromotive force generated in the secondary winding. This increase of potential, which follows when the condenser is brought into the circuit, may be just sufficient to cause the spark to break through the insulation and pass by way of the convolutions of the secondary circuit instead of across the spark-gap.

In order to remedy the difficulty, J. J. R. will probably have to rewind and insulate the secondary. When he has done this he probably will find that the coil will operate effectively and will produce sparks sufficiently powerful to affect the coherer or other receiving device over a considerable distance.

Senator Sutherland has introduced a bill to provide for the granting of rights-of-way within and through the various forest reserves of the United States for the purpose of construction and operation of telephone and telegraph lines and lines for the transmission of electric light and power. The right is to be granted under rules and regulations to be prescribed by the secretary of agriculture.

Mercury-vapor Lamps in Steam-laden Atmosphere.

By Eugene D. Hays

An interesting application of Cooper Hewitt mercury-vapor lamps is found in the lighting of rooms filled with steam. The feeding mechanism of arc lamps under this condition is a source of considerable trouble. For this class of work a special type of Cooper Hewitt lamp is supplied, with separate resistances, and the holder or fixture is made of brass except for the suspension bar and crowfoot. In order to avoid leakage of current, due to condensation of steam on the inside of the suspension bar, the wires leading to the tube are carried on porcelain cleats mounted on the outside of the suspension bar. The resistances are placed preferably outside the steam room, but may, if necessary, be in the same room.

A good example of this class of work is found at the plant of the J. B. Stetson Company, Philadelphia, Pa., probably the largest hat manufacturing company in the United States. The photograph (Fig. 1) gives a good idea of one of the "sizing rooms" of this company. The size of the room in question, together with the location of the lamps, is shown in the sketch (Fig. 2). The total area of the room, less elevator and stock room, amounts to 7,240 square feet. The building is of concrete, with white walls and ceilings. Ceilings are 14 feet high. The lamps used are type K, two in series on 220 volts direct current. Each of these lamps gives light from a tube 45 inches long and one inch in diameter. With the standard reflector the average candlepower measured from the horizontal is as follows:

At 30 degrees, 800 candlepower.
45 degrees, 955 candlepower.
60 degrees, 1,100 candlepower.
90 degrees, 1,200 candlepower.

Each Cooper Hewitt lamp consumes 385 watts, or a total of 4,620 watts for the 12 lamps. This gives 0.64 watt per square foot of floor space lighted. Twenty-four arc lamps taking 660 watts each—a total of 15,840 watts, or 2.19 watts square foot of floor area—were formerly used to light this floor until replaced by the Cooper Hewitt lamps.

In the sizing room on the eighth floor there are 12 type K mercury-vapor lamps replacing 24 two-ampere 220-volt arcs. Here there are 48 machines, with eight men at each, the total number of men being 384. In the tipping and brim-stretching room on the fifth floor there are 12 mercury-vapor lamps replacing 24 three-ampere 220-volt arcs. Here there are seven rows of machines, double, with 12 men in each row; number of men, 84. The size of these two rooms is the same.

It will thus be seen that the current consumption has been reduced to 29 per cent. of the amount formerly required. In other words, there is a saving in current of 71 per cent. In addition to the saving in current, and of much more importance, the production of the men in the room has been increased, due to the better quality and more even distribution of the light. The men are on piecework and naturally prefer Cooper Hewitt lamps.

The John B. Stetson Company is now using a total of 96 type-K lamps for this class of work. The larger portion of these lamps have been in use for over a year without requiring any repairs and are in good condition.

This Picture is Reproduced from a Photograph Made at Night by Light from Mercury-vapor Lamps.
FIG. 1. THE LIGHTING OF A LARGE HAT FACTORY IN PHILADELPHIA.

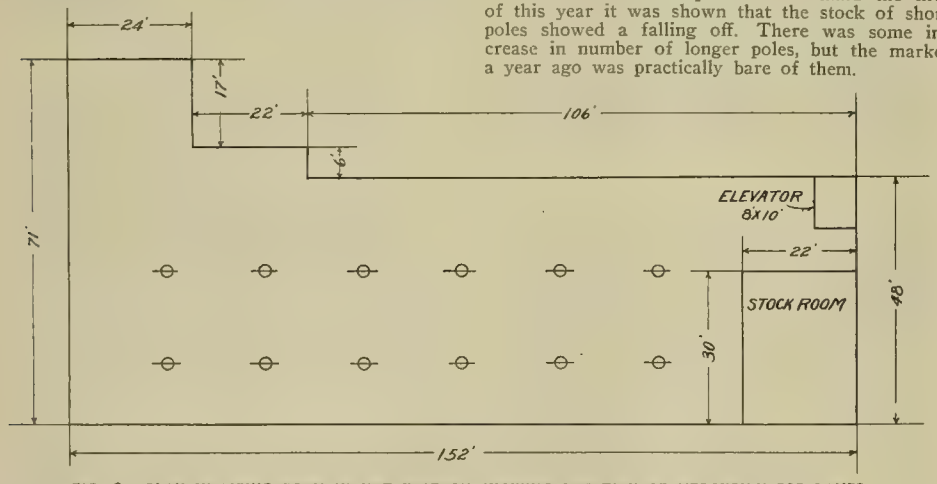


FIG. 2. PLAN IN SIZING ROOM IN HAT FACTORY SHOWING LOCATION OF MERCURY-VAPOR LAMPS.

Northwestern Cedarmen's Association.

The eleventh annual convention of the Northwestern Cedarmen's Association was held on January 8th at the Spalding Hotel, Duluth, Minn., with a good attendance. In the absence of President Marshall H. Coolidge the meeting was called to order by Vice-president P. W. Raber. While the conditions of the pole market were stated by the members as being exceptionally good and the outlook for the coming year's business excellent, the conditions in the woods are said to be very bad for lumbering operations, which means uncertainty as to the size of the year's supply.

After reading the minutes of the last meeting, which was a special one held in Minneapolis last fall, Secretary M. O. Nelson was called upon to report his review of work of his office. The report of cedar produced is the most thorough ever gathered by the secretary's office. It is furnished by 120 wholesale dealers, of whom 27 are members of the association. The secretary said that an analysis of the report would show that in 1906 there was a much smaller production of stocks from seven to 20 feet in length than during 1905. On poles from 12 to 20 feet in length the product of the last year was somewhat in excess of that reported for 1905. On long poles, 25 feet and longer, there was a slight increase in 1906.

In his review of dry stocks on hand the first of this year it was shown that the stock of short poles showed a falling off. There was some increase in number of longer poles, but the market a year ago was practically bare of them.

After the reports of the various committees were presented and the regular business of the association transacted the chair appointed a nominating committee, which presented the following-named to serve the coming year: President, P. W. Raber, Chicago; vice-president, A. T. Naugle, Chicago; treasurer, W. B. Thomas, Manistique, Mich. The committee's recommendation was unanimously adopted, and a vote of thanks to retiring president Coolidge was passed.

After adjournment the board of directors held a meeting and re-elected M. O. Nelson of Minneapolis secretary.

In the evening the members attended an elaborate banquet, with the Duluth Log Company, L. R. Martin, Martin Bros., Cloquet Tie and Post Company, Marshall H. Coolidge Company and the Pittsburg and Lake Superior Iron Company as hosts. This proved a highly enjoyable event, several novel and entertaining numbers being presented, and the members showed their appreciation by their enthusiastic praises.

Notes of the Convention.

E. L. Clark of the Valentine-Clark Company, Chicago, took an able part in the proceedings.

Popularity spells "Mueller," and he of the William Mueller Company of Blaney, Mich., was there of course. A cedarmen's convention without him would not be complete.

"Archie" Naugle, as he is affectionately called, was there to help guide the destiny of the association.

Among those to extend a royal welcome to Duluth was T. P. Bradley of the Duluth Log Company.

Mr. Norton of the Escanaba office of the Kellogg Switchboard and Supply Company was in attendance.

Secretary W. P. Bowring was present to represent the C. H. Worcester Company in his own effective way.

H. W. Reade, secretary and treasurer of the Pittsburg and Lake Superior Iron Company, came along with the Escanaba delegation. Mr. Reade gave and took warm welcomes on every hand.

Mr. Ricker Van Metre, representing the Deer River Lumber Company of Deer River, Minn., made his initial appearance at the cedarmen's gatherings, and his happy faculty for making friends led all to hope he would be a regular attendant henceforth.

Electric Drive in Modern Plate-glass Plant.

The Crystal City plant of the Pittsburg Plate Glass Company is now about completed at Crystal City, Mo., 28 miles below St. Louis. There are 15 buildings, all of reinforced concrete. It is estimated that 50,000 barrels of cement will be used in the building process. In the equipment of this large plant, due provision has been made for adopting the most modern methods of manufacture. The machinery will be driven by electric motors of exceptional size. The power equipment already contracted for includes an 1,800-horsepower Allis-Chalmers gas engine, direct-connected to a 1,000-kilowatt Allis-Chalmers generator. This unit will be installed in the same power house with a 5,000-horsepower Allis-Chalmers engine, famous as the "Big Reliable." This engine carried the entire lighting load for the illuminating of buildings and grounds of the Louisiana Purchase Exposition at St. Louis. The name was given it by the attendants because of continued good service during the entire duration of the Fair. Sixteen-hundred-horsepower in induction motors will be used to drive grinders and polishers.

Exports of Manufactures from the United States.

Exports of manufactures from the United States in the calendar year 1906 were valued at more than $700,000,000. The Bureau of Statistics of the Department of Commerce and Labor has completed the figures for the 11 months ending with November, and added to these a conservative estimate for December. Ten years ago, in the fiscal year 1896, they amounted to but $258,000,000; in 1886, but $145,000,000, and in 1876, $105,000,000. The share which manufactures formed of the total exports was, in 1906, 42 per cent.; in 1896, 30 per cent.; in 1886, 22 per cent., and in 1876, 20 per cent. Thus, the exports of manufactures in 1906 were 3½ times as great as a decade ago, and the share which manufactures form of the total exports about one-third greater than at that time.

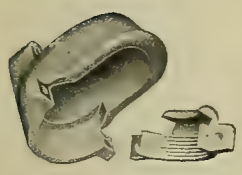
Practically one-half of the manufactures exported from the United States goes to Europe, the great manufacturing section of the world. Of the $686,000,000 worth of manufactures exported in the fiscal year ended June 30, 1906, $318,000,000 worth went to Europe, $182,000,000 to North America, $79,000,000 to Asia, $64,000,000 to South America, $30,000,000 to Oceanica, and $13,000,000 to Africa. Of the $318,000,000 worth of manufactures sent to Europe, $73,000,000 was manufactures of copper, $46,000,000 mineral oil, and $44,000,000 manufactures of iron and steel.

The United States now holds third rank among nations as an exporter of manufactures. The total exports of manufactures from the United Kingdom in the latest year for which statistics are available were $1,333,000,000; from Germany, $910,000,000; from the United States, $700,000,000; from France, $661,000,000; from Netherlands, $347,000,000; from Austria-Hungary, $215,000,000; from Belgium, $204,000,000; from Italy, $200,000,000; from Switzerland, $141,000,000, and from Russia, $117,000,000.

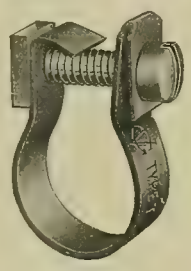
Manufactures form, however, a much larger percentage of the exports of the great manufacturing countries of Europe than they do of the exports of the United States. The share which manufactures form of the exports of the United Kingdom is 83 per cent.; Switzerland, 76 per cent.; France, 70 per cent.; Germany, 67 per cent.; Italy, 60 per cent., and of the United States, as above indicated, 42 per cent. The value of manufactures now entering the world's international commerce aggregates about $5,000,000,000, and the United States thus supplies nearly 15 per cent. of that total.

Pipe Cap and Telephone Clamp.

The accompanying illustrations represent two interesting specialties made by the Gillette-Vibber Company of New London, Conn. One is the G. V. pipe cap, a cap for covering the outdoor end of service pipe. The manufacturer asserts that this is the only practical pipe cap yet devised. It is used on pipe either threaded or plain, can



G. V. PIPE CAP.



G. V. TELEPHONE CLAMP.

be applied without interrupting the service and can be used for any number of wires. It is galvanized and has brass screws. It comes in sizes from one-half inch to four inches and six inches.

The telephone clamp, as the name implies, is designed especially for telephone work. It readily conforms to any irregularities in the pipe and can be either clamped or soldered. This company also makes ground clamps for electric-light work. The western representative of the company is George W. Edge, Victoria Building, St. Louis.

BOOK TABLE.

PRACTICAL LETTERING. By Thomas F. Meinhardt. New York: The Norman W. Henley Publishing Company. 1906. Pp. (13¾ by 8¾ inches), 16; two plates. Price, 60 cents.

This work, with its original system for spacing, supplies a much-needed source of information as to the proper design and spacing of the letters of the alphabet. It gives the information and instructions in a very practical way. The spacing system is one that is devised and patented by the author and assists the draughtsman, engineer, architect or student to procure the best optical effect in his lettering work. Plates are given with complete explanation, and each individual letter is analyzed for the Gothic and Roman alphabets. In addition to these there is a plate which gives a number of the more commonly used plain and fancy alphabets.

The Telephone in Chicago: The Exchanges, the System, the Users.

By ANGUS S. HIBBARD,
Second vice-president and general manager of Chicago Telephone Company.

Probably very few people who use the telephone in Chicago realize that in this city there have been invented and developed many of the most important devices and appliances which have made it possible to operate large telephone exchanges and carry on service between thousands of subscribers who wish to communicate with one another daily.

The original telephone, the wonderful invention of one man, Alexander Graham Bell, made it possible to talk to a distant person, by means of electricity. The later developments which have made it possible to extend wires from hundreds and thousands of telephones into offices called telephone exchanges, and operated there by means of switchboards, so that the various wires may at will be connected together and as rapidly disconnected, represent the inventions of telephone engineers and experts, who since about the year 1880 have been engaged in what was then practically started as a telephone business. The equipments for small exchanges were comparatively small, being limited by the number of wires and the consequent restricted use. As the number of subscribers increased, the amount of use increased in an undue and unexpected proportion, and to provide for this service many hundreds of inventions and combinations of devices have been required which have finally resulted in the standard telephone appliances of today, which are represented in the equipment of the central-exchange offices of the Chicago Telephone Company, of which there are now 15 in operation in the city exchange, rendering service to something more than 123,000 telephones.

At the subscriber's end of the wire is placed the telephone instrument—either upon the wall or on his desk—represented by the transmitter, in which he speaks, the telephone through which he hears, and the switchhook, upon which the telephone is hung when not in use. These comparatively simple instruments, with the directing voice of the telephone user, however, govern a combination of electrical and mechanical mechanisms of necessarily such intricate and elaborate complexity that it is difficult to describe them briefly or in a manner readily understood.

It is rather generally known that when the telephone user removes his instrument from the hook, an electric-lamp signal is lighted in the switchboard at the telephone exchange. The operator, in response, connects her telephone with the line and inquires what is wanted, and, being informed, proceeds in her endeavor to establish connection with the line of the subscriber wanted. During the conversation the connecting wires, represented by flexible cords, which the operator has used, are governed by two small electric-lamp signals, both of which remain dark while the users are talking and their telephones remain off the hook, but which are lighted at the close of the conversation, when both telephones are hung up; and, in response to these signals, the operator disconnects the lines and they are available for further service.

The means of accomplishing such an operation are not so readily described. The wires from the subscriber's instrument, led in twisted pairs, properly insulated, first through the protective devices at the point of entrance to the building, reach the distributing line, where overhead wires (generally upon poles in alleys) lead to the aerial cable, usually comprising a group of about 100 wires encased in lead and attached to the pole line or to the underground cable, where wires are properly grouped in lead cables containing from 200 to 1,200 separate wires. These cables are carried under the streets in vitrified-clay ducts, until they finally reach the basement of the telephone exchange building. Here they are led again through protective devices, arranged to prevent damage through contact with high-tension currents of electric-lighting or power companies. The wires reach the main intermediate distributing frames, where they may be connected to the desired terminals in the switchboards, to which they are finally carried.

Here one branch of the subscriber's line leads to the "multiple switchboards," where it is brought to the front throughout the entire series of boards every six feet, so that this particular line may be reached by any operator employed in the exchange who may have occasion to call for it. Throughout these multiple boards the circuit is protected by a third wire, known as "test" wire, which must indicate whether the line is in use to any operator who may have occasion to first test and then make connection with it. The other branch of the line leads through the answering jack and lamp. The "jack" is the point of contact at which the circuit may be reached by the plug and cord of the operator, and the lamp indicates when the subscriber makes a call. The cords and plugs, controlled by the current from the main battery (which also supplies the signaling and talking current for the subscribers), are equipped with the keys, relays and other devices necessary to provide means for ringing the subscriber wanted, as well as for controlling the lamp signals.

As all of the subscribers' lines cannot be led into one exchange, it is necessary to provide trunk lines from each exchange office to every other exchange in the city system. The number of these trunk lines varies in accordance with the size of the exchange and with the amount of traffic. At the present time in Chicago there are 4,449 such trunk lines leading from one exchange office to another, all of which are contained in underground cables. Each operator who answers calls in the exchange has access to these trunk lines, by means of which she can reach every other exchange office in the city. At every office, therefore, there are provided trunk-line switchboards, at which the calls coming in from the distant exchange offices are handled.

This combination of answering and trunk-line switchboards, and the operators employed to manipulate them, is the necessary means which must be employed to make possible connections from any one subscriber's telephone to another, to control the various mechanisms during the conversation, and so to provide that the lines may be promptly disconnected from each other; and the entire combination is under the control of the user of the telephone, by means of switchhook at his hand.

The switchboards in the 15 Chicago offices—and which are of the most modern and approved standards—represent an investment of approximately $2,000,000—a sum greater than the cost of the buildings in which they are contained. A force of 3,254 operators in the traffic department is now required to handle them, an increase of nearly 900 operators during the last year. To maintain and increase this force, about 2,500 new operators have been employed during the year. In the training school, where telephone operators are taught, 3,158 students were entered during the year; 1,106 were dropped on account of inability to graduate and take positions as operators, and about 2,000 have taken positions in the exchanges of the company.

The principal improvements in inventions and developments made by employes of the Chicago Telephone Company and their associates have been the multiple switchboard, by means of which any subscriber's line in an exchange may be reached by any operator; the use of electric lights as signals in telephone switchboards, together with many of the relays and other appliances used for controlling these lamps; special party-line devices, by means of which subscribers' bells on lines with as many as four subscribers are rung only when the particular number is called for; trunk-line-controlling devices, by means of which the rapid control of trunk lines in operation may be accomplished from one exchange to any other, etc.

GROWTH OF THE EXCHANGE.

Up to the year 1896 telephones in Chicago were operated at flat rates; an annual sum was paid for the telephone, and its use was unlimited. When the exchange reached 10,000 telephones, it was the largest in the world. The development from that time until the year 1897 was very small—being only about 1,500 telephones between 1896 and 1897. At that time measured-service rates were introduced, and the subscriber was enabled to pay for the amount of service rendered. This immediately made telephones available to the small user, and as there are a great many more of this class than there are heavy users, a great increase and growth in the exchange was immediately started. During the year 1897 the net growth was nearly 5,000 telephones. This has increased each year, until 1906, when the net growth in number of Chicago exchange telephones was 17,317—reaching a total of 123,177 instruments, to which may be added about 8,000 telephones operated within the city limits in exchanges in outlying districts, such as Austin, Pullman, Rogers Park, etc.

Of the 123,000 telephones, about 9,300 are operated at the old business flat rate, and, together with extension telephones and residence telephones operated at flat rates, make a total of less than 16,000 instruments now operated upon that plan, so that there remains upward of 107,000 telephones now operated at measured rates in the city, and of these about 70,000 are on the nickel-in-the-slot plan, where the user pays for the service at the time it is rendered, and the subscriber guarantees a minimum payment, the service being paid for at the rate of five cents for each completed call. Counted by the subscribers alone, the measured service is the most popular plan of use by more than 10 to 1, and is being extended more rapidly than any other.

The extension of telephone service in the city at the present time requires the investment of large amounts of capital each year; new buildings must be erected and equipped with switchboards, underground conduits and cables extended in every direction, and telephones installed in subscribers' premises at the rate of from 100 to 200 for each working day. More than $15,000,000 has already been invested in the company's plant in the city. It has been well expended, upon properly engi-

neered plans, and represents a modern and satisfactory equipment.

In response to the request of the mayor asking for a readjustment of telephone rates, and properly to provide for extension and for the necessary additional funds which must be invested, the company has applied for an extension of its franchise from the date of its expiration, in 1909. It is proposed that rates shall be substantially reduced and the service improved. The greatest present class of users is found in the subscribers for 10-party residence telephones, who guarantee receipts amounting to five cents a day. It is proposed, without increasing this rate, to change about 31,000 telephones of this class to the four-party line and reduce about 14,000 subscribers who now have the four-party service, at a guarantee of 10 cents per day, to the rate of five cents a day.

Other substantial reductions are offered for two-party and single lines; and a measured service is proposed for business lines at the rate of $5 a month, including 100 calls, with additional calls as low as two cents each. The overloading of the 9,300 flat-rate business lines has brought about more congestion and bad service in the Chicago exchange than perhaps all other causes combined. These lines, indiscriminately used by neighbors and employes, are so overloaded with messages that they are found busy and unavailable an inordinate, and in many cases an unbearable, number of times. The service over such lines, in many cases, cannot be controlled, and this overloading affects the service of every other telephone in the exchange.

A plan limiting the service on such lines to the necessary calls which should be made over one telephone line in a business day, making it possible for many users to provide two telephones for $120—less than the cost of one telephone at the rate of $125—will very materially improve the service of the entire exchange and make it possible to extend it to any limit without congestion or bad service brought about from this cause.

It is the consensus of opinion all over the world that in great telephone exchanges the best telephone service can be provided only at measured rates, where each user pays for just what he gets, according to his needs. If it may be brought about that the Chicago Telephone Company is enabled to extend its business upon this plan, providing only a reasonable return upon the capital actually invested, a good and continuing service can be furnished to all citizens at the lowest possible average rate. The foundations are well laid, the company has no worn out or antiquated plant upon its hands, and its preparations for the future have been adequate. Already nine out of 10 of the present Chicago subscribers are paying for service upon the measured-rate plan, which has been universally commended as being the fairest to all users. If the ordinance negotiations result in an extension of the company's right to do business in the city upon this plan, which alone can provide for the best service, the lowest rates and the greatest good will have been accomplished for the greatest number of citizens who are telephone users.

Indiana Telephone Items.

The Farmers' Co-operative Telephone Company has incorporated, capitalized at $10,000, to operate in Fulton, Marshall, Miami, Wabash, Kosciusko and Whitley counties, with the principal office in Silver Lake. Thomas E. Ball, Jas. Paxton and John Shumme are directors.

The Big Creek and Marble Corner Telephone Company of Dupont has incorporated. Jefferson, Ripley and Jennings counties will be its field. James M. Smart, John Munier, Michael Bush and William Dilk are directors.

Robert Field, manager of the Cumberland Telephone Company at Rockport, has been transferred to Owensville, and J. J. Shelton of Nashville, Tenn., succeeds him at Rockport.

J. E. Armstrong of Leesburg has purchased the Wilmot telephone plant at Cromwell and will remodel and improve it.

The Newcastle Telephone Company is advertising for women 30 to 35 years of age who have no present intention of marrying. The inroads made by cupid into the force of operators has made such an obligation necessary, says Manager John Monticue.

The Home Telephone Company of Washington, Ind., has announced that it will rebuild and enlarge its system at an outlay of $50,000. It is said that in case the home company continues to deny the Bell company the privilege to connect its toll lines with its system in Washington the Bell company will spend $100,000 in establishing a competing system.

The Indiana Legislature was convened January 10th. The committee of seven on telephones and telegraphs is headed by E. E. Moore. A bill will be presented by W. H. Freeman, secretary of the State Board of Forestry, providing for adequate protection for the trees along the streets and highways from the depredations of the telephone and telegraph companies.

A. M. Knotts, ex-mayor of Hammond, will present a bill making the exchange of business compulsory between the Bell and Independent companies. This, of course, will require the connection of the wires. It is understood that the bill is in the interest of Gary, which proposes to build and operate its own telephone system, but will want connection with Chicago. S.

Telephone News from the Northwest.

The Farmers' Mutual Telephone Company of Eureka, S. D., has been incorporated with $15,000 capital.

Contractors at Mankato, Minn., will experiment with the manufacture of concrete telephone poles along the lines followed at Richmond, Ind.

The Ellendale Rural Telephone Company of Ellendale, Minn., has been incorporated with $10,000 capital stock.

A consolidation has occurred of the Ege and Riverside telephone exchanges, and the Centerville Telephone Exchange Company succeeds to the business. Centerville, S. D., is headquarters.

The Brewster (Minn.) Telephone Company has changed its title to the Brewster and Round Lake Telephone Company, having sold stock to some Round Lake men.

B. W. Moore has been appointed assistant general manager of the People's Telephone Company, at St. Charles, Minn., assisting George R. Thompson.

The Cascade Telephone Company of Cascade Springs, S. D., has been incorporated with $1,500 capital.

The Bell Telephone Company is building a line from Steele City, Neb., to Hanover, Kan.

J. C. Killarney, president of the Auburn (Neb.) Telephone Company, has sold his controlling interest therein to E. Ferneau and associates. R.

Telephone Improvements on the Pacific Slope.

The Pacific Telephone and Telegraph Company, which was recently incorporated under the laws of the state of California to take over the Sunset and Pacific States companies, has authorized an issue of first-mortgage and collateral trust five-per-cent. sinking-fund bonds, $3,000,000 of which are being offered for public subscription. In connection with the plans for a vigorous pushing of extensions of the Bell system all over the Pacific Coast the new company is issuing $17,000,000 common and $17,000,000 preferred stock in exchange for the outstanding stock of the Pacific States Telephone and Telegraph Company and an additional $1,000,000 of its stock for working capital. The proceeds of a bond issue of $35,000,000 will be used for the reconstruction and extension of toll lines and general reconstruction of exchange plants. The system extends from Vancouver on the north to San Diego on the south, making 90,000 miles of toll lines with 240,000 subscribers. The net earnings of the companies after payment of operating expenses, maintenance and taxes are given as $1,917,968 in 1905 and $1,648,030 in 1906, the decline in the latter year being due to conditions incident to the San Francisco fire.

GENERAL TELEPHONE NEWS.

A complete telephone system is to be installed by the Homestake Mining Company of Lead, S. D.

A local exchange for Cleveland, N. D., and neighboring towns is projected by C. J. Anderson and others.

The New Home Telephone Company will install a complete telephone system in the Paddock Hotel in Beatrice, Neb.

An inquest "over the telephone" was held in Tiffin, Ohio, recently. Edward Lepper, the coroner of that city, learning that the roads leading to the place where the suicide occurred were impassable, called up the attending physician and learned the particulars and then rendered the verdict.

It is said that the York (Pa.) Telephone Company will increase the bonded indebtedness from $200,000 to $1,000,000. If the proposition carries, the company will have one of the finest exchanges in the state, with a possibility of underground wires. The increase, it is said, will mean the taking over of a number of smaller corporations operating Independent lines.

An induction coil has been invented and patented by Professor S. H. Sauve of Spokane, Wash., which is said to increase the available power in telephones from 35 to 40 per cent. and greatly increase long-distance transmission. Some tests were made of the new coil on the Bell Telephone Company's lines in Washington, Oregon and California, and it is stated that these were very satisfactory.

Contracts for 32 miles of fence have been awarded by the Spokane and Inland Empire Railway to a Spokane company, making 128 miles of line under fence. The company is building nine stations, 25 by 160 feet, on its line between Spokane and Oaksdale. The cost is $3,000 each.

Chicago Telephone Franchise Negotiations.

The committee of experts which is investigating the technical details of the telephone ordinances before the Chicago council committee reported that up to a few days ago it had been unable to get from the Manufacturers' Telephone Company the estimates upon which its proposition is based, and in consequence it is now considering the figures in the Chicago Telephone Company's offer. The policy of certain representatives of the Manufacturers' company was severely criticized by members of the council committee, who asserted that an effort is being made to have it appear that the committee is dominated by the Chicago Telephone Company.

A petition from the Merchants' Association, requesting the city to grant no telephone franchise which does not provide an opportunity for entrance into the city by Independent telephone companies operating in the West and Northwest has been presented to the council and referred to the committee on gas, oil and electric light. The ordinance of the Chicago Telephone Company now under consideration by the committee makes no such provision.

Electrical Resistance and the Absolute Zero.[1]

Under the action of heat all gases dilate and contract in the same manner; whatever may be their nature, they contract when they cool; they contract by the two-hundred-and-seventy-third of their volume at 0 degree centigrade for each lowering of one degree centigrade in their temperature; if, then, the temperature could be lowered to 273° below zero, the volume of the gases would become nul. Or, if conformably to the ideas that have been previously expressed, if the size of the intermolecular spaces be connected with the quantity of heat in the body, then, if, in the case of gases, these spaces become nul at 273°, the gases would contain no heat, and, consequently, they would be at the absolute zero. The notion then becomes precise.

Nevertheless, it might be rash to draw, without further precautions, so general a deduction from one particular set of facts. But, on all sides, and in quite different fields of investigation, very precise facts do appear, which add to the foregoing deductions the important support of their evidence.

One of the most remarkable can here be cited, obtained by the genius of Ampère previous to the announcement of the fact in question.

Pressed by the necessity of combining in the same theory the inseparable phenomena of electricity and of magnetism, the illustrious scientist was led to consider magnetism as due to the circulation of currents of electricity around each molecule of the magnetized body. One difficulty, however, embarrassed him, namely, how to reconcile the expenditure of inherent energy in the circulation of the electrical currents as they are revealed to us, with the maintenance, indefinitely and without expenditure of energy, of the magnetism of the magnets. The adverse argument assuredly required refutation, and an admirable hypothesis enabled it to be made, which later-discovered facts confirm in the most remarkable manner. According to this hypothesis, the conducting molecules do not oppose any resistance to the propagation of the current; electrical resistance only appears during the passage of the current across the intermolecular spaces. Now the elementary currents preserving the magnetism of each magnetized molecule not having to pass through any intermolecular space, can persist indefinitely without expenditure of energy. In this manner is reconciled with the thesis of the identity of magnetism and of electricity the disconcerting fact of the permanence of the magnets.

But an hypothesis can only remain in science by the verification of the different consequences predicted by it. Now, from Ampère's hypothesis can be deduced that the electrical resistance of good conducting bodies ought to diminish with their temperature, since when they cool they lessen their intermolecular spaces which the current has to cross. This consequence is perfectly verified by experiment; not only does the resistance of the pure metals diminish when their temperature lowers, but this diminution takes place with such regularity that by prolonging the curves of resistance beyond the experimental limits, the temperature can be found to which it is necessary to descend in order that all resistance completely disappear, which is to say, in order that, according to Ampère, the molecules come into absolute contact with each other.

Now—coincidence very remarkable—the physicists, who, at the suggestion of Maxwell, proceeded to make, for the first time, this extrapolation, found in this manner precisely the limit 273° centigrade, which the gaseous theory assigns for the absolute zero! This was at once, could it be implicitly accepted, a striking justification of the views of Ampère, a confirmation of the theory which assigns to magnetism and to electricity a community of origin, and the definitive establishment of the ideas of the physicists regarding the absolute zero.

1. From "L'Air Liquide," by Georges Claude. Translation by Chief Engineer B. F. Isherwood, U. S. N., in Journal of the Franklin Institute.

CORRESPONDENCE.

Continental Europe.

Paris, January 1.—The Brown-Boveri firm, in connection with the Italian Franco Tosi Company, is building a number of large steam turbines for a station which is erecting at Buenos Ayres. It is intended to set up five turbine-alternator sets for the first outfit of the plant. Each of these is built for 11,000 horsepower, or 7,500 kilowatts. The alternators which are mounted on the same base plate are three-phase machines and are designed to furnish 12,500 volts. One of the groups is no doubt the largest steam-turbine set which has yet been built in Europe. It has mounted on the shaft two separate alternators, each one of which can take the whole power of the turbine. One of the alternators is designed to give 25 cycles and the second machine gives 50 cycles. Three other turbines for the station are being built by the Franco Tosi Works. It is estimated that the plant will be able to furnish 100,000 kilowatts in the near future.

The process of electric welding of storage-battery plates is coming into use in France and seems to be quite superior for making the connections between the lead pieces. However, it requires to be properly carried out in order to make a good joint. The best method is the use of an arc-lamp carbon held by a wooden handle and provided with a flexible cable. Copper-plated carbons are preferable in this case. Here the positive pole of the machine or battery is connected to the piece to be welded or with a metallic table which carries different lead pieces to be welded. Placing a small amount of tallow on the joint gives a better fusion of the metal and collects the globules of lead. This process is easier to use by the workmen, and there are no lead vapors given off nor any danger from explosion.

A large hydraulic plant is to be erected in Spain by the Oerlikon firm of Switzerland for the Societa Hidroelectrica del Guadiaro. The station is located at about 80 miles from Seville and will furnish a large amount of current for that city over a three-phase high-tension line. Some 4,500 horsepower will be given at first by the three turbine sets to be set up in the station. The alternators of the standard Oerlikon type are designed to work at 5,000 volts, three-phase, and have a capacity of 1,300 kilowatts each, operating at 400 revolutions per minute and 40 cycles. Two 65-kilowatt exciters working at 110 volts are run by smaller turbines. By a bank of 10 large transformers the current is raised to 52,000 volts, which has been adopted for working the overhead line. Oil transformers with an efficient water cooling are to be used here, and they will have a capacity of 600 kilowatts each. Where the line reaches the city of Seville it runs to the large Utrera sub-station, which is provided with a bank of large transformers for lowering the voltage for the city mains.

It is stated that the Norwegian government decided not along ago to utilize as many as possible of the existing falls in the country which can furnish over 2,200 kilowatts, and it is estimated that the total amount of power available will be 900,000 horsepower. Of this 400,000 horsepower will be utilized to commence with, and probably in the near future. After the hydraulic plants are erected current will be used for operating the different railroads of the country, commencing this gradually and afterward carrying it out on a larger scale.

In Switzerland a project is on foot for an electric railroad which will run through the Splugen tunnel and connect on the Italian side with the Valtelline electric railroad. About 30 miles of the new road will be laid on Swiss territory and the remaining 10 miles in Italy, and afterward it is proposed to make an extension of about the same length to connect it with the Valtelline road. The new line will begin at Chur and pass through the towns of Ems and Rothenbrunn to Thusis and then pass through the Splugen tunnel. When the extension is made the trains will run as far as Chiavenna on the Valtelline road. It is proposed to use electric locomotives between Rothenbrunn and Chiavenna and steam locomotives at the beginning of the road from the former point to Chur. The new line will have a total length of about 40 miles, or, counting the proposed extension, 50 miles. A. DE C.

Great Britain.

London, January 2.—Quite a mild sensation has been caused in Woolwich (London) over a report issued by Sir Alexander Kennedy respecting the local municipal electric-supply undertaking. Woolwich started an electric central-station business a good many years ago, at the hands of a company, but the ruling spirits on the council were extremely socialistic in their tendencies, and nothing less than the acquisition of the company would satisfy them. In due time the undertaking was purchased, at a good price, for the company had a good many years existence still to run. Reorganization was the order of the day, at once. All the business portion of Woolwich is centered on the bank of the Thames, close to which the company had erected its generating station. But a second generating station was erected, and a municipal wiring department commenced operations. Profits, however, did not accrue, and with a change in the political constitution of the council awkward inquiries began to be made. The engineer resigned, and, as stated above, an outside expert was called in to report in respect of the business. This report, in effect, condemns the whole system. Sir Alexander Kennedy is of the opinion that the second generating station was unnecessary; that the wiring department should be abolished, for the simple reason that it is losing money; that the staff is too large; no allowance has been made for depreciation, etc., and concludes with the recommendation that before continuing to extend plant, the council should seriously take into consideration the advisability of securing a supply of energy in bulk from a neighboring power company. The whole affair is another instance of London's belatedness in matters electric.

Apropos to the above may be mentioned a few details concerning the electric power bills that will be considered in the coming session. The London County Council's bill will be the most important, and several striking changes are to be noted, compared with the bill of last year. A schedule of prices is included, a separate scale being given as a maximum for both "authorized distributors" and private consumers. Then the bill transfers to the County Council the right, at present held by the borough councils, of purchasing the companies' undertakings in London, so that will all come under the supreme control. Against this proposition —and there is bound to be opposition from the borough councils themselves—the companies affected have introduced a bill of their own, in which, in the event of the County Council having the above right transferred, the period of purchase should be 42 years, from date, and not 25 years, which will be the period, as things stand at present. The companies also seek to constitute a London electrical joint committee for supplying London with power. A new power company is also seeking authority for a power supply, much on the lines of the Administrative County of London and District Electric Power Company in previous years. The latter, as already reported, is merely asking to be authorized to enter into an agreement with the London County Council, and these two proposals apparently stand or fall together.

Another interesting bill, of which I have been able to see an advance copy, relates to the proposed tunnel between England and France, from Calais to Dover. Although it merely includes permissive powers to adopt electric traction, there is such a very complete set of electrical regulations in the bill that there seems little doubt that electricity will be adopted for the propulsion of the trains. The only other matter in connection with the private-bill legislation for 1907 which seems to call for notice is another proposal to construct a transporter bridge, of which there are already two samples in Great Britain. This time it is the corporation of Middlesborough which seeks powers, and the arrangements will be very similar to those at Newport in Monmouthshire, which bridge I described in the Western Electrician in October last.

The retirement of Mr. John Gavey, the engineer-in-chief to the General Postoffice, under the age limit, is announced. Mr. Gavey is one of the numerous staff of the old International Telegraph system which was acquired by the government in 1870, being at the time a district superintendent. Mr. Gavey has been very largely a telephone man. He valued the trunk lines acquired by the state from the National Telephone Company. Latterly he has done a good deal in connection with wireless telegraphy, and represented the British government at the Berlin Conference. Mr. Gavey's age is 64 years.

An unfortunate boiler explosion at a London company's generating station, a few days ago, may possibly give rise to some interesting technical questions, although at present no official information has been allowed to leak out. A boiler at the works of the South Metropolitan Electric Light and Power Company's plant, fitted with a thermal storage drum, exploded, killing two men. By a curious irony of fate, the thermal storage drum was blown right into the neighboring gas works. An official inquiry will be held by the Board of Trade, whose report upon it should make interesting reading.

It is announced that the whole of the capital asked for in connection with the Victoria Falls Electric Power Company has been subscribed.

A report has been issued by the American consul in Birmingham, calling attention to the strong efforts that are being made by engineering firms there to combat foreign competition. This is chiefly taking the form of improved works organization, and the consul states very clearly that American methods have been followed to such an extent that United States competition is being reduced considerably. There are a large number of electrical firms in Birmingham, and the news given out by the consul was not unexpected. G.

Dominion of Canada.

Ottawa, Ont., January 12.—It is probable that a new electric road will be built between Montreal, Kingston, Ottawa and western points. Mr. P. W. Leffler, head of the Leffler Electric Company of Chicago, has been in the city inquiring into the feasibility of the project and also concerning the application to the government for a charter. Mr. Leffler is the inventor of a magnetic system applied to railways.

The Dominion government has concluded an agreement with McIntyre & Robert of Montreal whereby the available waterpower on the Beauharnois Canal, estimated at 8,000 horsepower, is leased to these gentlemen for a term of 21 years. Provision is made in the contract with the object of preventing the power in question falling into the hands of any monopoly. To guard against the exaction of excessive prices from the public for light and power the rates are subject to government approval. The lessees must preserve the waterway for purposes of navigation and maintain it in its proper order, charges for which amount at present to $20,000 a year. The lessees assume whatever capital outlays are required, including an expenditure at the outset of some $60,000. The lease is renewable upon terms to be agreed upon at the expiration of the present contract, under which the lessees are to pay an annual rental to the government of $12,000.

Any doubt as to the favorable view taken by the people of the scheme by which the Ontario government proposes to supply cheap electric power to the municipalities of the province has been dissipated by the result of the vote recently taken in many industrial centers in Ontario. In only one place, Brantford, was the by-law defeated. Some such result was expected after the notable verdict given in Toronto, but the small municipalities have shown a keener desire for cheap Niagara power than even the big city. The next step is to receive the formal contracts from the hydro-electric commission, which the municipal councils are now empowered to make, and when these are prepared the ratepayers will again vote for their ratification. It is stated that the commission already has tenders for the supply of electric power in quantity and that the figures to be furnished will show a price nearer $15 than $18 per horsepower delivered. The government will probably purchase the power at Niagara Falls, with an option of taking over the generating plant at a given time and distribute it over a government transmission line. W.

Winnipeg, Man., January 12.—At a meeting of the board of consulting engineers appointed for the Winnipeg power plant at Lac du Bois Falls, Manitoba, it was decided that the following machinery and equipment is necessary in connection with the construction of Winnipeg's $3,500,000 power plant: The first development will be of 15,000 kilowatts. Two transmission lines will be constructed to Winnipeg, a distance of 60 miles, each capable of carrying 9,000 kilowatts. The banks of transformers will be made up of three units, each of 3,000 kilowatts. While this development will be composed of five units the ultimate development will be 15 generators, giving a capacity of 45,000 kilowatts, with five transmission lines. The turbines will be of 6,000 horsepower each, giving a wide margin for possible loss. They will be of the two-runner Parson's type, directly connected with the 3,000-kilowatt generators, delivering three-phase current at 2,200 volts and 60 cycles frequency. The speed of the generators, which are of the revolving-field type, with 44 poles, will be 165 revolutions per minute. The transformers receive the current at 2,200 volts, raising it to 66,000 for transmission. The connections are delta to delta. Extreme flexibility is the great feature of the installation. Tenders for the machinery and materials will be called for from time to time. Cecil B. Smith, civic power expert, Winnipeg, or Colonel H. N. Ruttan, Winnipeg, can give further particulars.

The De Forest Wireless Telegraph Company has made an offer to the Dominion government to install its system between Ashcroft and Dawson City, Y. T. This is the dangerous portion of the Dominion Yukon telegraph line, and owing to snowstorms, windstorms and avalanches the line is operated under an annual deficit of $100,000. The company offers to install a system upon receipt of a bonus of $50,000 and an annual subsidy of $50,000, and in addition will cut the present rate of $4 for 10 words down to $2.

Councilor Garland, Portage la Prairie, Manitoba, will introduce a motion at the next council meeting for the town to purchase and operate the electric-lighting plant of the Central Electric Company. The price asked is $50,000.

The International Gas, Lighting and Heating Company, Cleveland, Ohio, has applied to the Regina (Sask.) City Council for a 20-year franchise, and if this is granted the company will erect a $100,000 plant there.

Preliminary surveys have been started by the British Columbia Electric Street Railroad Company on the line to connect Chillawac and New Westminster, B. C. As soon as the surveys have

been completed work will be commenced on grading the line. R. H. Sperling, Vancouver, B. C., is superintendent.

The Town Council of Stonewall, Manitoba, is considering the installation of an electric-lighting plant. Ira Stratton may be addressed.

The municipal telephone system at Fort William, Ont., is said to have paid a net profit of $3,300 for the year 1906. The rates are $1 a month for residence telephones and $2 a month for business. The electric-light plant paid a profit of $1,000 for the same period.

The electric-light plant at Claresholm, Alberta, has changed hands and is now owned by a company headed by L. H. Ugland. Several extensions to the plant will be made this year.

The council of Strathcona, Alberta, has decided to grant a 15-year franchise to the city of Edmonton to extend its automatic telephone system across the river to Strathcona. Work on the new system will be commenced immediately.

The Brandon City Council has decided to grant a franchise to the International Gas, Lighting and Heating Company of Cleveland, Ohio, to supply light and heat to that city. The company will at once arrange for the erection of a plant to cost $100,000.

W. Day of Daysland, Alberta, states that the settlement is about to be incorporated as a town for the purpose of installing an electric-light plant. R.

New England.

Boston, January 12.—The Old Colony Street Railway Company has asked the Massachusetts Railroad Commission to approve the local rights to carry baggage and freight between Middleboro and New Bedford through Lakeville and Freetown. The amount of freight and express business on electric railways is gradually increasing in New England. The Boston and Worcester Street Railway Company has secured local permits to carry freight and baggage in Newton, Marlboro, Wellesley, Natick, Framingham, Westboro, Shrewsbury, Northboro, Southboro and Hudson. The company has several freight cars ready for operation and it wishes to carry newspapers, agricultural products, baggage and all classes of light freight and express matter.

In his inaugural address Governor Guild of Massachusetts said: "The justification of state supervision of telephones and telegraphs—a policy in which, by the law of 1906, Massachusetts is a pioneer—has already been amply demonstrated. I suggest for the Legislature's consideration whether even greater powers of regulation should not be given."

Mayor Fitzgerald of Boston states that he is negotiating with the Boston Elevated Railway Company with a view of having cars run through the East Boston tunnel all night and securing additional facilities for rapid transit to Dorchester. In regard to the New York, New Haven and Hartford Railroad Company's service, he said: "I think that I can safely say that the electrification of the lines of road which serve the suburban traffic will take place within a couple of years." In regard to the recent attempt to secure a franchise for a new telephone company, which he vetoed, he said that it called renewed attention to the unfortunate lack of power in the city government to require proper compensation for such franchises or to impose proper terms and conditions upon their exercise.

The Boston Elevated Railway Company has arranged to increase its power supply by the construction of two gas-engine plants supplying 1,675 kilowatts; by the installation of a turbine generator rated at 2,000 kilowatts, and by the purchase of about 3,600 kilowatts; altogether an increase of about 20 per cent.

The Massachusetts Supreme Court has ruled that a person who is injured by the jostling and struggling of a crowd in a subway station may bring an action against the street-railway company using the subway. The ruling was given in a decision sustaining a verdict of $2,000 for a fractured wrist and other injuries caused by the plaintiff being thrown down by a crowd when attempting to board one of the company's cars.

The plans for the proposed new union station at Worcester, Mass., call for nearly 2,000 electric lights to be operated from independent generators in the boiler room.

The Massachusetts Institute of Technology has received two valuable sets of samples from the Allgemeine Elektricitats Gesellschaft of Berlin, Germany. One set shows the process of manufacturing a 10,000-volt three-phase cable, beginning with a sample of the single wire and ending with a sample of the completed cable. The other set shows the complete process of manufacture of a 200-pair armored telephone cable. B.

New York.

New York City, January 12.—A member of the Board of Rapid Transit Commissioners is authority for the statement that the board will make no opposition to the recommendation of Governor Hughes that the commission be abolished and a state board be substituted. He said: "The present commission has only power to build new railways and regulate the subways. What is required is a new commission with power to regulate all the transit and public-service corporations." Nevertheless the commissioners are probably not oblivious to the fact that the controlling committees at Albany have been so judiciously selected that any hostile legislation this winter will be almost out of the question and that their very laudable desire to assist at their own undoing will not be gratified.

The New York City Railroad Company, which owns and operates the few horse-car lines still running in the city of New York, has at last made up its mind to electrify these lines and is making rapid preparations to do so. It has taken a long time and no small amount of ridicule from our country cousins to make the company realize that in this respect New York is not as progressive as some of the country towns, but the company seems to be alive to the fact now, and is moving with such commendable activity that the early spring is promised as the time when the last horse car shall disappear from the streets of New York.

Judge Sharp of Baltimore while in New York heard the pleas of attorneys in the case of the mayor and City Council of Baltimore against the Canton company, relating to the title to Canton Park, over the telephone. The argument was conducted by Assistant Solicitors Ritchie and Goldsmith, in the presence of Deputies Bowman and Campbell of the Supreme Court. Judge Sharpe will go over the case while in New York and be prepared to render a decision on his return to Baltimore next week.

With the production of stock-reporting instruments of a speed surpassing the ability of the sending operator to manipulate the keyboards, it appeared as if the limit had been reached, and inventors have for some time practically abandoned that field. Superintendent Healy of the New York Quotation Company has, however, recently made a new and very valuable improvement in the instruments used by his company, in the shape of an original and very simple unison. This unison, he says, adds from 16 to 20 per cent. to the working capacity of the instrument, without increasing the number of the revolutions of the type wheels or in any way impairing its reliability. The application of this improvement to nearly 1,300 machines without interfering with the service has been a long and tedious work, but now that the system is complete the results have proved most gratifying, both to the inventor and to the company. Mr. Healy says that he obtains far better results at speed of 140 revolutions per minute than the competing company does when running at 165 revolutions per minute, and explains that this is due to the fact that his unison is entirely automatic, enabling the sending operator to "unison" or to pass from one type wheel to the other from any point without going either to the zero point or touching a shift key, as is required in the ordinary type of "ticker" now in use.

From up the state is reported a merger of gas and electric properties representing an actual investment of more than $7,000,000. The Utica Gas and Electric Company has purchased the stock, franchise, plants, machines and real estate of the Herkimer Light and Power Company, the Glens Falls Gas and Electric Company, the Consolidated Light and Power Company of Whitehall and the United Gas, Electric Light, Heat and Fuel Company of Sandy Hill, Fort Edward and South Glens Falls. For the present the several companies will maintain their individual organizations, but as soon as the necessary legal formalities can be complied with they will be merged into one corporation. This will be in effect a union of the most important gas and electric interests in the Mohawk Valley and the upper Hudson Valley. D. E. P.

Southeastern States.

Charlotte, N. C., January 12.—The Southern Power Company is now engaged in the work of building transmission lines from Charlotte, N. C., to Concord, 21 miles, to transmit current from the Catawba River to be used in a number of manufacturing establishments in Concord.

Charles E. Van Bibber and associates seek a franchise for the Rapid Transit Company to build another electric line in the vicinity of Asheville, N. C. It is expected that the desired rights will be readily granted by the city.

The Common Council of Richmond, Va., has voted $10,000 for fighting electrolysis and preventing the corrosion of the city's mains.

Books of subscription to the capital stock of the Chester (S. C.) Traction Company are being opened, and the backers of the enterprise desire to secure $850,000 for carrying out their plans. The town previously granted a franchise to the traction company.

The City Council of High Point, N. C., has appointed a committee to secure a location and the necessary equipment for a modern electric-light plant and water station.

The new Memphis (Tenn.) Power Company has started up its $500,000 plant in that city, supplying light and power. E. G. Cowdery is president of the company.

The Maryland Electric Railways Company is negotiating for a lease of the Bay Ridge Park property near Annapolis, and will probably complete an electric line to that resort. Already the company is electrifying the Baltimore and Annapolis Short Line, and it looks as if the resort will be soon connected by a first-class electric-railway service with Baltimore, some 30 miles distant.

The United Railways Company of Baltimore has had a new 7,500-horsepower turbine installed at the Pratt Street station, this being the first turbine to be placed in commission by the company. Another of the same horsepower is soon to be installed at the Pratt Street plant.

At the first annual meeting of the Kentucky Electric Company, held at Louisville, Donald McDonald was chosen president and Bryan H. Allen, secretary. The company was organized last autumn.

J. C. Perrin and J. H. Gault have been authorized to contract with the Southern Power Company for 275 horsepower by day and 175 horsepower by night for the town, part of the current to be sold by the town to small manufacturers. L.

Ohio.

Cleveland, January 12.—This has been rather an exciting week in street-railway circles here. In the first place, the United States Supreme Court decided that the franchise of the Cleveland Electric Railway Company on Central Avenue, Quincy Street and a portion of Erie Street expired in March, 1905, and that the company has no rights there. Following this, a public meeting of the City Council was held on Thursday evening, when President Andrews of the Cleveland Electric proposed to operate these lines until a permanent arrangement could be made at cost, excluding interest on the investment, the fare to be three cents, and if it is found that there is a surplus at the expiration of the arrangement H. J. Davies of the Cleveland Electric and A. B. Du Pont of the Municipal Traction Company shall ascertain the amount due the city, as shown by the business done. He also proposed that the same gentlemen ascertain the amount due the city for the use of the streets since the franchises expired, although, he said, the company was under no legal obligations to pay anything. The amount which the arbitrators shall award the city shall not exceed the profits on the business for that time, after deducting interest at six per cent. and the depreciation of the property. If they cannot agree, a third man shall be called in.

The Municipal Traction Company made a proposition to lease the lines of the Cleveland Electric on the same basis that it is now operating the Forest City line, that is, six per cent. on a valuation that shall be determined by a commission on the physical property and the unexpired franchises.

The Low Fare Railway Company proposed to lease the Central Avenue and Quincy Street lines at six per cent. on the appraised value of the property, to be paid in the form of monthly rental, and to operate at a rate of three cents per passenger, with transfers to all lines that will give transfers to its roads. The lines are to be kept in good condition and operated until some permanent arrangement is made for their disposal.

Mayor Johnson, who presided, seemed well pleased with the proposals made and advised an executive meeting on Friday afternoon to consider them. However, an open meeting was held at the request of citizens and newspaper men. A communication was read from President Andrews of the Cleveland Electric and A. B. Du Pont, saying that they had declared a truce in their warfare for 30 days in order to arrive at some definite conclusion as to what is best to do in the way of making a settlement. They asked that the council approve of the plan, and this was done in the shape of a resolution.

The proposition of the Cleveland Electric Railway Company, made on Thursday evening, was also accepted, with a few dissenting votes. Under the conditions of the agreement between the companies, the injunctions that have been secured against the new companies will be inoperative for 30 days and their cars will be permitted to run over the Cleveland Electric line from the western terminus of their line to the Public Square. On the other hand, the new companies are to do no more construction work and make no attempt to operate cars east of the Square. If, at the end of 30 days, no conclusions have been reached, then the matter will stand just where it did.

All those interested directly in the matter are considering the holding-company plan. If the plan is carried out as Mayor Johnson has been considering it, the holding company will be given a franchise, with fares limited to three cents, and universal transfers. The Cleveland Electric will be given a security franchise at a higher rate of fare to continue 20 or 25 years. In case the holding company fails to pay the rentals or allows the property to depreciate, then it is to revert to the

old company, to be operated under the franchise granted it. It is probable that negotiations to this end will be entered into the coming week, and appearances now indicate that they will be successful. O. M. C.

Indiana.

Indianapolis, January 12.—The municipal ownership and operation of the electric-light plant has not proven a success in English, and the Town Board has sold the plant to a private company and the latter will improve the system.

Thirty automobiles were destroyed in a midnight fire in Marion, involving a loss on the machines alone of $45,000. The property belonged to the Campbell Garage Company.

The Jasonville Electric Company, recently incorporated, has been granted a franchise to construct and equip a lighting plant in Hymera. The plant is to be in operation by December 1st.

The Washington Motor Car Works is building a large automobile factory in Washington, Ind. It will have a capacity of 30 cars per week.

An electric gasoline-motor car on the St. Joseph Valley traction line was burned at Elkhart on Tuesday. The fire started from crossing the car's wires with the electric-light wires, the blaze reaching the gasoline in the tank. It was one of the first motors of the kind used in the Central States and is said to have proven a success.

A municipal gas and electric-light plant is proposed for Evansville. The movement is due to alleged poor service of the local company.

According to figures obtained from the settlement by the city of Indianapolis with the interurban lines entering the city, at a rate of four cents for each round trip there were a total of 87,730 round trips during 1906. This was a gain of nearly 7,000 over 1905. Averaging 30 passengers to a car, 5,000,000 passengers were brought into this city alone by the interurban cars, a gain of 500,000 over last year.

The City Council of Richmond is attempting to compel the interurban companies to discontinue the hauling of freight through the streets of Richmond.

Because of a dispute as to the value of land for a right-of-way the Chicago, Lake Shore and South Bend Electric Railway Company has begun condemnation proceedings against the East Chicago Land Company for a right-of-way from East Chicago to Hammond.

Arrangements and plans are being made for the erection of a union traction station at Washington and Fifth streets in Marion and uniting the service of the Kokomo, Marion and Western and the Marion, Bluffton and Eastern Traction companies.

The Indiana Union Traction Company was recently robbed of $1,000 worth of copper bond wire. The discovery revealed that bond wires for a distance of two miles between Alexandria and Tipton had been stolen.

The Louisville and Nashville steam road, which has been operating local trains between Evansville and Mt. Vernon in competition with the interurban line, has removed its local trains.

The present Indiana Legislature will deal with a one-cent-a-mile rate bill; a bill to put interurban lines under the jurisdiction of the Railroad Commission; a bill to make electric-railway companies liable in damages to employes injured, even though injured or killed as a result of their own negligence in part, if negligence also may be proven on the part of the company; a bill to repeal all subsidy voting laws and in their place to enact a law providing for the voting of subsidies in the aid of railroads by land owners or property owners who can show a tax receipt, and a bill providing for safety devices and full crews to man trains.

A bill has been introduced in Congress to permit the Chicago, South Bend and Indiana Traction Company to build a bridge across the Calumet River near East Chicago. This bridge is to accommodate one of the new interurban companies building in Northern Indiana.

From Terre Haute comes a report of a possible merger of the Stone-Webster and the McGowan interests, with a view of connecting the Terre Haute system with the central system around Indianapolis. S. S.

Illinois.

Peoria, January 12.—The Hillsboro and Southwestern Railroad Company has changed its offices from Hillsboro to Chicago.

The Central Electric Manufacturing Company of Rock Island has increased its capital from $30,000 to $60,000.

The Pfanstiehl Electrical Laboratory of Waukegan has been incorporated with a capital of $10,000 to manufacture and deal in electrical machinery and supplies. Incorporators are M. A. Sattley, L. D. Ballou and Marquis Raton.

The St. Louis Electric Bridge Company at Venice has been incorporated with a capital of $2,500 to construct a bridge across the Mississippi. Incorporators are W. H. Burke, G. A. Wright and George M. Mattis. This is the McKinley syndicate corporation which proposes to build the bridge. Congressman McKinley has sought the aid of Secretary of War Taft in the construction of this bridge from Venice to North Street in St. Louis. If Congress will pass the enabling act the company will agree to build a bridge to be used for both wagon traffic and electric cars, at a cost of not less than $2,000,000.

Beginning February 1st the Illinois Traction Company will run eight limited cars each way a day between Springfield and St. Louis, instead of four, as at present.

At Neponset they are using the telephone in revival meetings, connecting the church with neighboring towns and the various farmer lines.

The secretary of state has issued incorporation papers for the Terre Haute and Western Railway Company; principal office to be in Paris, capital stock, $500,000. The road is to be built from Paris to the state line, thence to Terre Haute. Incorporators are Frank T. O. Hair, James Stewart, William H. Trodgson and John E. Lamb.

The Springfield Consolidated Railway Company has raised the pay of all the employes who have been in the employment of the company for two years.

The Wolschlag Co-operative Coal Company of this city is installing electric mining locomotives in its mine near this city.

The Illinois Traction Company is about to absorb the East St. Louis and Suburban, the Alton, Granite and St. Louis system, the Alton street-railway system and the gas and electric system. As soon as an examination of titles is completed the properties will be taken over. V. N.

Northwestern States.

Minneapolis, January 12.—Plans are being perfected for organizing a company to build a street-railway system at Mankato, Minn. If possible the company will be formed entirely of local capital.

The Legislature of South Dakota will be asked to pass a law permitting the city of Sioux Falls to grant a 30-year street-car franchise.

La Crosse, (Wis.) capitalists are backing the proposed trolley line from La Crosse to Gilmanton and Eau Claire. A survey has been completed from La Crosse to Whitehall, which is about half of the distance.

The Grand Forks (N. D.) Gas and Electric Company has placed its new plant in operation.

Agitation has been started to secure a trolley line from Duluth, Minn., to Proctor, and the Duluth-Superior Traction Company will be asked to build such a line.

There is some talk at Dickinson, N. D., of building an electric railway from there south to connect with the Chicago, Milwaukee and St. Paul Railway Company's new coast extension.

W. E. Kelsey of Grand Forks, N. D., proposes to build an electric railway from that place to Valley City, provided a bonus of $50,000 is raised.

The Duluth Engineering Company is preparing estimates for an electric-light system at St. Hilaire, Minn.

The Ellsworth (Wis.) Power Company will shortly begin work on a dam to be constructed across the Rush River for generating electric power.

A special election will be held at Tecumseh, Neb., for the purpose of voting for the establishment of an electric-light system. R.

Pacific Slope.

San Francisco, January 10.—The Stanislaus Electric Power Company of San Francisco has closed a contract for an electric power transmission plant of much importance. The site of the proposed plant is at Vallecito, on the Stanislaus River, near Angels Camp, and the proposition contemplates the utilization of the waters of the Stanislaus River, transmitting the electric power to San Francisco, besides tapping the southern mines and the upper San Joaquin Valley. The initial installation will include the largest power units that have ever been used for impulse wheels. The operating head is 1,400 feet. The equipment order calls for three 6,700-kilowatt generators, each of which will be driven by a Pelton waterwheel unit of 12,000-horsepower capacity. The capacity of the proposed plant, over 36,000 horsepower, is said to be greater than that of any existing impulse-wheel installation, though in the plant of the Puget Sound Power Company at Electron, Wash., there are installed four Pelton-wheel units, each driving a 3,250-kilowatt generator, with a combined maximum capacity for the station of 30,000 horsepower. Each unit will consist of two Pelton wheels, each overhanging the opposite end of a heavy shaft which carries the rotor of the generator in the center. This contract is under the direct supervision of the engineering firm of Sanderson & Porter of New York, the complete hydraulic equipment being furnished by the Pelton Water Wheel Company of San Francisco, and the electrical apparatus by the General Electric Company.

The Oakland Traction Company, which controls the extensive local electric-railway lines of Oakland and the neighboring towns, reports that its earnings have almost doubled during the last year, instead of increasing at the rate of 15 per cent., as has been the case for several years previous. The following figures are for 1905 and 1906, respectively: Gross earnings, $1,441,470.84, $2,218,833.45; operating expenses, $740,365.44, $968,334.99; net earnings, $701,103.40, $1,250,498.46; fixed charges, $392,954.53, $428,142.50; surplus, $308,148.87, $822,356.46. Important additions are planned, and for this purpose bonds to the amount of $12,000,000 will be issued at once, of which $7,000,000 will be held to retire the present bonded indebtedness and $5,000,000 will be used for additional equipment and extensions.

A prominent holder of the securities of the United Railroads of San Francisco takes a very hopeful view of the road's prospects and present condition. He says that notwithstanding the delays and losses occasioned by the fire and strike in San Francisco, the gross receipts of the United Railroads for 1906 decreased only $1,116,000 from the earnings of 1905, which were $5,941,000. The gross passenger receipts for December were $556,000. The officers and directors of the United Railroads are confident that the rebuilding of San Francisco will go forward with continued vigor. A special train load of new electric cars is en route from St. Louis, and is expected to arrive about January 15th. These cars are the first of an order for 250 that is being filled in St. Louis.

The newly incorporated Monterey, Fresno and Eastern Railroad Company has been granted franchises by the Board of City Trustees of Monterey, Cal., for telephone and telegraph lines and a double-track electric railroad over certain streets for 50 years.

The Pacific States Telephone and Telegraph Company's business in Oakland, Cal., has increased so the last few months that it will soon be impossible to handle it from the present main office. A reinforced-concrete building is to be erected at once.

James T. Shaw of Masonic, Cal., is arranging for the building of an electric plant in the new mining camp of Mono County. The machinery has been ordered from San Francisco. The plant will be used for lighting and to work a number of electric hoists being erected in the district.

The Shasta Power Company has completed its pole line through the city of Redding, Cal., following the alleys instead of the streets. The 25-mile main pole line from the power plant to Redding is in place, ready for the wire. The generating plant is to be ready for operation within a month, but some details regarding crossings of the Northern California Power Company's transmission line are yet to be adjusted.

Among other reports that are in circulation as to impending changes in the electric power situation in San Francisco and Northern Central California is one to the effect that the interests represented by the Fleishhacker Brothers and the San Francisco Coke and Gas Company are preparing to combine. The Truckee River General Electric Company and the American River Electric Company, controlled by the Fleishhackers, could not transmit power profitably to San Francisco, but, possibly, additional power plants might be built.

The Northern California Power Company, which has three electric power plants, has commenced work on a fourth. The new plant will be erected on Battle Creek, below Volta, in Shasta County, and will be of a capacity to develop 12,000 horsepower. Mining and engineering circles are interested in the outcome of the enterprise of this company in the construction of its 50-ton experimental electric smelting plant for iron ores, to be located six miles east of Kennet, near the confluence of the McCloud and Pit rivers. Operations are under the supervision of W. S. Morgan of San Francisco, and a force of about 25 men is at work. A.

PERSONAL.

Mr. James H. Raymond, for many years a leading patent lawyer of Chicago, died at his home in Evanston on January 11th. He was 56 years of age.

J. S. Brosius has resigned his position with the Western Electric Company at Chicago, and is now with the Electric Controller and Supply Company, Cleveland, Ohio.

R. M. Klein has resigned from the Bureau of Equipment, Washington, D. C., to join the staff of the Northern Electric Manufacturing Company at Madison, Wis.

Francis Porter Johnson has left the Shaw Electric Crane Company of Muskegon, Mich., to become manager of the electrical department of Fairbanks, Morse & Co. at Detroit.

Mr. Charles A. Howe, general sales agent of the Holophane Glass Company, New York, is calling on Chicago friends and visiting the electrical show. Mr. Howe was called to Davenport, Iowa, a few days ago by the serious illness of his father, who is now reported as much better.

B. J. Wallingford, who for more than 12 years has ably filled the position of superintendent for the Electric Appliance Company, Chicago, has resigned, to take charge of Northern Illinois sales for the Ajax Line Material Company. A handsome gold watch and chain, as a farewell token from

his former colleagues, shows his popularity among them during a career noted for a strict but uniformly courteous attention to his varied duties.

Mr. Vincent H. Martyn, well known and highly esteemed in the engineering field, died in San Francisco, Cal., on January 1st from pneumonia. He was western advertising representative of the Engineering and Mining Journal. The body was brought to Chicago and burial was at Oakwoods on January 10th.

Mr. Robert L. Allen, manager of the Economy Light and Power Company of Joliet, Ill., died in Joliet on January 12th at the age of 59. He was postmaster at Joliet under Cleveland, warden of the Illinois state penitentiary under Governor Altgeld, and at one time secretary of the Washington Park Club, Chicago.

J. B. Ingersoll, assistant manager and chief electrical engineer of the Spokane and Inland Railway, has been appointed general manager and chief electrical engineer of that road, also of the Spokane Terminal Line. Mr. Ingersoll succeeds F. A. Blackwell, who will give all of his time to the office of chairman of the board of directors of the Inland Empire system.

Howard M. Post is now advertising manager with the Quincy, Manchester, Sargent Company, manufacturer of railroad appliances, with offices in Chicago and New York. Mr. Post originally fitted himself for a telephone engineer and while with the Kellogg Switchboard and Supply Company of Chicago took out a large number of telephone patents. The Kellogg company then offered him the advertising managership, which he accepted and handled very successfully for a number of years. Mr. Post is thoroughly conversant with all branches of the advertising business.

ELECTRIC LIGHTING.

Citizens of Jewell City, Kan., have voted to issue bonds to establish a light plant.

The Tampa Electric Company has been granted a franchise to extend its lines to Campbell, Fla.

Terrell, Tex., has voted the issuance of bonds to the amount of $15,000 for installing an electric-light plant.

The Board of Public Works of Buffalo, N. Y., will advertise for bids for letting new contracts for lighting the streets.

Jones, Finnegan & Crawmer, merchants of Bartley, Neb., are installing an electric-light plant for lighting their business building.

The Hearne (Tex.) Light and Power Company has been incorporated with a capital stock of $20,000 by J. J. Hall, J. R. Henry and others.

The New State Electric Company of Oklahoma City has been incorporated with a capital stock of $30,000. C. H. Leach and H. L. Rubholdt are interested.

The Shawnee (Okla.) Gas and Electric Company has been incorporated with a capital stock of $1,000,000 and has succeeded to the business of the Shawnee Lighting Company.

Bids will be received until January 21st for furnishing the city of Peoria, Ill., with 770 street lamps of 2,000 candlepower for a period of one, two and five years. E. A. Furry is commissioner of public works.

The police authorities of Libertyville, Ill., are seeking the person who stole an electric arc lamp from one of the downtown street corners a few nights ago. It is said that the lamp was burning at the time it was stolen.

The Danbury and Bethel (Conn.) Electric Light and Gas Company will remodel its present plant completely and install new machinery of 400-kilowatts capacity. W. S. Barstow & Co. of New York, and Portland, Ore., will do the engineering.

The citizens of New London, Mo., have decided against municipal ownership by a vote of 160 to 2. An election was held to see whether New London should own its own electric-lighting plant or grant a franchise to a corporation. It was decided to grant the franchise.

Mr. Paul Lüpke, 222 East State Street, Trenton, N. J., wants everybody's assistance in making the 1907 Question Box of the National Electric Light Association a good one. All questions should be sent at once. Mr. Lüpke, who is editor of the Question Box, says: "Even if you know all you want to know, let us have questions that will secure answers showing others, less fortunate, how you gained your knowledge."

The franchises granted at last spring's election to the Denver Gas and Electric Light Company, the Denver City Tramway Company and the Northwestern Terminal Company were practically settled a few days ago in favor of the companies when the Supreme Court of Colorado handed down a decision that the County Court had no jurisdiction to try cases in which validity of franchises is contested. The court held that no charter of the city and county of Denver could confer such jurisdiction. The only leg the franchise contestors have to stand on now is the suit in the federal District Court, which is admittedly lame.

The following-named directors were elected on January 8th at the annual meeting of the stockholders of the Edison Electric Light Company, the Westinghouse Electric Light, Heat and Power Company, the York Steam Heating Company, and the York Suburban Land Company, allied corporations, all of York, Pa.; John C. Schmidt, David Young, George Frazer, Thomas Newall, Grier Hersh and A. B. Hayward.

Edward P. Bailey and Charles D. Cole of the Jamestown (N. Y.) Electric Company have been granted a franchise for the erection and installation of an electric-light and power plant in the village of Lakewood. The proposed electric plant will be driven by a gas-producer plant. In addition to the residence and store lighting, the village has contracted for street lights. Lakewood is one of the pretty places off Chautauqua Lake.

ELECTRIC RAILWAYS.

The council of Wallace, Idaho, has granted a franchise to W. J. Hall and associates to build an electric railway in that city and eight miles outside the limits. The rights are for 50 years.

Stockholders of the Interurban Railway Company of Lexington, Ky., propose to increase the capital stock $1,000,000. Extensive improvements are to be made in the lines and power houses.

The connecting link of the Elgin-Belvidere electric railway, recently described at some length in the Western Electrician, was completed on January 13th. This line now serves to connect Janesville, Wis., with Chicago and Freeport, Ill. The company expects to carry express and passengers by February 1st.

A charter has been granted the Southwestern Electric Railway Company of Guthrie and Chicago, which proposes ultimately to build an electric line from Chicago to Denver; capital stock, $250,000,000. Incorporators are P. M. Dunn and Louis F. Rabe of Chicago and H. W. Pentecost and N. D. McGinley of Guthrie.

An ordinance of the Executive Council of Porto Rico to J. G. White & Co., for the construction of a railroad between the towns of Rio Piedras and Caguas, on the island of Porto Rico, has been submitted to Congress by the president. The franchise calls for the construction of an electric road and is good for 99 years.

Another effort is being made to get a crosstown line in Washington, D. C., to extend along Florida Avenue from Seventh Street, N. W., to Eighth Street, N. E., and thence southward to connect with the present tracks of the Capital Traction Company. Spasmodic efforts have been made to get the necessary sanction of Congress ever since the winter of 1897.

Legislation asking that electric railways, at least those outside of incorporated cities, be placed under the jurisdiction of the State Railroad and Warehouse Commission is recommended in the annual report of the Minnesota commission to the Legislature. Believing that it is a matter of a short time only when there will be many electric lines built into the country, mainly as feeders to the railroads, the commission thinks that the best interests of the state can be served by placing those lines under the jurisdiction of the commission.

During the 198 days of the Milan Exposition of 1906, Consul Dunning of Milan reports that the records of the Milan street railway, which ran 100 extra cars during the exposition, show that during the time mentioned there were carried more than 72,250,000 passengers—more than twice the whole population of Italy. During October 13,700,000 passengers were carried by the city lines, and the smallest number transported in any month during the entire exposition was 9,800,000. The greatest single day in this regard was September 8th, on which date 640,000 people paid fares in the cars.

PUBLICATIONS.

The Allis-Chalmers Company has sent out an interesting bulletin, No. 1040, on polyphase induction motors, which takes up the advantages of the induction motor. There is also one on rotary converters, No. 1045, which considers the characteristics and special features of machines of that type.

A new monthly electrical publication, issued by the Buyers' Reference Company of New York, is the Electrical Record—"a consolidation of the electrical dealers and contractors', light and power plant, and street-railway editions of the Buyers' Reference." Thus three quarterly editions are supplanted by one monthly. The leading purpose of the magazine, or, at any rate, the one mentioned first, is "a record of new goods put on the market." In addition, there are other features of varying degrees of excellence, the whole enclosed in the bright red cover with which users of the old Buyers' Reference are familiar.

A neat little pamphlet on adjustable electric-light fixtures and portables has been sent out by the Gail-Webb Manufacturing Company of Buffalo, N. Y. The pamphlet shows the various forms of adjustable ceiling, wall and desk fixtures; also forms of universal lamp holders. Dimensions and prices are given.

An attractive booklet descriptive of P. & S. standard brass sockets has been issued by Pass & Seymour, Solvay, N. Y. It has a bright red cover with a full-size reproduction in gilt relief of one of the sockets. The booklet contains a description of the many excellent features embodied in the different styles of sockets manufactured by the company, and the designs are well illustrated.

A sample of the aggressive advertising campaign of the Western Electric Company is a folder entitled "A Tale of Five Cities." It uniquely illustrates the fact that the yearly product of one cement plant, which is equipped with Western Electric generators and motors, would make a chain of barrels about 600 miles long. The chain formed would be long enough to connect the offices of the Western Electric Company in Chicago, Indianapolis, Cincinnati and St. Louis, passing through LaSalle, Ill., where the cement mills are located.

Electrical Engineering, the announced new electrical journal, has made its appearance in London, the first issue being dated January 3d. It is to be published weekly and has evidently set a high standard for itself as "the new engineering journal of the electrical industry." It is conducted by technical journalists of ability and experience and published by the Kilowatt Publishing Company—a rather fanciful name, one would think, for staid and decorous England. The first number, with articles by H. F. Parshall, J. W. Meares, A. P. Trotter and others, makes an excellent impression. There is no long-winded "salutatory," which is a good thing. All told, the new venture gives promise of taking high rank among the English electrical journals.

Among recent trade literature of the General Electric Company are bulletins bearing the following titles: "Automatic Time Switch, Type T;" "Dial Controllers, Type PP;" "Railway Motor, GE-76;" "Pipe Thawing Transformers;" "Ammeter and Voltmeter Pocket Instruments, Types O and OS;" "Accessible Manhole Junction Boxes, Type SD;" "Parts of Type K Series Parallel Controllers," and "Mercury Arc Rectifiers." There is also a bulletin by John R. Hewett on the Toledo and Chicago interurban single-phase railway. The single-phase current is fed to the trolley at 3,300 volts, and the cars may be operated on either alternating current or direct current. In about a year's time Chicago will be connected to Toledo by an unbroken chain of interurban roads, it is said.

SOCIETIES AND SCHOOLS.

The twenty-eighth spring meeting of the American Society of Mechanical Engineers will be held in Indianapolis on May 28th to 31st. Mr. J. R. Whittemore, general superintendent of the Atlas Engine Works, is chairman of the local committee.

The fourteenth annual year book of Armour Institute of Technology, Chicago, is out. It contains 204 pages of information concerning the 15 departments and courses of instruction. This excellent school has made marked progress since it was founded in 1892. Seven of the courses—mechanical, electrical, civil, chemical and fire-protection engineering, and general science and architecture lead to the degree of bachelor of science. Copies of the year book, the circulars of the evening classes and of the summer courses will be sent on application.

The executive committee of the Ohio Electric Light Association held its midwinter meeting in Columbus, Ohio, on January 10th. The committee at that meeting selected Toledo, Ohio, as the place for the thirteenth annual convention of the association and fixed the date as August 20, 21 and 22, 1907. The programme will be entirely by central-station men and its features particularly attractive to central stations. In accordance with the action taken at the first convention the central stations of Indiana will be invited to be guests of the Ohio association at this convention. Mr. D. L. Gaskill of Greenville, Ohio, is secretary of the association.

TRADE NEWS.

The dissolution is reported of the electrical supply firm of George & Bower of South McAlester, I. T.

In the future the enterprising Nebraska Electric Company of Omaha will act as agent and distributor in its territory for the Buckeye Electric

Company of Cleveland, the well-known incandescent-lamp manufacturer.

Col. John T. Dickinson, who for several years past has been connected with the Consolidated Railway, Electric Lighting and Equipment Company, has tendered his resignation and accepted the position of vice-president of the Bliss Electric Car Lighting Company of Milwaukee. Colonel Dickinson's headquarters will be in New York, at the new offices of the Bliss Electric Car Lighting Company, in the Night and Day Bank Building on Fifth Avenue. The Chicago office of the Bliss company will be in the Monadnock Building, and Mr. W. N. Lalor, who was formerly also with the Consolidated Railway Electric Lighting and Equipment Company, will be in charge as assistant general sales manager. The extensive additions for the large plant of the Bliss Electric Car Lighting Company will be completed on February 1st. They will afford ample facilities for the manufacture and prompt delivery of electric car-lighting and train-lighting equipment batteries and supplies

The December issue of the Proceedings of the American Institute of Electrical Engineers says: "Although a comparatively new structure, the Edison Building, 44 Broad Street, for many years the headquarters of the General Electric Company in New York, has been sold to the City Investing Company. The General Electric Company has leased an entire floor in the City Investing Company's new building at Cortlandt Street and Broadway. The floors in this building will each contain about 19,000 square feet rentable space. The lease is for a term of 10 years, to begin as soon as the building is finished. Until that time the General Electric Company will continue in the Edison Building."

The DuBois Iron Works, DuBois, Pa., a $1,000,000 corporation, has taken over the entire business of the Lazier Engine Manufacturing Company of Buffalo, N. Y. The DuBois Iron Works have been manufacturing gas and gasoline engines for years under the patents and designs of Mr. Arthur A. Lazier, former vice-president and general manager of the Lazier Engine Manufacturing Company, who has sold out his entire interests and retired. Numerous improvements and changes will be made, which, the company says, will put "DuBois" engines (the name they will be sold under) far in advance of any of the horizontal gas or gasoline engines now claiming the distinction of being the best known to modern gas-engine practice. The engine will be made to operate on natural, illuminating, coke-oven gas, gasoline, alcohol, distillate, crude oil and kerosene, in sizes ranging from five horsepower to 300 horsepower. Mr. Peter Eyermann of Germany is chief of the engineering department, and under his designs and supervision the new and improved "DuBois" will be produced. The DuBois Iron Works will continue the manufacture of its celebrated Simplex steam pump. The officers are: President, John E. DuBois; vice-president, W. C. Pentz, secretary and treasurer, E. A. Badger; general manager, I. N. Hamilton; sales and advertising manager, C. E Stuart.

BUSINESS.

The Balance Cable Crane Company has recently placed orders, through the Millard Construction Company of Jersey City, N. J., for six 40-horsepower Crocker-Wheeler crane motors. The Isbell-Porter Company of Newark, N. J., has also ordered one 35-kilowatt 250-volt direct-current generator, one 12-horsepower, two six-horsepower and one five-horsepower motors.

The Compania Minera Borda Antigua y Anexas, S. A., whose mines are located close to the Dos Estrellas mines, near Tlalpujahua, have recently placed an order with Messrs. G. & O. Braniff & Co. for an electrical installation for their mines. The motors, transformers, etc., will come from the works of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., and the pumps from the Byron Jackson Machine Works of Oakland, Cal.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 8, 1907.

840,478. Protective Apparatus for Electrical Circuits. Harry P. Davis, Pittsburg, and Frank Conrad, Edgewood Park, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 20, 1904.

A transformer having two primary windings, which normally produce opposing fluxes in approximately equal amounts, and a secondary winding, which is energized by the resultant of the fluxes, is used to energize a selective apparatus to energize a certain tripping coil.

840,479. Protective Apparatus for Parallel Transmission Lines. Harry P. Davis, Pittsburg, and Frank Conrad, Edgewood Park, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg. Original application filed January 20, 1904. Divided and this application filed January 30, 1905.

A polyphase electromagnetic device is used for closing the circuits of the tripping coils of the circuit-breaker. Means are provided for energizing one of the windings of the electromagnetic device, when the normal direction of current in one of the lines is reversed. (See cut.)

840,480. Apparatus for Recovering Metals from Ores and Other Substances. Leon Dion, New York, N. Y., assignor to the American Electro-Hermatic Company, New York. Application filed March 4, 1904.

A group of electrodes are arranged in a chamber through which the fumes, gases, or vapors arising from the molten metals may be passed. Means are provided by which a liquid may be passed between the electrodes in the form of a spray.

840,506. Commutator Brush and Holder for Dynamos and the Like. Joseph A. Misland, New York, N. Y. Application filed December 7, 1905.

A commutator brush is provided with a socket set into the brush, which is provided with a concave recess. The holder for the brush is provided with a spring plunger having a convex end engaging the socket in the brush, the plunger being disposed obliquely to the face of the brush and having a loose bearing to enable it to vary its obliquity.

840,508. Telegraphic Apparatus. Thomas W. McKenzie, Kenton, Manitoba, Canada. Application filed January 15, 1906.

An automatic caller is placed in the loop circuit, and a switch is provided, so that the loop may be switched into and out of the main line circuit. Means, controlled by the opening of the main line circuit, cut out the loop circuit.

840,516. Switching Arrangement. Otto Rennert, London, England. Application filed January 12, 1903. Renewed June 17, 1905.

A ratchet wheel, as actuated by the armature of an electromagnet, which operates a cam to work a circuit-breaker.

840,531. Electromagnet. Thomas M. Walsh, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 14, 1906.

A disk of non-corrosive material is associated with one of the heads for supporting the wire terminals of the winding. Metal terminals on the head are provided for securing the wire terminals of the winding.

840,537. Switchboard. Welby D. Weir, Winnsboro, Texas. Application filed October 2, 1905.

Circuit-closing rings are arranged in openings in a pair of parallel boards and are provided with flanged end portions projecting beyond the faces of the boards. A spacing member, formed of insulating material, is arranged between the boards, and has openings of larger diameter than the circuit-closing rings for the reception of the flanged ends of the rings and serves to maintain the latter in spaced relation.

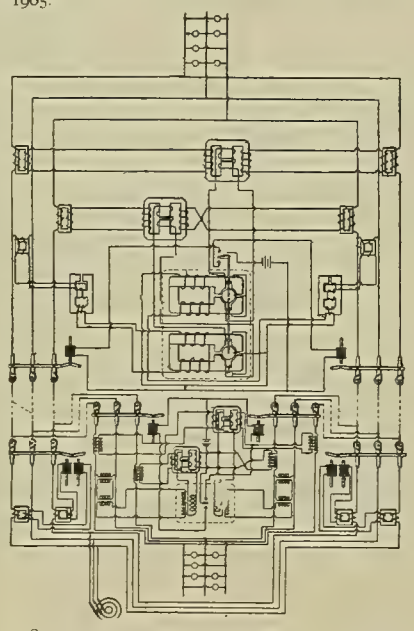
840,544. Party-line Telephone Mechanism. Charles H Wood, Cleveland, Ohio, assignor of one-fourth to John T. Hobbs, Cleveland, Ohio. Application filed February 17, 1904.

An electrical mechanism, adapted to be operated from a distant station, controls the position of a circuit-lever, which, in one position, is in electrical connection with the switchhook, and, in the other position, is out of connection with the switchhook and in connection with the other station terminal of the main line.

840,557. Automatic Circuit-controlling Mechanism. Herbert G. Crawford, Elmont, Va. Application filed March 22, 1905.

A needle provided with a threaded arch, having poised screws, is mounted on a shaft. The needle swings over a number of contacts, and means are provided for causing engagement of a needle-carried contact with one of the other contacts at regular predetermined intervals.

840,562. Time Circuit Closer. William S. Guthrie, Terrell, Texas. Application filed August 29, 1905.



NO. 840,479.—PROTECTIVE APPARATUS FOR PARALLEL TRANSMISSION LINES.

Means are provided for permitting the intermittent movement of a motor, which actuates a device for making and breaking an electrical contact.

840,569. Electrical Measuring Instrument. John M. Lea, Chicago, assignor to the International Electric Motor Company, Chicago. Application filed September 25, 1906.

A combined voltmeter and ammeter has separate meter movements mounted in tandem. Indicating needles therefor swing in planes one above the other. A scale plate is mounted in a plane between the planes of the needles, and a separate scale plate is mounted under the lower needle. (See cut.)

840,582. Electric Alarm Device. John F. O'Neill, Newburgh, N. Y. Application filed August 4, 1906.

An overflow alarm for ice boxes and other uses. A contact arm is secured to a movable member or platform. An adjustable spring prevents contact being made until the platform moves against the spring.

840,589. Telephone Signal. Gustavus W. Schuessler, Mason, Texas. Application filed September 23, 1905.

A switchboard drop has a magnet and an armature. An oscillating rod is movable with the armature and carries a visual indicator. Means are provided for holding the rod in raised position.

840,590. Electric-motor Controller. Simon Sparrow, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed October 27, 1905.

Reversing means for the motor are controlled by an automatic stop, which is controlled by the rotation of the motor. (See cut on next page.)

840,614. Electric Circuit-breaker. Stanley B. Freiberg, Cincinnati, Ohio. Application filed December 28, 1904.

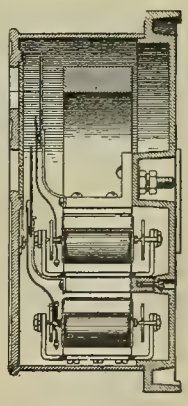
A spring normally retracts an armature. Means normally connect a pivoted switchblade and the armature, and means normally act to separate them.

840,623. Incubator Alarm. Fremont R. Harris, Kenmare, N. D. Application filed August 10, 1906.

An electric bell is operated by the closing of a circuit upon the movement of the damper arm of the incubator.

840,634. Electrical Conductor for Lighting Purposes. Isador Ladoff, Schenectady, N. Y., assignor to Philip C. Peck, New York, N. Y., and Anna M. Ladoff, Schenectady, N. Y. Application filed December 2, 1903.

An arc-light pencil consists for the most part of an alloy of titanium with another metal possessing greater conductivity than titanium.



NO. 840,569.—COMBINED VOLTMETER AND AMMETER.

840,646. Electric Time Switch for Beacons. Robert P. Nelms, Jacksonville, Fla. Application filed March 20, 1906.

A time mechanism or clock work is used to close a circuit, including a battery and eleceric lamp.

840,648. Trolley Wheel. James A. Norton, Wilkesbarre, Pa., assignor of one-half to William L. Raeder, Wilkesbarre, Pa. Application filed July 27, 1905.

The hub of the wheel is sectional and each section is provided with independent lubricant chambers that open through the outer faces of the hub section, and passages for conducting lubricant from the chambers to the stationary bearing. Plates are adapted to be detachably engaged with the outer faces of the hub to close the openings through which lubricant is supplied to the chambers.

840,649. Trolley-pole Connection. Jacob M. Olinger, Springfield, Ohio. Application filed April 28, 1906.

The pole base has an extension and a collar provided with a spiral groove depressed near its end to form a shoulder. A spiral spring encircles the extension and fits the groove, the spring being deflected near its end to form a shoulder engaging the shoulder of the groove

840,659. Signal and Alarm Attachment for Mine Hoists. Bernard T. Reilly, Wilkesbarre, Pa., assignor of one-half to Luke French and one-fourth to Maurice C. Gaertner, Wilkesbarre, Pa. Application filed July 23, 1906.

Independent electrically operated means operate each of two signal bells. There is an indicator for each bell, and a third indicator is automatically operated when both the bells have been actuated.

840,685. Automatic Engaging and Disengaging Device for Dynamo and Storage Batteries. Otto Böhm, Berlin, Germany. Application filed September 14, 1906.

An electromagnetic device is adapted to detach a friction wheel from engagement with the dynamo, the friction wheel being on a driving shaft.

840,699. Telephone Operator's Switching Device. William Kaisling, Chicago, assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 23, 1903.

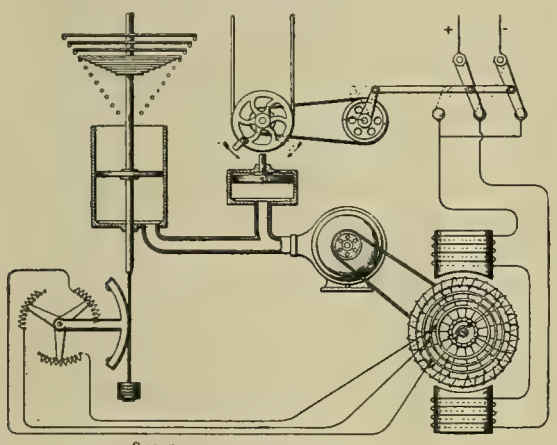
A number of switches are mounted on the same support and are operated by the pressure of a number of buttons extending beyond the top of the support, each switch element having a separate button.

840,714. Tool for Testing the Current in Electric Wires. Alfred Scheibler, Aarau, Switzerland. Application filed October 3, 1906.

The insulating handle, with rods therein, is connected at one end to spring plates carrying fuses and has at the other end projections adapted to be placed on the electric wires.

840,718. Visual Recorder for Telephone Systems. Richard W. Shoemaker, Pasadena, Cal., assignor of part to Reginald H. Shoemaker, Jr., Pasadena, Cal. Application filed February 13, 1905.

A character-printing mechanism and electromagnetic controlling means therefor are provided. An operating connection for the controlling means has a normally closed connection to the line. Means are controlled by a switch, which normally opens circuits, the telephone connection with the line, to open the operating connection for the printing mechanism when the telephone is used.



NO. 840,590.—MOTOR CONTROLLER.

840,726. Telephone Exchange System. Harry G. Webster, Chicago, Ill. Application filed May 28, 1903.

A subscriber's bimetallic line circuit normally includes a source of current. Test terminals normally are disconnected therefrom. A controlling relay therefor has a single winding permanently connected to the line, and means are provided to supply energizing current to said relay in making connection with the line.

840,728. Electric Induction Battery. Halle E. Willis, Lebanon, N. H., assignor to Kendrick & Davis, Lebanon, N. H. Application filed November 15, 1906.

The circuit-breaker of an induction coil is yieldingly mounted, so as to move in all directions.

840,746. Parcel Carrier. Arthur S. Bretherton, Cleveland, Ohio. Application filed September 25, 1906.

Track rails have wires arranged above the same, one of said wires serving as an electric conductor, of a carrier. An electric motor is placed thereon, and an axle is driven by the motor. Grooved wheels are fixed upon the axle to run upon the track rails and engage the wires. A motor-controlling device upon the carrier is actuated by a trip, arranged adjacent to the track rails.

840,802. Electrostatic Separator. Greenleaf W. Pickard, Amesbury, Mass., assignor to the Huff Electrostatic Separator Company, Boston, Mass. Application filed January 29, 1906.

Means are provided for feeding material to a repelling electrode. An opposite electrode is divided into a number of subdivisions, each of small superficial extent, as contrasted with the repelling electrode. Each of the subdivisions is enclosed in a dielectric envelope, to bring the subdivisions into closer electrical proximity to the repelling electrode than to each other. Means are provided for electrically exciting the electrodes.

840,815. Electrostatic Separator. Philip H. Wynne, Boston, Mass., assignor to the Huff Electrostatic Separator Company. Application filed January 20, 1905.

Means are provided to supply potential to the electrodes at intervals, and means are provided to deprive the electrodes of potential in the intervals between the acts of supply.

840,848. Circuit-breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 7, 1904.

A swinging tripping coil is movable with a movable contact, and an operating handle has a permanent controlling relation to the coil to shift it, but is movable relative to it. (See cut.)

840,857. Electric Heater. Nicholas N. S. Matcovitch, San Francisco, Cal., assignor to J. Earl Moore, Los Angeles, Cal. Application filed January 25, 1906.

Flexible resistance conductors are secured between a pair of blankets and arranged in series, and the blankets are provided with one or more pockets.

840,865. Electrically Propelled Vehicle. Mathias Pfatischer, Philadelphia, Pa., assignor to Russell Thayer, Philadelphia, Pa. Application filed November 25, 1905.

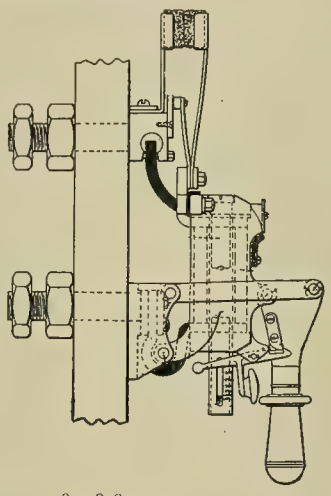
Means are provided to operate the motor directly by connection with a storage battery, and indirectly with a railway supply system, through a dynamometer.

840,866. Electrically Propelled Vehicle. Mathias Pfatischer, Philadelphia, Pa., assignor to Russell Thayer, Philadelphia, Pa. Application filed November 29, 1905.

Means are provided to operate the motor directly by connection with a storage battery, and indirectly with a railway supply system, through a direct-current transformer.

840,868. Electrical Distribution and Control in Body Appliances for Medical Purposes. John F. Richardson, Montreal, Quebec, Canada, assignor of part to John Campbell Wardell, Montreal, Canada. Application filed December 4, 1905.

The battery, induction coil and switch are mounted on a plate and arranged so that the various kinds of current can be distributed through the human body when the apparatus is applied.



NO. 840,848.—CIRCUIT BREAKER.

840,889. Starting Rheostat. William C. Yates and Paul H. Zimmer, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed April 26, 1906.

The controlling arm of the rheostat is biased to the starting position, and means are provided for giving the arm a quick break between successive increments of variable impedance.

840,908. Space Telegraphy. Sewell Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed November 18, 1905.

There is an elevated transmitting-conductor system. The receiving system has its terminals connected to the elevated transmitting-conductor system at a point, which, during transmission, has practically zero potential to ground.

840,909. Space Telegraphy. Sewell Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Original application filed November 18, 1905. Divided and this application filed November 25, 1905.

The sending key operates means which automatically renders the receiver inoperative by separating the cooperative parts of it.

840,915. Battery Binding Post. George H. Cove, Roxbury, Mass., assignor of one-half to Frank R. Kimball and one-half to Hampton V. Hayward, Boston, Mass. Application filed March 3, 1906.

A nut is provided on its opposite sides with forwardly extending spring members, having their free ends bent and normally separated. One of the free ends has a longitudinal recess to receive the terminals of the opposite member when they are pressed or sprung past each other, for receiving and clamping a service wire.

840,947. Tower for Electric Transmission Cables. Albert K. Mansfield, Batavia, Ill. Application filed May 21, 1906.

Four or more converging angle iron columns form a pyramidal tower. The columns are braced and a cross-arm is secured near the upper braces.

840,987. Telegraph Relay. William E. Athearn, New York, N. Y., assignor to the American Telephone and Telegraph Company, New York. Application filed November 28, 1906.

The magnet has oppositely situated poles, and the armature is movable between the poles. Means are provided for controlling the attractive force of each of the poles. Operating mechanism, common to the controlling means of both poles, is provided for oppositely varying the attraction of the poles.

840,995. Method of Poly-station Signaling. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Original application filed May 19, 1905. Divided and this application filed August 9, 1905.

A tuned body is vibrated by means of periodic increments of energy. The energy is caused to be stored in the body, until a desired totality is reached, when the vibration is instantly interrupted and the stored energy is used to flex the body to produce a stroke of such short duration as not appreciably to retard or alter the normal or periodic movement of the vibrating body.

841,004. Interrupter for Electromagnets. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed February 3, 1906.

An electromagnet has an armature. A spring latch keeps a spring switch normally closed, and means are carried by the armature, which are adapted to operate the latch. An energizing circuit for the magnet includes the switch and a source of current, together with an electromagnetic device for controlling the circuit, so that the electromagnet alternately opens and closes its own circuit as long as the same remains closed at all other points.

841,033. Telephone Exchange System. Frank J. Mersman and Joseph Mersman, Ottawa, Ohio. Application filed April 14, 1906.

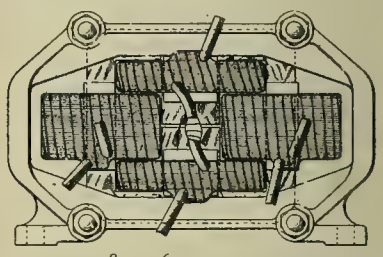
The metallic-circuit subscribers' line has one side normally continuous and the other side normally broken at each station. A polarized relay at each station is normally connected to the end of the broken conductor leading to the next preceding. Means, controlled by this relay, close the telephone circuit and complete the broken conductor to the next succeeding station. Means controlled by an operator, may send current impulses over the line.

841,035. Electrical Switch. John E. Morris, Columbus, Ohio, assignor of one-half to Edward Glaze, Columbus, Ohio. Application filed July 28, 1905.

The contact arm is carried by a pivoted parallel arm, which carries an anti-friction roller, which is adapted to be engaged by a cam. The cam is mounted on a rotative element.

841,064. Telegraph and Trolley Pole. Thomas P. Stanley, Athens, Ga. Application filed February 17, 1906.

A continuous cement or concrete body has embedded in it a number of longitudinal truss members. Each member extends substantially the length of the pole in a plane radial to the center of the pole.



NO. 841,076 —TRANSFORMER.

841,076. Transformer. Harry P. Davis, Pittsburg, and Frank Conrad, Swissvale, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Original application filed January 20, 1904. Divided and this application filed March 23, 1906.

There are two primary windings, a secondary winding, and a core having three legs, the intermediate one of which has greater reluctance than the outer two and upon which the secondary winding is placed. The primary windings are placed, respectively, on the outer legs. (See cut.)

REISSUE.

12,589. Electrical Switch Mechanism. Hubert F. Krantz, Brooklyn, N. Y. Application filed December 26, 1905. Original No. 755,141, dated March 22, 1904.

An approximately flat cross-bar is adapted to be supported edgewise to the bus-bars of the switch mechanism, and is electrically connected to one of the bus-bars. The cross-bar is provided with U-shaped ends, forming four contacts for the switches of the mechanism.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 14, 1907:

419,186. Hood for Electric Lamps. D. A. Culman, Jr., Kansas City, Mo.
419,245. Electric Motor. S. C. C. Currie, Philadelphia, Pa.
419,282. Electric Steam Generator. J. O'Meara, New York, N. Y.
419,308. Conduit for Electric Railways. B. J. Black, Richmond, Va.
419,309. Electric Street Railway. B. J. Black and W. F. Jenkins, Richmond, Va.
419,313. Electric-railroad Telegraph. B. Cade, Louisburg, N. C.
419,314. Electric Railroad. B. Cade, Louisburg, N. C.
419,365. Electric Connector. J. A. Seely, Brooklyn, N. Y.
419,367. Meter for Alternating Electric Currents. O. B. Shallenberger, Rochester, assignor to the Westinghouse Electric Company, Pittsburg, Pa.
419,487. Electric Cut-out. J. F. Wollensak, Chicago, Ill.
419,524. Shade for Incandescent Electric Lights. J. H. Huber, Greensburg, Pa.
419,588. Electric Railway. I. Kitsee, Cincinnati, Ohio.
419,617. Socket for Incandescent Lamps. C. H. Lawton, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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The Domestic Uses of Electricity.

Probably no class of exhibits at the Chicago Electrical Show attracted more genuine interest than that devoted to electrical cooking and heating utensils and other electrical devices for the household, including motor-driven apparatus. There were several exhibits of this character, and at some of them very complete demonstrations were given. These exhibits were of especial interest to the ladies.

The demonstrations given left no doubt as to the practicability of electric cooking and heating devices, and their desirability and efficiency were proved. The principal demonstrations in this line were given in the exhibits of the Chicago Edison Company, the General Electric Company and the Simplex Electric Heating Company. In each of these booths two or three ladies, prepossessing and skillful exponents of the art of domestic science, manipulated the various utensils and treated the spectators to coffee, biscuits, rarebits, cakes, fudges, popcorn and many other appetizing eatables, all prepared on the spot by electrical methods.

In one section of the Chicago Edison Company's display an electric oven was used to bake tea biscuits, which were served to visitors with coffee from electric percolators. Visitors were also given toasted marshmallows prepared in the electric oven, as well as fresh waffles cooked on the electric waffle iron, a utensil which is ideal for this purpose. The electric heating devices included the well-known electrotherm or electric heating pad, which is greatly superior to the old-fashioned hot-water bag, and enlarges the scope of that familiar sick-room adjunct; luminous electric air heaters of two sizes, and various small car-type electric radiators and carriage footwarmers. Among electrically heated utensils were the popular electric flatiron, electric curling iron heaters and electric soldering irons.

The cooking and heating exhibit of the General Electric Company was much the same as mentioned above, the object being to educate and enlighten the people to the proved advantages of the wide application of electricity to household uses. A feature of the exhibit was a series of suppers given in the booth by Mr. Frank H. Gale of the General Electric Company. The parties consisted of six to eight persons, the table being set in the center of the booth and artistically decorated by the aid of miniature electric lamps. Everything was prepared electrically by the Misses Lyons, Potts and Abbott. There were five courses requiring as many different utensils, including a complete kitchen range. The "pigs in blankets" (oysters wrapped in thin slices of bacon and broiled) could not have been excelled anywhere, and the Welsh rarebit, aside from the excellence of its quality, was especially commented upon because of the ease with which it was prepared in the electric chafing dish.

Biscuits, cookies and cakes hot from the electric oven were served, also electrically popped corn and electrically cooked fudges. Coffee was drawn from an electric coffee percolator which adorned the center of the table. At the conclusion of the supper cigars were lighted by a new type and convenient electric cigar lighter of portable design.

The devices for heating and cooking by electricity exhibited by the Simplex Electric Heating Company of Cambridge, Mass., were no less interesting and instructive. The many questions of the interested ladies were answered by Messrs. C. W. Richardson of the eastern office, H. R. Hixson and Mr. Strauss of the Chicago office, and Messrs. McAlister and Ruby. A display of 50 smoothing irons, no two of which were alike, and weighing from three to 50 pounds, was the attraction for many. Electric stoves, chafing-dishes, coffee percolators, teakettles, coffee urns, ovens, complete kitchen ranges, radiators, glue pots, sterilizers, hot-water boilers and other devices were open to inspection. Demonstrations were given with the various utensils by two ladies who are expert in household arts, and they were able to impress the visitors with the many good points in favor of electric cooking and heating devices.

Of especial interest in the line of electrically operated household utensils was a portion of the exhibit of the Westinghouse Electric and Manufacturing Company. Here were shown some of the heavier devices used in the home, the club and the restaurant, and they brought out much favorable comment. Among these were a dough mixer driven by a two-horsepower motor, an ironing mangle operated by means of a one-eighth-horsepower motor, and a sewing machine driven by a motor of one-twenty-fifth horsepower. A laundry washer of family size was shown in operation; also dish washers, coffee grinders, etc.

VIEWS SHOWING THE DEMONSTRATIONS OF ELECTRIC COOKING AT CHICAGO ELECTRICAL SHOW.

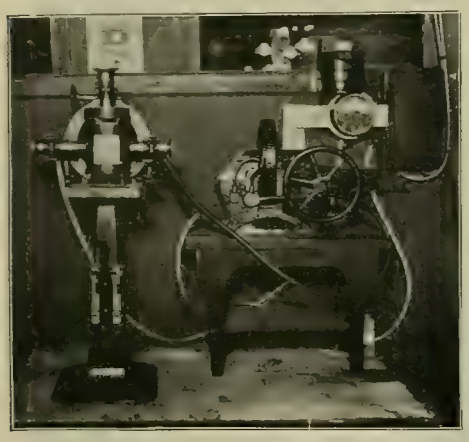
THE CHICAGO ELECTRICAL SHOW OF 1907.

The second annual Chicago Electrical Show, which has been in progress at the Coliseum for two weeks, beginning January 14th, was, without doubt, the most complete, profitable and generally successful electrical trade exposition ever given in this country. It might well be called an educational exposition, as the predominating spirit among the exhibitors seemed to be along the lines of making clear to the public the manifold uses to which electricity can be put and to demonstrate the innumerable advantages in the application of electricity to every-day work in every walk of life.

All kinds of electrical machines, devices and appliances, with kindred apparatus, were exhibited at the show, as a study of the pages in this issue devoted to the show will prove. Some of the newest inventions and developments in the electrical field were shown for the first time, and there was much that appealed to the purely technical man and the student of electricity.

Attendance throughout the two weeks was very large, even during the extremely bad weather of the first week. The electrical industry in its various branches was represented by visitors from all parts of the country, and the exhibitors were not confined to Chicago, but came from the whole country; and there were also exhibits of some foreign products.

The special days at the show brought out large throngs. On Franklin day, Thomas A. Edison day



THORDARSON ELECTRIC FURNACE.

and Telephone day the management gave out some very neat souvenirs. There were also several conventions and meetings of electrical men during the exposition, among these being the very successful annual convention of the Northwestern Electrical Association, and the organization meeting of the Chicago branch of the Illuminating Engineering Society. These are reported elsewhere in this issue.

A large gathering of the Sons of Jove was occasioned by the show and an enthusiastic rejuvenation was enjoyed, 43 new members being added to the ranks. An effort will now be made to form a Jovian Club in Chicago. This will provide weekly lunches and a monthly meeting for rejuvenations and to listen to matters of interest to the members. Mr. Blocker, W. P. Crockett and A. O. Einstein are on the committee arranging this work.

Central-station men were greatly interested in the new illuminating devices recently developed and some of them show for the first time in public. The ladies were attracted by the demonstrations in household cooking and heating devices, and the numerous motor-driven machines. Telephone men had an opportunity to inspect the very latest telephones, switchboards and parts.

Supply of Current for Exhibits

To the practical electrical man one of the particularly interesting features of the exhibition was the temporary arrangement made for supplying the large extra demand for current for lighting and power at the Coliseum during the two weeks of the show. The "juice" was taken from the street mains of the Chicago Edison Company, and the load amounted to about 500 kilowatts, exclusive of the regular load for the normal electric lighting of the building, which is carried by the Coliseum Company's plant.

Two services were installed from the low-tension distributing system of the Chicago Edison Company, one consisting of three 1,000,000-circular-mil cables and another of two 1,000,000-circular-mil cables. These cables were brought from a manhole in the alley at the rear of the building through iron pipe to a service board which was installed especially for the Electrical Show, and which was located some 15 feet above the main floor at the northeast corner of the building. From this board five feeders were run through the building—one of 350,000 circular mils to supply the exhibitors along the east aisle, one of 250,000 circular mils for the exhibitors in the middle aisle, two for the west aisle of No. 0000 cable and a feeder for the motor-generator which

PROFESSOR CLARKE'S LECTURE APPARATUS.

supplied the alternating-current service for the exhibitors.

This motor-generator consisted of a 160-kilowatt three-phase, 2,200-volt Fort Wayne alternator belt-driven by a 230-volt direct-current motor of the same make. The 2,200-volt three-phase current was stepped down to 115 volts through three 15-kilowatt transformers. The secondaries of these transformers were connected in Y, giving the exhibitors 115-volt single-phase current from neutral to either phase wire or 200-volt three-phase current from the three-phase wires.

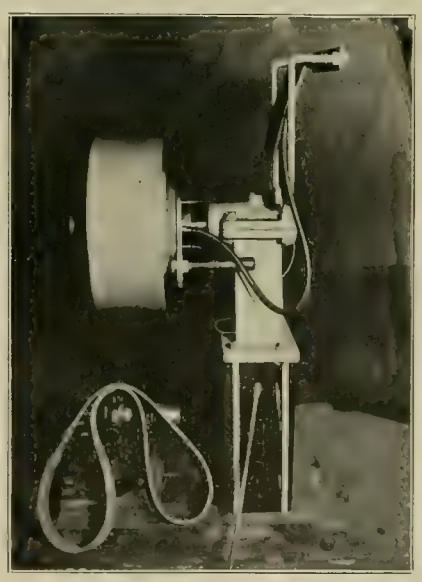
The secondary main running from these transformers down the center aisle of the building consisted of four No. 0 conductors. There were also two No. 00 two-wire mains, one running along each side of the building under the balconies, which were connected on opposite sides of the Edison system.

The distributing mains in the various aisles were suspended by messenger cables, which were secured to the balconies at frequent intervals, both longitudinally and laterally. These mains were provided at intervals of 50 feet with service fuse blocks to which exhibitors' branch mains were run.

Current was supplied to exhibitors on flat rate or meter as they preferred.

The Thordarson Demonstrations.

One of the most interesting pieces of scientific apparatus, and a machine of decided interest to those working with induction coils or almost any electric current vibrating mechanism, was the Thordarson spark analyzer. To describe it briefly, this device consists essentially of a constant-speed motor



THORDARSON SLOW-SPEED AUTOMOBILE MAGNETO.

driving a pointer attached to the armature shaft at a speed of 3,000 revolutions per minute within, and concentric with a brass ring about four inches in diameter. By a suitable arrangement of a commutator and four switches the sparks from four automobile induction coils could be thrown into circuit so that each swing of the coil vibrator would throw its respective spark from pointer to ring or ring to pointer, at its proper time interval. Consequently the spark of any given coil, instead of appearing as a single spark or flame, was "drawn out," so to speak, for inspection, and each impulse occurs at a space interval around the circumference, depending on the speed of the coil's vibrator and its relation to that of the revolving pointer.

This device will undoubtedly find its way into the hands of automobile coil manufacturers, to say nothing of the school and college laboratories of the country.

Among the novel pieces of electrical apparatus exhibited at the Electrical Show and illustrating modern electrical progress was the Thordarson electric furnace. This furnace is being placed on the market by the Thordarson Electric Manufacturing Company, Chicago, and has been in operation at the Thordarson laboratory for some time.

The Thordarson furnace is simple in itself, although it is provided with every possible adjustment to facilitate the handling of its heavy carbon electrodes. It was mounted on a firebrick foundation and cast-iron stand. The furnace proper consists of a cylindrical retort of firebrick with three openings, one on each side and one at the top. Through these openings are introduced the carbon electrodes.

As the machine is adapted for service on a continuous current circuit, a single-phase alternating circuit, or for work with tri-phase currents, a maximum of three electrodes is required. As will be seen by a close inspection of the picture these three electrodes in the Thordarson furnace are attached to a basic foundation in ring form on the back of

EDUCATIONAL DISPLAY OF ARMOUR INSTITUTE.

the machine. Each electrode may be advanced, so to speak, around the circle into any radial position by the hand-operated worm wheels. Each electrode, too, by a thumbscrew, gear and rack arrangement, can be moved in or out, so as to obtain the finest sort of electrode adjustment within the retort. A thumbscrew is provided by which each electrode may be clamped into permanent position. For service on alternating-current circuits an ingenious and convenient impedance coil is provided for throttling the current. This was especially designed by Mr. Thordarson and consists of a hand-wheel gear-and-rack arrangement by which the greater bulk of a laminated iron core may be withdrawn from, or introduced at will, into the impedance coil proper. It should be stated that the type of regualtor which is used in connection with the Thordarson furnace is also supplied by the Thordarson company in various sizes; in fact, it is a variable impedance for general alternating-current service. Incidentally it may be stated that Mr. Thordarson has recently shipped to Professor Burgess of the University of Wisconsin a large electric regulator of design similar to the one here shown. This regulator for the university at Madison is now being used by Professor Burgess in his extended research work in metallurgy. This electric furnace can be used as an "arc" or "resistance" furnace as desired.

A new style of magneto machine and ignition system for service in connection with gasoline automobiles was also shown. The device consists simply of the combination of a magneto and automobile flywheel. The magneto is contained within the space bounded by the rim and center of the flywheel, with no external projections. In a word, the Thordarson auto-magneto is, in simple language, merely a very slow-speed magneto, but within an automobile flywheel so as to make the magneto and the flywheel one piece of mechanism. The entire mechanism is within the flywheel itself. There are no brushes, no collector rings, no gear wheels, no chain or belt drives and no rotating wires. The armature of the magneto is a permanent part of the shaft on which

the flywheel revolves. The rotary magnetic field consists merely of polar projections from permanent magnets attached to and forming a part of the rim of the flywheel. An important mechanical point, too, is that there is, consequently, only one bearing for the flywheel.

It is hardly necessary to state that on account of the above features, where this magneto is used no battery or induction coils are necessary. One of the most important, if not the most valuable feature of the Thordarson auto-magneto, lies in the fact that the ignition system may be started by hand when the flywheel is actually at rest. This is the reason that no auxiliary batteries are required. This machine as shown in operation at the Electrical Show delivers ignition sparks to four plugs in succession.

PROFESSOR CLARKE'S POPULAR LECTURES.

One of the most interesting features of the exhibition was the series of lectures delivered by Mr. W. J. Clarke of New York city. A spacious platform was fitted up in the Coliseum Annex and four lectures were delivered each day upon the subject of "Wonders of Modern Science." Mr. Clarke had a large amount of interesting apparatus, and the lecture room was crowded at almost every lecture. Electric welding was shown by taking one turn of heavy copper and rigidly fastening two pieces of heavy round steel in the jaws that formed the terminals and allowing the pieces to press against each other with some force given by the spring of the coil. When this was placed as a secondary to a transformer the steel was perfectly welded in a very few seconds.

The writing telegraph was shown in full operation, and a number of experiments were given showing the repulsion power of the alternating-current magnet and the effect of transformer coils upon each other at a distance. Professor Clarke seems to have worked out this last to a nicety as he had no difficulty in lighting an incandescent lamp, ringing a vibrating bell, and running a small trolley car, all of which were attached to the secondary coil, the primary being from four inches to a foot away from it.

In showing Tesla's high-frequency experiments Mr. Clarke caused about a sixty thousand-volt spark to pass from his hand to that of his assistant. The sparks were heavy and brilliant and about three inches in length. A tube of Mr. D. MacFarlane Moore's was lighted to full brilliancy when one end was held by Mr. Clarke and the other by his assistant. Another Tesla experiment was made by Mr. Clarke in the lighting of an ordinary 110-volt 16-candlepower lamp to full candlepower by the current passing from the oscillator through his body to the ground.

People who found it difficult to hear on account of deafness were provided with the Hutchison Acousticon and then had no difficulty in hearing comfortably. The Multiphone is one of the latest inventions of Mr. K. M. Turner of the Acousticon Company, and Mr. Clarke had this on exhibition in its most perfected form. Three large horns were placed in the lecture room and these were connected with an Acousticon transmitter in a distant part of the building. When music was played into the transmitter it was reproduced in the hall with wonderful distinctness.

The speaking arc lamp was hugely enjoyed by all. An ordinary hand-feed arc lamp was placed on the lecture table and when the distant transmitter was spoken into the lamp repeated the words to the audience so loudly that several hundred people could hear it if there was quiet in the room. During the last week of the exposition Mr. Clarke concluded all of his lectures with an exhibition of perfected moving pictures preceded by a special mechanical stereopticon slide that proved to the audience that the pictures did not move at all, and that the effect was produced by optical illusion.

DANCING SKELETON.

It may be interesting to describe the device that operated the dancing skeleton at the end of the hall. It is a flasher, the first of its kind that has ever been built, and can be likened to an immense music box, electric switches, of which there are 24 in number, taking the place of the little tongues that produce the sound. The skeleton itself was divided into 24 circuits, or clusters of lamps, each cluster representing some portion of the body, and these clusters were thrown on and off as required to produce the image desired. When one set of switches was thrown on to show a certain position of the figure the other cluster was working alternately with one lot of switches, producing another position which had the appearance of the image quickly changing from one position to another. The flasher itself consists of an immense revolving cylinder, 13 feet in circumference and driven by a small 1-20-horsepower motor. It made about one revolution per minute. Attached to a side frame supporting this cylinder were 22 switches arranged in two sets for manipulating the various clusters of lights. On the face of the cylinder were small brass projections, ranging from one-half to six feet long, which raised and lowered the switches for any length of time, according to the length of the brass projection. To produce the figure in one position it may be necessary to raise ten switches simultaneously. To produce another figure it may be necessary to raise six switches. The skeleton figure was 14 feet wide and 15 feet high and contained about 800 lamps.

A SUCCESSFUL SHOW.

The close of the show is scheduled for Saturday night, January 26th. The Electrical Trades Exposition Company deserves much credit for the unquestioned success of the show from every viewpoint. The management was directly in charge of Mr. Homer E. Niest. In the following pages will be found details of the exhibits.

A DAYTIME VIEW OF THE CHICAGO ELECTRICAL SHOW.

EDUCATIONAL INSTITUTIONS.

In a booth artistically adorned the Armour Institute of Technology, Chicago, presented a number of very interesting electrical instruments and devices, of which an illustration of a rotating magnetic field was perhaps the most interesting to visitors. A two-phase coil rests under a piece of glass on which is pasted a circular piece of paper. Small particles of iron are seen running around in a zigzag manner. In the center, mounted on a spindle, is a piece of sheet iron having four right angles, which rotates in the direction of the rotation of the field. The fundamental principle of the induction motor in its simplest form is thus clearly demonstrated. A voltmeter having a capacity of measuring 100,000 volts is a unique feature, by reason of the extreme high voltage for which it is constructed. An instrument which has not yet been on the market a year is the Grassot flux meter, designed to measure the intensity of a magnetic field directly in lines of force. Heretofore it has been necessary in determining the number of lines of force in a field to make a test coil and measure the deflection on a voltmeter, calculating the number of lines of force from the

reading. The new instrument does away with all calculations, the needle staying at the readings for about 10 minutes. A very large and handsomely finished instrument is the Wolff potentiometer, which is indispensable in the laboratory for accurate measurements of current and electromotive forces. Another valuable instrument is the flicker photometer for the study of commercial illuminants. It has eliminated all personal error due to different colors of lights under comparison. By means of the instrument it is possible to compare two lights of widely different colors with the greatest ease and accuracy—a problem which had long been found to be an exceedingly difficult one. The oscillograph has been referred to in the Western Electrician before. The instrument was shown this year with all the necessary instruments to show any form of alternating-current wave, both in quality and quantity. An ammeter measures the amount of current, a voltmeter the voltage, a phasemeter the amount of lead or lag of the current in the circuit, and a frequency meter the number of oscillations per second. Many different wave forms

HAMBURGER'S DISPLAY OF FLAMING ARCS.

were shown, some with capacity in the circuit and others with inductance. A very interesting wave produced is that by the telephone transmitter. The electrical wave in the telephone wire is shown graphically by the oscillograph. The actual wave produced by the human voice is projected upon a screen. The alternating current for the oscillograph was taken from a motor-generator set which can be regulated to any desired frequency, a fairly wide range of voltage being obtained. Many other instruments were exhibited, the entire display showing the fine instrument resources and original work at the Armour Institute.

The International Correspondence Schools, Scranton, Pa., had an attractive booth, the feature of which was a life-size figure of a young man turning a grindstone. This was placed in a conspicuous position and on a large card was the question: "Is your nose on the grindstone?" In the booth was a library of technical textbooks of 81 volumes, also drawing outfits, various instruments and phonograph outfits for teaching languages. A half-dozen sets of students' corrected lessons were exhibited as a means of showing the methods of instruction, also lesson sheets of courses. Over 200 courses are offered by the Schools, of which electrical engineering is a prominent one. There are 36,000 students in Chicago and 973,000 in all the schools. Mr. H. S. Hoover, superintendent of the Chicago branch, and Mr. F. H. Tigue were in charge.

SIMPLEX ELECTRIC HEATING COMPANY'S EXHIBIT.

Illumination, Lamps, Signs, Etc.

Of special interest to central-station men was the display of all the newest lamps recently brought out. The new tungsten-filament lamp was given the first public demonstration in this country at the booths of the General Electric Company and the National Electric Lamp Association. Many other forms of new illuminants were shown in the various exhibits mentioned in the following paragraphs.

To take up first the General Electric Company, its collection of incandescent lamps was one of the features of the show. The exhibit space was thickly studded overhead with the new incandescent units. Illustrations were given of all the newer lamps, with various forms of Holophane reflectors. An ingeniously arranged flashing device presented the various forms and lighted up, consecutively, Gem, tantalum, Meridian and tungsten lamps. There was also a "working" display of various standard carbonized-filament lamps, including all of the miniature lamps. The exhibit covered all the different new types of incandescent lamps made in America, and illustrated in a most practical manner the wide range of illuminating units now available. The tungsten lamp is the most recent development in commercial incandescent lighting and secures an efficiency higher than that given by any form of electric light except the flame arc.

The General Electric Company's engineers have been able to produce tungsten filaments which give excellent life results at the remarkable high efficiency of 1¼ watts per candle (mean horizontal English parliamentary). Tungsten (or wolfram) is a metallic element discovered in 1781 (before tantalum) and named from the Swedish "tung" (heavy) and "sten" (stone). It is not found native, but occurs as the tungstate of iron and manganese in the mineral "wolframite" and as the calcium tungstate. The pure metal is a bright, steel gray, hard, brittle, crystalline substance. It has been used chiefly to increase the hardness and tenacity of steel for hard tools. The fusing point of tungsten is very high, about 2,500° C., which property enables it to operate at the very high efficiency obtained in the tungsten lamp. The filaments of the tungsten lamps exhibited at the Electrical Show are made by processes developed by the General Electric Company in its own laboratory. The lamps exhibited consume 105 watts, giving about 85 candlepower (mean horizontal). The life of the tungsten lamp is approximately 700 to 1,000 hours and appears to be equally good on either alternating or direct current. The lamp is not on sale or listed as yet, but production will be undertaken in the near future, so that the lamps will probably be available in limited quantities during this year.

The engineering department of the National Electric Lamp Association, Cleveland, Ohio, had an interesting exhibit of tungsten, tantalum and Gem metallized-filament lamps. The booth was in charge of representatives from the engineering department, which is located in Cleveland. It was provided with a number of large easy chairs, reading tables, etc., which harmonized with the green and black of the walls and woodwork. The posts at the corners and entry carried large electroliers, on which were displayed the tungsten and Gem metallized-filament lamps. On the back walls were arranged a number of brackets for exhibiting tantalum lamps, and a unique device for showing the light quality of tantalum and Gem metallized-filament lamps. At the back and above the booth was a sign showing the monogram of the association, NELA, in red letters, with a solid background of nearly four hundred white sign lamps.

A GLIMPSE SHOWING SHELBY LAMPS, HALLER SIGNS, REYNOLDS DULL FLASHERS AND BODINE MOTORS.

The engineering department is among the first to show the tungsten lamps, the latest development of the lamp manufacturer. The lamps shown were of 80 candlepower and consume 100 watts, giving an efficiency of 1¼ watts per candle. This lamp was easily distinguished from the other incandescent lamps in the Coliseum on account of its extremely high brilliancy and the whiteness of the light, which closely resembles daylight. The lamp is designed for multiple service on 100 to 130-volt circuits and contains five hairpin filaments in series. The lamp fits the standard Edison socket and is burned to best advantage in a vertical position. The life of the lamp, as shown by tests, lies between 1,000 and 2,000 hours, with a loss of from 10 to 15 per cent. in candlepower during life. The fluctuation in candlepower, with change in voltage, is only two-thirds that of the carbon lamp, behaving in this respect somewhat similar to the Gem metallized and tantalum-filament lamps. Tungsten lamps are adapted for use on direct-current and alternating-current circuits of any frequency. The price of this lamp will be such that there will be great economy in its use, due to its long life and its increased efficiency. The tantalum and Gem metallized-filament lamps were also on exhibition and attracted a due amount of consideration from the large number of people visiting the booth.

Among those who were in attendance at the booth of the National Electric Light Association were: J. C. Fish of the Shelby Electric Company, president of the association; H. B. Vanzwoll of the Sunbeam Incandescent Lamp Company, secretary of the association; S. E. Doane, chief engineer of the association; H. M. Vanzwoll, general office of the association; J. R. Crouse, general office of the association; E. J. Kulas of the Brilliant Electric

North Shore Electric Company. Crane Company.
Chicago Pneumatic Tool Company. Federal Electric Company.

EXHIBITS AT CHICAGO ELECTRICAL SHOW.

Company; E. H. Haughton, Bryan-Marsh Company; L. P. Sawyer, Buckeye Electric Company; A. C. Garrison, Columbia Incandescent Lamp Company; M. Lobenthal, Economical Electric Company; G. G. Lockwood, Bryan-Marsh Company; H. H. Geary, Fostoria Incandescent Lamp Company; W. Coale, Sterling Electrical Manufacturing Company; E. Irving, Sunbeam Incandescent Lamp Company of Canada; E. E. Nash, Warren Electric and Specialty Company. Many other assistant managers and salesmen of the companies, which support the engineering department of the National Electric Lamp Association, were present. These companies are listed below: Brilliant Electric Company, Bryan-Marsh Company, Buckeye Electric Company, Colonial Electric Company, Columbia Incandescent Lamp Company, Economical Electric Lamp Company, Fostoria Incandescent Lamp Company, General Incandescent Lamp Company, Jaeger Miniature Lamp Manufacturing Company, New York and Ohio Company, Shelby Electrical Manufacturing Company, Sterling Electrical Manufacturing Company, Sunbeam Incandescent Lamp Company, Sunbeam Incandescent Lamp Company of Canada, Warren Electric and Specialty Company.

One Row of Lights is Composed of Tungsten Lamps.
LAMP AND DOMESTIC-ELECTRICITY EXHIBIT OF GENERAL ELECTRIC COMPANY.

The Western Electric Company showed in operation a series alternating arc-lamp equipment, consisting of 12 arc lamps, switchboard, transformer and regulator. The new "Hawthorne" type 20-inch arc lamp attracted considerable attention and many orders were received. This lamp is especially adapted for low ceilings.

The lighting exhibit of the Westinghouse Companies was adequately provided for by six different types of illuminants, those being alternating-current multiple, direct-current multiple and alternating-current series arc lamps. In conjunction with the latter, six Nernst lamps of the street series type were kept burning, the current being regulated by a 6.6-ampere constant-current regulating transformer. Cooper-Hewitt mercury-vapor lights, both types H and K, were lighted to demonstrate their advantages for shop lighting. Sawyer-Man incandescent lamps were shown burning in clusters, and a complete collection of samples was also shown in a neatly arranged sample case.

Among the special features of the arrangements in the Chicago Edison and Commonwealth Electric companies' exhibit may be mentioned the illuminated beams over the entire ceiling of the spaces occupied. These were hollow beams, two sides and the bottom of which were of opalescent glass. Within the space thus enclosed a large number of electric incandescents were arranged at regular intervals, so as to produce uniform illumination of the glass. Various effects were secured by means of separate circuits, controlled by centrally located switches, which made it possible to turn on either plain or colored lights, or a combination of both, within these beams. Considerable space in the exhibit was devoted to the uses of the reception room. Photograph albums were available, containing numerous interesting pictures, and illustrations of decorative table lamps. Pendant wall lamps were supported on the wall in convenient position for giving an excellent reading light to anyone occupying a lounge or easy chair in the vicinity. A useful little book of electric chafing-dish recipes and a pretty little calendar were given away. Mention is made elsewhere of the companies' extensive exhibit of electric cooking and heating utensils and other household utensils. A large space was devoted to the publication of the Electric City, which was printed, folded, stitched and trimmed by machines of the latest type, all operated by individual electric motors. One space in the exhibit was devoted to the exhibition of various electrical construction supplies sold by the supply department of the two companies, including large and small cables, insulating material, various kinds of single and multi-conductor insulated wire, and numerous specialties. The exhibit was arranged and constructed by and under the supervision of Messrs. J. F. McGlensey and N. A. Rollins, engineers, and Mr. D. H. Howard, of the advertising department, Mr. Bradley Buell assisting.

Central-station men and illuminating engineers, as well as the general public, who visited the Electrical Show, were greatly interested in the exhibit of Felix Hamburger of New York. There was to be seen the new domestic flaming arc lamp, known as the "Jupiter," which is said to surpass the imported lamp (also exhibited), at a reduction in price. The "Radianté" and "Economy" lamps demonstrated what beautiful effect in arc lamps can be gotten through a limited supply of air instead of absolutely enclosed arcs. A remarkable feature of the exhibit were the miniature "Liliput" arc lamps, giving a very bright, true and penetrating light at only two and three amperes, alternating or direct current. Other features of the exhibit were: Various types of flaming arc lamps, made by the Carbone Company of Berlin, for five, six, eight and 10 amperes, burning singly, and with ordinary carbons and not with the impregnated "effect" carbons; the new "Bivolta" lamps, made by Siemens, for 10 amperes, and the "Sirene," a new acoustic apparatus. The characteristic feature of this apparatus is its extraordinary noise, which is most penetrating and makes it very useful for signals of all kinds. Mr. Max Austrich was in charge of the exhibit.

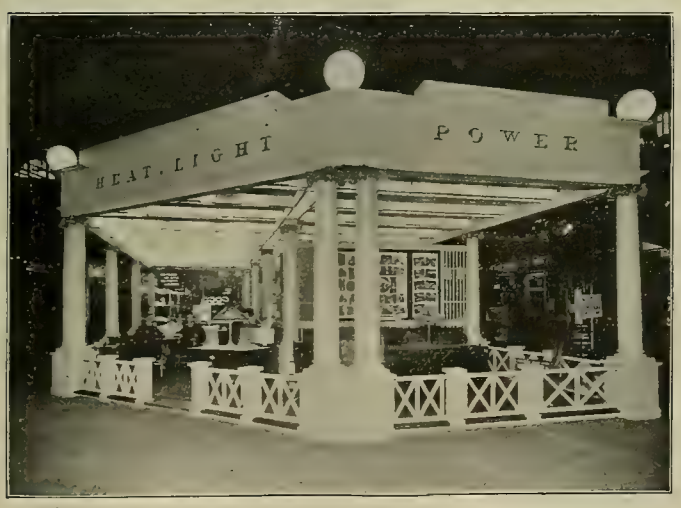
The North Shore Electric Company, which furnishes light to the suburbs of Chicago, occupied a very pretty booth near the northeast corner of the Coliseum. Among the towns which are lighted by the company are Waukegan, Highland Park, Evanston, Maywood, Chicago Heights and Harvey. The booth was designed for the reception of visitors. A large line of cooking and heating utensils for the household was exhibited.

The Fort Wayne Electric Works of Fort Wayne, Ind., gave a complete working demonstration of its series alternating-current arc-lighting system of 25-light capacity. This company makes a specialty of this system of arc lighting and explained the merits and advantages of the system, as well as the details of operation. With the standard switchboard and type SA regulator, a type A transformer, the regulation of the system can be made well-nigh perfect. The company installed in one part of the building a motor-generating set of 150-kilowatts capacity, which furnished all alternating-current energy for exhibitors at the show. This generating unit comprised a direct-current motor fed from the Chicago Edison Company's mains and belted to a 150-kilowatt multiphase alternator. The company also exhibits its standard line of supplies, types K and W single-phase, multiphase and prepayment wattmeters, and its prepayment devices used separately with either type K or W wattmeters. A few interesting applications of small-power motors, together with its standard line of fan motors, were also very much in evidence. Messrs. W. S. Goll, A. S. Pond, J. H. Raymond, W. Hines and Frank Wiemeyer were in attendance.

The exhibit of the Phœnix Glass Company of New York attracted a number of visitors. The delicate tinting on shades and globes and the cut-glass electric domes were much admired. Mr. A. H. Patterson, vice-president and manager, visited the show as a guest of Mr. E. H. Fox, the western agent.

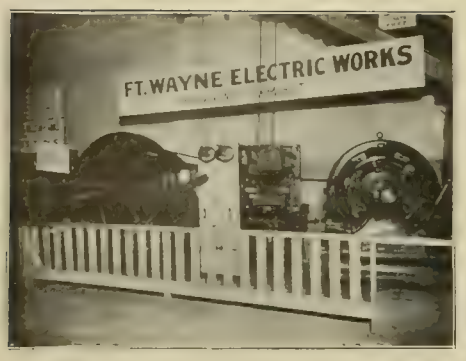
The large collection of electric lamps and portables shown by Mandel Bros., Chicago, was one of the prettiest displays at the Coliseum. Many new and charming modern appliances for artistic lighting were shown, including electric dining-room lights, library, piano and hall lights.

The Chicago Lamp and Reflector Company's display consisted of a number of beautiful lamps,



BOOTH OF CHICAGO EDISON AND COMMONWEALTH ELECTRIC COMPANIES.

Tungsten Lamps over Entrance.
HEADQUARTERS OF NATIONAL ELECTRIC LAMP ASSOCIATION.



THREE-PHASE ALTERNATOR FURNISHING CURRENT FOR EXHIBITS.

shades, etc., the exhibit being of the same character as Mandel Brothers'.

An interesting exhibit of electric signs and illuminated advertising devices occupied the south wall of the Coliseum. It was made up by four joint exhibitors and constituted an excellent example of the application of electricity and electrical devices to advertising. The signs, of a large variety, were made by the Haller Machine Company of Chicago. There were also some very pretty illuminated emblems. The familiar trademark of the Anheuser-Busch Brewing Company was one of the signs which attracted attention. It is nine by 14 feet, two colors, and is part of a 22 by 30-foot electric sign being constructed in Chicago by the Haller company. A grooved letter "K," 11 by 18 feet, to be a part of a 40 by 250-foot sign, was shown. Besides there were many other flashing signs, including representations of lightning, a jumping rabbit, crawling snake, etc. Messrs. William Goltz, Carl Haller, H. F. Fetzer and R. J. Wherry represented the Haller company.

All the flashing for the above-mentioned signs was done by the Reynolds Dull Flasher Company of Chicago, which company exhibited a large variety of flashers. Eighteen machines of different types were shown in operation. These ranged in capacity from 20 to 700 lamps per circuit. The flasher for the dancing skeleton, described elsewhere, was operated in this booth.

Small direct-current motors, ranging from one-twentieth to one-eighth horsepower, were in operation in the above-mentioned joint exhibit. They are the product of the Bodine Electric Company of Chicago, and are applicable to sign flashers, envelope seals, duplicating machines, advertising novelties, dental tools, phonographs, etc. The company was ably represented by Messrs. C. D. and P. J. Bodine.

All lamps in the joint exhibit were furnished by the Shelby Electric Company of Shelby, Ohio. This company also furnished the lamps used in the skeleton, which attracted so much attention. These were largely four-candlepower lamps. This company showed for the first time its new 17-watt sign lamp, which, on comparison with some other lamps, is said to give 2.3 candlepower, as against 1.7 candlepower. Some new street-railway lamps were shown, in which the filament is double anchored, eliminating vibration. Long life and low-current consumption is claimed for these lamps. The company exhibited a full line of its well-known lamps. R. P. Bricker, Will Love and W. P. Clawson were in attendance, the latter being of Hibbard, Spencer, Bartlett & Co., the Chicago agents.

Dinsmore & Lawton of Chicago exhibited some attractive electric signs, also flashers and flashlight signs. The company's signs are absolutely fireproof. They are all metal, with glass fronts, and have single and double faces. One 16-candlepower lamp is all that it needed to operate the D. & L. signs. They are made for inside and outside use, a large variety being exhibited.

One of the features of the Electric Midway was the spectacular production entitled, "The Shipwreck," produced by electric lamps and reflectors against specially built scenery. It is the product of the Aetna Electric Stage Lighting Company of Chicago. This company had also an interesting exhibit in the show. It makes a specialty of electro-mechanical spot and flood-light devices, and manufactures anything in the way of lamps, rheostats, effects, etc. The olivette or flood light is one of its specialties. The "Kansas Cyclone," which proved such an attraction at Riverview Park, Chicago, last summer, is a product of this company. Messrs. E. T. Erickson and H. A. Rieke represented the company at the show.

An attractive exhibit of brass art lamps and the brass parts of all kinds of decorative and portable lamps was made in the booth of C. G. Everson & Co. of Chicago. This company also showed its attractive line of filters and water-cooling systems for buildings and houses. These are operated by electric motors, except the smaller outfits, which are run by the pressure in the water mains. Mr. R. B. Everson was in charge of the exhibit.

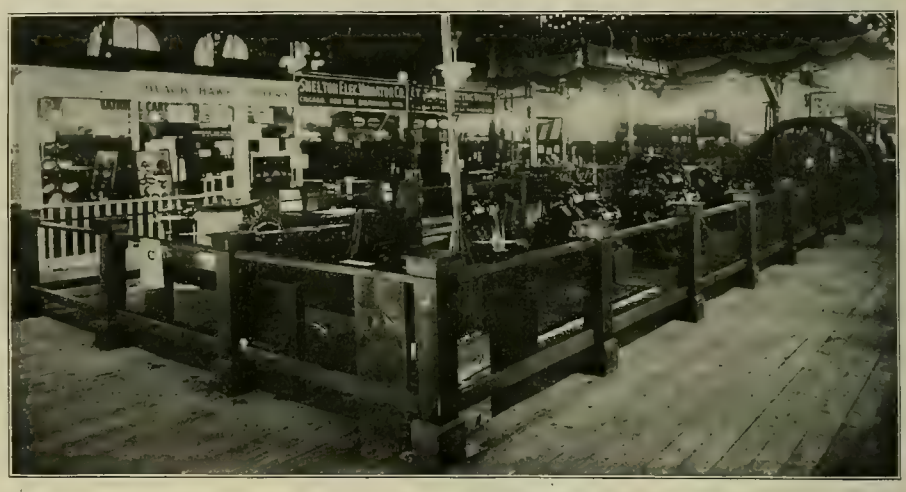
The Federal Electric Company of Chicago displayed a number of Federal porcelain enameled steel signs, having a surface of glass fused into steel. This material can easily be kept clean, its high reflective power permitting the use of a lamp of but two candlepower, thus reducing operating expenses to a minimum.

Electrical Machinery in General.

Allis-Chalmers Company, Milwaukee, exhibited an extensive line of machinery. A new 75-horsepower self-contained alternating-current generator received the attention of electrical men. Much interest was manifested by those who were shown a 10-horsepower induction motor-generator set, a line of K motors for direct current, 1⅓ to 20 horsepower, and a 15-horsepower high-speed engine generating unit. The movable and stationary rings of blading of a 500-kilowatt Allis-Chalmers steam turbine were seen in a small model which was viewed by many. Some of the principal types of machinery manufactured by the company were shown by means of photographs and illustrations. The exhibit was in charge of Messrs. C. A. Tupper, W. S. Heger, G. B. Foster, C. H. Helvey, C. S. Buell, Ervin Dryer, F. L. Webster, J. M. Denniston, E. R. Jacobs, D. K. Chadbourne, H. I. Keen, A. W. Catlin, L. St. J. Smith, P. C. Van Zandt, George Voigt and C. H. Howe.

The Westinghouse exhibit occupied spaces 1 to 5, in section D, in the center of the hall, and was conceded to be one of the most complete, instructive and attractive exhibits at the show. A feature of the exhibit was the many industrial applications of electric motors shown in actual operation, including a dough mixer of J. H. Day & Co.'s manufacture, driven by a two-horsepower Westinghouse type CCL motor; a centrifugal pump manufactured by the Dayton Hydraulic Company, operated by a one-horsepower type CCL motor; an ironing mangle of the American Ironing Company's make, operated by means of a one-eight-horsepower type DA alternating-current motor, and a Singer sewing machine, driven by a one-twenty-fifth-horsepower alternating-current motor. A Conkling laundry washer, of a size particularly adapted to laundries and hotels, was operated by a 3½-horsepower type S motor, and alongside it was displayed a family-size washer made by the 1900 Washer Company, the latter being operated by a small DA motor. The device applied to the large Conkling washer for the reversal of the cylindrical tub, obviating the necessity of reversing the motor, aroused considerable interest.

A generating set, consisting of a type A engine made by the American Blower Company and a Westinghouse seven-kilowatt type S generator were shown in the Westinghouse exhibit, and also an American Blower 24-inch fan operated by a Westinghouse one-half-horsepower type R motor. A one-twentieth-horsepower DZ direct-current motor was used to operate an automatic pin-ticketing machine. A Gould triplex pump, designated as type A, was electrically operated. The Larsen-Baker Ice Machine Company demonstrated the adaptability of electric motors for ice making. This apparatus attracted wide attention. Near by a 10-gallon ice-cream freezer made by Thos. Mills & Co. was motor-driven. A forge made by the Champion Blower and Forge Company, a 16-inch engine lathe made by the American Tool Works Company, a Hoeffer drill press, a Chandler & Price printing press, a Henry Tromner coffee grinder, a Blakeslee dish washer, and a small centrifugal pump made by Erwin & Co. were separately operated by motors adapted to the varying classes of service.



ALLIS-CHALMERS EXHIBIT.

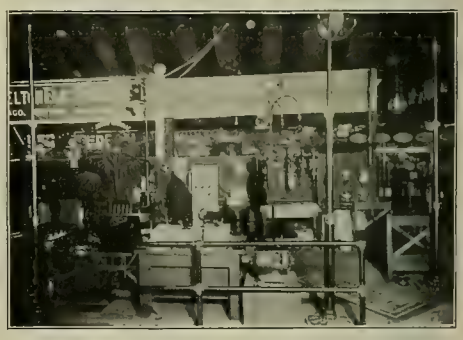


EXHIBIT OF FORT WAYNE ELECTRIC WORKS.

EXHIBIT OF THE WESTERN ELECTRIC COMPANY.

Saws were sharpened at the exhibit on the saw sharpener made by the Covil Manufacturing Company and driven by a one-half-horsepower CCL motor. Demonstrations made by the Sanitary Dust Removing Company in the Westinghouse exhibit created much interest. The entire exhibit of the Westinghouse Companies, as well as some of the adjoining exhibits, was cleaned from time to time by means of this vacuum process, which was driven by a three-horsepower type S motor. Two electrically operated Columbia phonographs amply demonstrated the commercial use of phonographs for correspondence. A stenographer was in attendance who transcribed from the phonograph records such letters as were dictated by visitors at the exhibit.

EXHIBIT OF THE WESTINGHOUSE COMPANIES.

A fairly complete line of apparatus designated by the Westinghouse Electric and Manufacturing Company as "details and supplies" was exhibited, the various types of electric instruments being attractively mounted upon marble switchboards. These details consisted in part of the following: Integrating wattmeters of the single, polyphase and prepayment alternating-current types, as well as a 500-volt direct-current type; a line of portable instruments; samples of various types of fan motors, samples of low-voltage line material, also of catenary line material for high-voltage single-phase railway installations; various types of lightning arresters, oil switches and circuit-breakers; samples of all types of lighting and power transformers under 50 kilowatts and a full line of small power motors for alternating and direct-current circuits. The company also had an attractive lighting display mentioned elsewhere.

Mr. J. C. McQuiston, manager of the Westinghouse Companies' publishing department, and Mr. E. M. Bischoff, in charge of the resales department of the Chicago office of the Westinghouse Electric and Manufacturing Company, had charge of the exhibit. Others in attendance were: From the Westinghouse Electric and Manufacturing Company—S. L. Nicholson, manager industrial and power sales, Pittsburg; C. S. Cook, manager railway and lighting sales, Pittsburg; T. P. Gaylord, manager Chicago office, and the following associates from his office: A. L. Millard, W. D. McDonald, Malcolm C. Carrington, R. H. Moore, Norman Stewart, Stephen Gardiner, Charles Talbot, D. E. Webster, A. M. Miller, S. G. Peticolas, H. H. Caughlan, R. L. Radcliffe, F. J. Moran, Malcolm McNeil, W. R. Pinckard, W. Bonham, C. Register, J. W. Bush, R. Schaulin, A. N. Brown, P. C. Ritchie, W. M. Oleen, J. M. Schilling, J. W. Robinson, also J. W. Lewis, from the detail and supply department, Pittsburg. From the Nernst Lamp Company—C. H. Davis, manager Chicago office and A. H. McMasters of the same office. From the Cooper-Hewitt Lamp Company—J. H. Keech, manager of the Chicago office. From the Westinghouse Machine Company—J. B. Allan, manager Chicago office; Mr. Rosie, T. H. B. Whitted.

The popularity of the Western Electric Company's exhibit was shown by the large crowds constantly in the booth. A large number of salesmen were present at all times to give any information desired. One of the principal features was a large 350-kilowatt alternator frame manufactured at the Hawthorne Works. The Western Electric Company is making rapid progress in the development of alternating-current motors and generators, and is now ready to figure on any size and capacity. The company had in active operation a motor-driven emery grinder and a very compact sewing-machine motor which can be attached to any make of sewing machine. The street-railway people were especially interested in the line of street-railway material on exhibition. The insulated material was of the famous "Electrose" brand, known for its high insulating qualities. This insulation has recently been adopted by the Interborough Rapid Transit Company of New York city for third-rail insulators for its tunnel system. Mention of this company's interesting lighting exhibit is made elsewhere. Mr. George H. Lounsbery of the supply department was in charge of the exhibit, ably assisted by the following-named gentlemen: L. J. Baldwin, P. Joyslin, H. D. Haring, C. Garner, O. O. Tucker, H. W. Dye, M. R. Lash, F. A. Henderson, H. F. Boardman, R. C. Kearsly, A. R. McNally, F. D. Killion, R. H. Harper, W. P. Hoagland, W. W. Templin, D. C. Guest, R. N. Baker, F. H. Hulscher, W. E. Meyers, M. B. Chase, John Young, C. A. S. Howlett, Irving Parker, H. A. Hoagland, F. J. Murphy, H. E. Griffin, W. H. Woods, R. E. Hulett, O. B. Duncan, B. S. Yorke, W. H. Tompkins, John Ryan, W. B. Minch, R. M. Hatfield, W. L. Stockton.

The Wagner Electric Manufacturing Company of St. Louis had on exhibition a complete and interesting line of Wagner products which proved to be of considerable interest to the central-station manager and the electrical fraternity in general, in that the Wagner company showed its variable-speed single-phase alternating-current motor operating a small pressure blower. This motor is a special adaptation of the standard Wagner motor used in connection with an auto-converter speed regulator, the latter device consisting of a single-coil transformer, with a number of taps brought out to a small switching and terminal head. The motor operates with the brushes on the commutator, as a repulsion type of motor, and the speed of the motor is dependent upon the voltage impressed and the load under which the motor is working. By means of the auto-converter any desired voltage from the line voltage down to zero can be obtained in steps of a few volts each. This gives a very wide range of speed control, useful in the operation of printing presses, ice-cream freezers and other small machines which it is desired to operate at varying speeds. The Wagner company's comparatively new single-phase elevator motor was also on exhibition and in operation. These motors have been designed to develop at the first instant of starting a very heavy starting torque. In this respect they are said to compare favorably with the best types of direct-current elevator motors. The Wagner company also had on exhibition one of its standard five-horsepower single-phase motors and one 15-horsepower vertical single-phase motor. The Wagner three-phase 10-horsepower induction motor created considerable interest and was commented on favorably on account of its heavy construction and substantial appearance. The company also showed transformers and switchboard and portable indicating instruments. A very unusual and interesting instrument, a combination voltmeter and frequency indicator was shown. This instrument consists of a voltmeter and frequency indicator combined in one instrument, with two scales, one reading cycles and the other reading volts. The voltage scale is plotted for any range required and the frequency scale is plotted for 10 cycles below and 10 cycles above normal. A change of one-half cycle is indicated by the instrument, and the frequency readings are entirely independent of any change in voltage, due to line conditions. The Wagner company's exhibit was in charge of F. N. Jewett, Chicago district office manager, assisted by C. B. Richardson and C. C. Warner of the Chicago office, and during the Northwestern electrical convention by V. W. Bergenthal, assistant sales manager, from the home office.

DISPLAY OF WAGNER ELECTRIC MANUFACTURING COMPANY.

ANOTHER VIEW OF THE WESTINGHOUSE EXHIBIT.

Among the things handled by Roth Bros. & Co., Chicago, were shown a Roth new style motor, and several varieties of blowers and grinders. A large grinder received the attention of many engineers and contractors.

The Bidwell Electric Company, Chicago, showed a variety of Bidwell cold and self-cooling motors and generators. The cold motor, it is said, can withstand overloads and excessive heating. In attendance were C. F. Bidwell, W. H. A. Davidson, H. Maston and John R Harmon.

Batteries, Primary and Secondary.

The Nungesser Electric Battery Company of Cleveland, Ohio, showed a variety of its batteries, including the 1900 telephone battery, the Acme gas-engine battery and the "Rapid Fire" dry cell, which has been placed on the market for the purpose of meeting the extremely hard service of gas and gasoline engine ignition. T. G. Grier is general sales manager; Mr. H. S. Greene was in charge of the exhibit, assisted by P. J. Cratty.

The Gould Storage Battery Company's exhibit consisted of one of its type V-1549 49-plate cells in a lead-lined tank complete with the Gould glass cover. The capacity of this cell is 5,760 ampere-hours. One of its smaller cells in lead-lined tanks was shown, the battery being its type S-619, 19-plate cell, with a capacity of 1,440 ampere-hours. Besides the above, the company exhibited a type O-521 21-plate battery, of 800 ampere-hour capacity, and two smaller sizes of 160 and 80 ampere-hour capacity, respectively. In this exhibit was also included several types of batteries for signal work, sparking and train-lighting sets. The company was represented by H. N. Powers, manager of the telephone department, New York, and R. H. Watson, J. Eipper and E. M. Hervey of the Chicago office.

The Vesta Accumulator Company of Chicago showed its sparking battery for automobiles and motor boats, also electric horns for automobiles, operated direct from the steering gear. Several styles of electric portable lanterns giving 15 to 18 hours on one charge were shown. These lanterns have two-candlepower lamps. They are charged

from any 110-volt circuit in series with a 16-candlepower lamp. The company manufactures a large line of electric lamps for automobiles and motor boats. In the Vesta sparking battery no free sulphuric acid is used, the electrolyte being in the form of a jelly, thus avoiding slopping and spilling. D. P. and Ward Perry were in charge of the exhibit.

The Chicago Compound Battery Company had a new closed-circuit battery on exhibition. It is of the Fuller type, but has some new and interesting features in so far as it has compound carbon electrodes and porous cups, a receptacle for the zinc sulphates which descends and replenishes the active solution; also a special porous non-destructible covering over the exposed positive electrode with means to keep the same in close proximity thereto. This, it is said, has a tendency to keep the positive electrode in a clean condition and prevent active or open circuit by keeping the positive electrode insulated on open circuit by preventing the escape of hydrogen therefrom. A small modified cell is put up in a portable condition. The company was represented by Benjamin J. Blamcuser, William Boucele and Nickolson Kribs.

A complete private houselighting plant—a combination of a Fairbanks-Morse generator and gasoline engine and a Universal battery—was the chief feature at the booth of the Universal Electric Storage Battery Company, Chicago. A train-lighting battery of 600 amperes an hour was shown. Inquiries were answered by J. S. Burnet, secretary of the company, and W. Bentley, general superintendent.

A new element for gravity battery cells to take the place of copper was shown by the Bryant Zinc Company. Mr. H. J. Hovey, who, with Mr. A. F. Klink, president of the company, was in attendance at the booth, says that the element acts exactly the same as copper and is practically indestructible. The manufacturers, however, have not disclosed what the component parts are. Although having been on the market for a short time only, the firm has succeeded in interesting several railroad companies in the new product.

The National Battery Company, New York, showed a complete line of the products it is manufacturing, including car lighting, station, automobile, ignition, lighting, fire-alarm and signal cells. This exhibit was in charge of Bertram Smith, district manager, assisted by A. Otto Heister and George S. Berger. Ralph Kimberly, treasurer of the company, attended the show, Frank Engle, superintendent, being also present.

The "Black Hawk" dry battery has a corrugated zinc cell, and "amalgamating generating matter to protect the same," and a device for the escape of gases which form in the chemicals. High amperage, high voltage and great recuperative powers are said to be its chief characteristics. The new P. D. battery connector is a device which prevents loose contacts and has contact on the nut, post and shoulder. F. J. Alvin, who was formerly general sales manager of the "Ever Ready" company, was in charge, assisted by George W. Edge of St. Louis; E. W. Dolliver, Columbus, Ohio; E. C. Schmencke, New York city; Charles Gillette, Chicago, and R. H. Mills, Moline, Ill. The booth was the center of much attraction, owing to the various small lighting effects in operation as well as miniature motors, etc.

The Electric Storage Battery Company of Philadelphia had a very instructive exhibit. It demonstrated the great variety of batteries it manufactures, ranging from the H-61 tank with a capacity of 4,800 amperes for one hour down to the little BT cell with a capacity of 2½ amperes for one hour. All of these batteries are of the "Chloride" type and include the R-73 elements in R-85 tank, 2,600 of which cells are now being installed by the New York Central Railroad Company in its electrification. Cells of this type will be used at Gary, Ind., by the Indiana Steel Company. The G-51 tank is used by street-railway companies throughout the country, and the other types shown are the F-21 for lighting and telephone work, both in wooden tanks and in glass tanks; the F-15, E-13, D-7 and C-5, all in glass jars. The Electric Storage Battery Company also showed a number of Exide batteries. This is the battery used as its standard for automobile work, both for propulsion and ignition. One interesting exhibit was the 7-SS Exide railroad signal cell, 10,000 of which are in use on the Harriman lines. This company makes a specialty of car-lighting work and the exhibit included its two-compartment tank containing ELS-11 elements and a variety of accessories for railway-car lighting. In addition to all the above this company exhibited its cell-filling device and its automatic signaling hydrometer, which is in operation. The company was represented by Charles Blizard, third vice-president; G. H. Atkin, manager of Chicago office; J. M. S. Waring, district engineer; W. F. Bauer, W. F. Rath, H. B. Marshall, F. W. Hyde and George Neth.

Instruments, Transformers, Switchboard Apparatus.

Visitors to the show found Weston instruments well represented among various exhibitors, who were using or exhibiting these instruments in connection with their own apparatus. The Weston instruments, of both the usual switchboard and also the portable types, were especially in evidence at the Central Electric Company's exhibit. The Ward Leonard Electric Company's apparatus, such as controlling panels, field rheostats and starters, were also to be seen in many of the exhibits, foremost among them being a 45-horsepower 250-volt "Navy type" controlling panel, which was exhibited by the Western Electric Company in connection with one of its large direct-current motors. F. B. Badt & Co. are the western agents for the Weston Electrical Instrument Company and the Ward Leonard Electric Company.

The Duncan Electric Manufacturing Company of Lafayette, Ind., had an attractive exhibit of direct-current and alternating-current meters reading in watt-hours, kilowatt-hours and dollars and cents. A feature was a meter running on a one-candlepower lamp, direct current. It proved of great interest to central-station men. Thomas Duncan, vice-president and general manager; William H. Sinks, E. C. Burch and Adrian Tobias were present at the show.

A full line of all sizes of Hornberger transformers was shown by the Lafayette Electrical Manufacturing Company of Lafayette, Ind. A transformer showing the interchangeable ratio connections was the feature of the exhibit. William H. Hornberger, Louis R. May, O. H. Hamilton and Charles W. Welch entertained visitors at the booth.

The J. Lang Electric Company of Chicago showed, among other things, two 6,000-ampere single-pole switches to be used, it is said, on the 17-panel board by the Congress Hotel Company in its new hotel. A. McWilliams' metering panel board, adapted to office buildings in which the personnel of tenants is constantly changing, was inspected by many electrical men. By single manipulation of the contact screws on the face of the switch panel, the metering circuits are transferred from one meter to the other.

The Universal Manufacturing Company, Chicago, demonstrated a machine that, it is said, will control any lighting circuit on a flat-rate basis with any number of eight-candlepower lamps. It absolutely controls the supply of current furnished to a customer by instantaneously automatically switching the current on and off at short regular intervals whenever the contracted load is exceeded by as much as one eight-candlepower lamp. It restores uninterrupted service the moment the overload is removed, and the load is normal. The machine, which is known as the Universal flat-rate controller, is simple in its construction and is noted for its strength. Gus Schmetzer and Frank Kramer, who had charge of the exhibit, were well pleased with the number of orders taken by them at the show.

Specialties.

The Kimble-Gregory variable-speed motors for alternating and direct current were made a specialty of the Guarantee Electric Company's exhibit. The variable-speed motors are designed for driving printing presses, engine lathes, air compressors, dental engines, blacksmith's forges, church organs, buffers and grinders, etc. Mr. Charles E. Gregory,

1. Thompson & Read. 2. Chicago Battery Company. 3. Dinsmore & Lawton. 4. M. E. Caven Manufacturing Company. 5. Guarantee Electric Company. 6. Erwin & Co. 7. Peirce Specialty Company. 8. McRoy Clay Works. 9. Phoenix Glass Company.

A GROUP OF EXHIBITS AT THE CHICAGO ELECTRICAL SHOW.

president of the company, was the designer and builder of the "kicking machine," a photograph of which appeared in last week's issue of this paper.

The United Indurated Fibre Company of Lockport, N. Y., had an exhibit which attracted the attention of electrical men of all branches. Sheet fiber of all kinds was shown, as well as a large variety of insulating devices made from this fiber. These included insulation for high voltages, insulating rings, third-rail covering one-fourth inch thick and capable of withstanding 25,000 volts, oil-switch tanks, trolley wire covers for mines and crossings, and fiber tubes for insulating service pipes from electrolysis. This fiber is weather and water-proof and is not affected by climatic changes. A number of attractive articles pressed out of this sheet fiber were shown, such as automobile battery cases, etc.

received many inquiries and was quite pleased with the prospects for 1907.

One of the interesting exhibits was that of the Peirce Specialty Company of Chicago. The display was made up entirely of the company's regular steel construction material, the framework consisting of channel and angle steel of the various sizes used in the manufacture of its different labor-saving products. Mounted in the steel frame were two-point Peirce brackets carrying leads from a 15-foot pole erected in the center of the space. Strung from these leads was a number of electric lamps. At the pole these leads terminated on the company's standard distributing circle. This is the well-known Peirce circle top of the type that may be erected, carrying only points sufficient for the need at the time of erection, permitting addi-

is neatly wound on inclosed reels, as was shown at the exhibit. The souvenir watch-fob, consisting of an arc lamp and chain in oxidized silver, was one of the most attractive distributed to central-station men during the show.

W. N. Matthews & Bro. of St. Louis exhibited their patented "money saving" specialties. The feature of the display was a panel filled with clay, showing the actual method of boring a Stombaugh guy anchor into the ground. This graphically illustrated the reason for the great holding power of the anchor. The Hargis cable-splicing joint was shown on a panel board, demonstrating various operations of splicing a telephone cable. The Kearney cable clamp was also shown in actual service on a miniature pole line and by an enlarged photograph of the heavy main distributing pole at To-

1. Ohio Brass Company.
2. Universal Manufacturing Company.
3. American Sewer Pipe Company.
4. American Steel and Wire Company.
5. C. G. Everson & Co.
6. Universal Electric Storage Battery Co.
7. Central Electric Manufacturing Company.
8. J. Allen Haines, Inc.
9. Gould Storage Battery Company.
10. Monarch Electric and Wire Company.
11. J. Lang Electric Company.
12. H. W. Johns-Manville Company.
13. Joseph Dixon Crucible Company.
14. J. L. Schureman Company.
15. Connecticut Electrical Manufacturing Company.

SOME OF THE EXHIBITS AT CHICAGO ELECTRICAL SHOW.

President Jesse Peterson and Morris W. Sheldon were at the show.

Included in the exhibit of the Diehl Manufacturing Company, Elizabethport, N. J., were motors for direct connection to sewing-machine tables, fans of all kinds, small power motors, direct-connected exhaust wheels and individual sewing-machine motors for family and manufacturing trade purposes. In charge of the exhibit was Mr. H. H. Smith, assisted by Messrs. W. D. Carnahan and J. M. Gregory.

The Anderson time switch was specialized by Albert & J. M. Anderson Manufacturing Company, Boston. It is a device for automatic control of windows, sign and street lighting. Some of the characteristics of the switch are: A brush contact switch operated by a toggle to minimize friction and render it constant; an air-tight compartment protecting the clock mechanism from dust; the division of the 24-hour dial in halves, one half indicating day and the other night. The company

tional points to be added from time to time till a capacity of 48 pairs is reached. In order to demonstrate the great saving in time effected by the use of the Peirce hammer drill, a block of stone weighing nearly 1,000 pounds was used. In the block of stone holes were drilled with the hammer drill, and Peirce expansion lead bolts were set. In no instance was the time consumed greater than one minute. Also on exhibition was a model ten-pin pole route equipped with the different methods of transposition, clearly illustrating the advantages of transposition brackets. In attendance were C. L. Peirce, Jr., president of the company; Al Haase, sales agent; A. J. Kusel, R. L. Crane and H. E. Ward.

The Oneida Community, Ltd., of Oneida, N. Y., showed Oneida galvanized chain for suspending arc and incandescent lamps. The exhibit showed the chain in use in connection with up-to-date line material, mast arm and arc lamp complete, also all sizes of chain used for sign hanging. The chain

peka, Kan. The Lima jackbox, the Hold-fast lamp guard, the Callahan cable roller and O. K. sleet cutter were also shown. James R. Kearney and V. L. Crawford were in attendance. To C. L. Matthews belongs the credit of getting up this interesting exhibit. Mr. W. N. Matthews attended during the latter part of the show.

The exhibit of the Vulcan Electric Heating Company of Chicago presented an interesting display of electric heating tools. Messrs. F. Holmes, L. P. Brown, G. M. Cox, J. W. Fay, Herman Haines, Mrs. May Lange and Mrs. J. W. Fay were in attendance. The Vulcan company makes a specialty of high-temperature electrically heated tools and has evidently spared no expense nor time in developing them to a high degree of excellence. Although adapted to a great variety of uses, the fundamental design is the same throughout. The tips of the soldering tool are made of forged copper and are perfectly shaped to fit the sockets in the heating heads, into which they should be tightly

screwed. The heating heads consist of copper cores of the greatest permissible diameters, in closest possible contact with which are windings of wire resistance of a special alloy. The Vulcan tools are small, neat, light, strong and most efficient. These tools are made in various sizes and are adapted to branding, waxing, glass leading, electrotyping, capping and tipping, shoe burnishing and soldering of all kinds, it being only necessary to provide the proper tip for each class of work. In one of the largest plants in Chicago using more than 800 of these soldering tools, the cost has been found radically less than the former expense of using gas. Other plants have been equipped as a matter of economy with these tools. The lesson from the Vulcan exhibit is that electric heating is both practical and economical. The opinion has been expressed by a number of practical men that these electrically heated tools will now rapidly replace those heated by gas, gasoline or charcoal. This exhibit has been a complete vindication of the practical possibilities of electric heating and has therefore benefited the entire industry.

In the exhibit of Mathias Klein & Sons, Chicago, was shown a case containing the different varieties of linemen's tools manufactured by the firm. Mr. Klein was present to answer the many inquiries made by electricians.

A varied assortment of specialties was shown in the booth of the Holtzer-Cabot Electric Company of Boston. It included magneto and battery telephone bells, skeleton bells, high-voltage bells and water-tight bells. Samples of buzzers in metal and wood cases were also exhibited.

The Ohio Brass Company of Mansfield, Ohio, showed an interesting line of goods, including rail bonds, overhead line material, insulators, third-rail insulators, trolley wire, connectors and bearings. F. H. Jameson is the Chicago manager. He was assisted at the show by A. L. Havens, E. A. Hurlbut, G. W. Cooper, R. W. Koenig, A. L. Price and C. E. Young.

The H. W. Johns-Manville Company of New York exhibited among its numerous electrical specialties a line of Victor direct-reading instruments. These consist of Victor direct-current volt and ammenters, Victor combination meters, both switchboard and portable types, as well as a special Victor combination meter for automobile use. Among the other materials exhibited were "J-M" friction tape, "Noark" subway and service boxes of one, two and three-pole construction and 250, 600 and 2,500-volt capacity, and a complete line of Noark National Standard fuses, blocks and accessories, and J-M overhead line material. This company's transite controller linings are made of transite asbestos fireproof lumber, an insulating material which absolutely prevents short-circuiting or grounding of controller cover.

The flexiphone and the flexilite are two well coined names for two new specialties of the Oliver Manufacturing Company of Philadelphia, whose exhibit at the Show under the management of George W. Conover of Chicago created favorable comment. The flexilite is a flexible lamp or light adjustable to any height, and swings to any position at a touch of the fingers. It is arranged to attach to any wall, desk, table, etc. A special form of the flexilite, with double rotating lamps for the use of physicians and professional men, was also shown. The flexiphone is a telephone support of ingenious design.

The J. L. Schureman Company, Chicago, made an attractive exhibit of its automatic motor-controlling devices, pumps, starters, elevator controllers, etc. Thousands of visitors inspected the company's devices.

Probably the most expensive booth in the building was that of the National Carbon Company of Cleveland, built entirely of carbon. The top of the booth was supported by several carbon columns 10 inches in diameter. The following gentlemen attended to the wants of customers: N. C. Cotabish, sales manager, Wallace O'Connor, A. L. Haskel, A. V. Wood and C. W. Wilkins.

The solderless cable joints shown by Dossert & Co. of New York are widely used. The Dossert solderless wire and cable connectors are intended to supersede the old and costly method of soldering cables, and they can be applied in a few minutes. Besides possessing maximum conductivity the company says that they possess the greatest tensile strength.

SUPPLIES.

The Metropolitan Electrical Supply Company exhibited a large line of supplies and portables and a variety of lamps, shades, two-horsepower Barrett motors, D'Olier shades and portables, Hylo lamps, Skeedoodle socket plugs, three-way Skeedoodle electric flashers, arc lamps, Stombaugh guy anchors, Noark fuses, cut-out blocks, Brilliant incandescent lamps and many other things. Those in attendance at the booth were W. H. McKinloch, G. Liver, F. Sadtler, A. Fadden and J. Yokel.

MATTHEWS & BRO.'S DEMONSTRATION.

The Central Electric Company of Chicago had an attractive exhibit. The booth, decorated in green and white, was surrounded by a railing made of 2½-inch loricated conduit. Over the center of the booth was hung an especially attractive sign, illuminated by two Stanley-G. I. flaming arc lamps. In one corner of the booth was a pillar, composed of reels of the various sizes of Okonite insulated wire. In the center was a large square column, around which had been built a series of extending platforms and on which were displayed a large variety of electrical appliances. On the north side of this column were three large showcases filled with various sizes and styles of Columbia incandescent lamps. One of the features was a large mass of Para rubber, from which Okonite insulation is made, and from its peculiar shape it was fittingly termed the "Okonite rubber biscuit." Another feature was a piece of Okonite submarine cable which had been twisted in the screw propeller of an ocean tug but without injury to its conducting qualities. Several coils of Deltabeston magnet wire were displayed. Tests were performed showing to what extremes of temperature this wire can be subjected to without injury to the insulation, D. & W. enclosed fuses, cut-outs, service boxes, subway boxes and transformer boxes were shown, also Stanley-G. I. arc lamps, Edison primary batteries, Edison battery fan-motor outfit, Knowles high-tension insulators, Okonite and Monson tape, conduit circuit-breaker and other electrical devices. Columbia Gem and Columbia tantalum lamps with Holophane reflectors provided illumination. Those in attendance representing the company were: F. R. Bryant, A. S. Pearl, R. K. Fast, L. Privat, J. W. Mason, A. F. Comstock, J. M. Lorenz, A. L. Hancock, R. L. Kimble, H. L. Miller, S. C. Penniman, D. M. Ayers, F. P. Kennedy, W. H. Pearl, G. R. Kluefer and H. F. Conly.

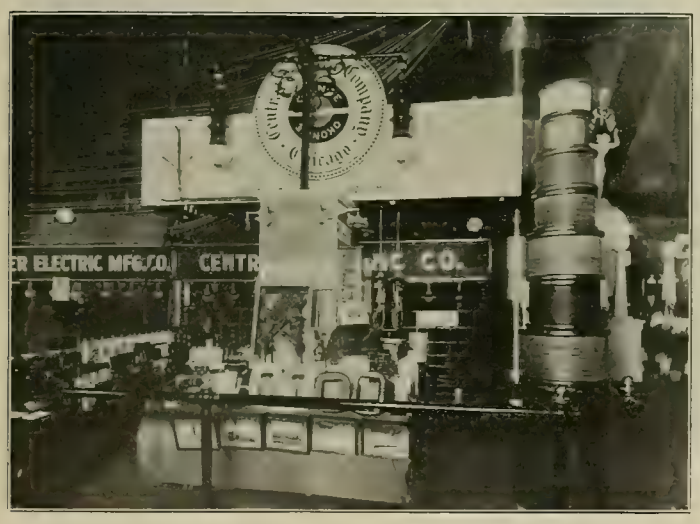
What is said to be the largest insulator ever made was exhibited by the Electric Service Supplies Company, Chicago. It is asserted that it will withstand 100,000 volts. In the Imperial arc headlights for interurban cars, as shown, the carbons are placed at such an angle that no dark spot is visible. The company also showed a line of protected rail-bonds which are in service on the largest railroads in the country. A contrivance known as the automotoneer, devised for the purpose of preventing motormen of street cars from turning on the full current in one sweep of the controller handle, attracted much attention. This company represented the Locke Insulator Manufacturing Company, Victor, N. Y.; Speer Carbon Company, St. Marys, Pa.; Crouse-Hinds Company, Syracuse, N. Y.; Miller Anchor Company, Norwalk, Ohio; Sterling Varnish Company, Pittsburg, Pa.; Colonial Electric Company, Warren, Ohio, and other concerns.

The various lines handled by the Monarch Electric and Wire Company were shown in spaces C 23, 24, in the center of the building. The 6,000-candlepower Nurnberg flaming arc lamps working two in series proved to be one of the chief attractions. Those in charge of the exhibit included Louis and Henry Schwab, E. W. Kearns, A. D. Gillespie and H. E. Mason. Mr. Schwab said that at last year's show about 400 of their customers visited them, while at this year's exhibition double that number was expected to call. The following concerns are represented in Chicago by the Monarch company: Crescent Insulated Wire and Cable Company, Trenton, N. J.; Crawfordsville Wire and Nail Company, Crawfordsville, Ind.; Faries Manufacturing Company, Decatur, Ill.; Nurnberg Flaming Arc Lamp Company, Hamburg, Germany; H. T. Paiste Company, Philadelphia; Crescent Company, Valparaiso, Ind.; Helios Manufacturing Company, Bridesburg, Philadelphia.

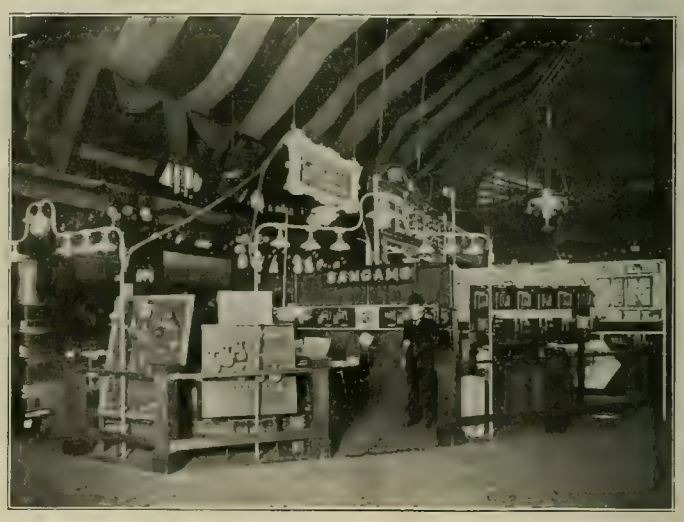
The William P. Crockett Company displayed a complete line of Bossert boxes and covers, Diamond "H" switches, DeVeau telephones, Sarco specialties, Sterling flexible conduit, Pittsburg standard conduit and Sachs enclosed fuses.

The products of the following companies were exhibited by J. Allen Haines, Inc., Chicago: Bishop Guttapercha Company; Wire and Telephone Company of America; the Dielectric Company; Stanley & Patterson (Inc.); Dayton Electrical Manufacturing Company; Schwarze Electric Company; Clifton Manufacturing Company; Reed Electrical Cordage Company. The insulated wires and cables manufactured by the Bishop Guttapercha Company and exhibited by them at the Centennial Exposition at Philadelphia in 1876 were shown and by reason of their age attracted considerable attention. Many other specialties such as coffee percolators, tea kettles, chafing dishes, laundry irons were displayed. Among the gentlemen in attendance were: H. A. Hammond, F. W. Potter, H. H. Hungerford, L. F. Ross, Welling, George Collins, A. C. Fiero, O. D. Allen and Mr. Haines.

George W. Edge, manufacturers' agent, exhibited the products of the Connecticut Electric Manufacturing Company, Bantam, Conn.; Wilmington Fiber Specialty Company, Wilmington, Del.; Pierson-Dean Company, Inc., New Haven, Conn.; W. J. Barr, Electric Manufacturing Company, Cleveland, Ohio; Gillette-Vibber Company, New London, Conn.; Schug Electric Manufacturing



CENTRAL ELECTRIC COMPANY'S EXHIBIT.



ELECTRIC APPLIANCE COMPANY'S EXHIBIT.

Company, Detroit, Mich. Mr. Edge makes his headquarters in St. Louis.

The Electric Appliance Company, Chicago, had a good display of the specialties which it handles. Sangamo meters in both house and switchboard types were shown on a special board, which attracted considerable attention. Other specialties, such as Packard lamps, Packard transformers, Stombaugh anchors, Sandwich pole changers, Paranite wire, were exhibited. The display was under the management of P. R. Boole, with F. J. Alderson in attendance. Many of the central-station men made headquarters at this company's booth.

TELEPHONES AND TELEPHONE APPLIANCES.

A device for protecting telephone users from contagious diseases was exhibited by the Antiseptic Company of Chicago. It is called the Red Cross antiseptic mouthpiece, and attracted much attention. The device can be readily attached to any telephone, and by its use the possibility of infection from germs ordinarily lurking in a telephone mouthpiece is said to be entirely eliminated. Nearly a half million of these mouthpieces are in use in the United States. John Schafer is president and manager of the company.

The exhibit of the Automatic Electric Company, Chicago, was a very elaborate one, the chief feature being a cross-section of a 100,000-line automatic telephone system, equipped with two of the

1. International Correspondence Schools.
5. National Battery Company.
9. Dossert & Co.
13. Vulcan Electric Heating Company.
17. The Holtzer-Cabot Electric Company. Oliver Manufacturing Company.
19. W. J. Burns.
2. Metropolitan Electrical Supply Company. Electro-Chemical Engraving Company.
6. William P. Crockett Company.
10. American Electrical Novelty and Manufacturing Company.
14. Chicago Lamp and Reflector Company.
20. Albert and J. M. Anderson Manufacturing Company.
3. Western Electrician.
7. Matthias Klein & Sons. Bigley Telephone Company.
11. Diehl Manufacturing Company.
15. Electric Storage Battery Company.
21. Oneida Community, Ltd.
4. United Indurated Fibre Company.
8. Roth Brothers & Co.
12. Dr. Emil H. Grubbe.
16. Electric Service Supplies Company.
18. Eureka Electric Company.
22. Duncan Electric Manufacturing Company. Lafayette Electrical Manufacturing Co.

CHARACTERISTIC EXHIBITS AT CHICAGO ELECTRICAL SHOW.

company's new "Keith Units" of 100 switches each, connected by a trunking section and representing a part of each of two branch exchanges. For demonstration purposes eight telephones were employed, four being connected up on each section. The equipment was mounted on a raised platform at the rear of the booth, separated from the rest of the booth by brass rails. Frequent demonstrations of the system were given by representatives of the company. In charge of the exhibit were H. H. Woodworth, advertising manager; C. L. Fisher, sales manager; J. A. Russell, R. B. Tyler, J. E. Fisher and P. J. Eubanks of the sales department, and F. Lübberger and J. S. Engh of the engineering department.

NATIONAL CARBON COMPANY'S BOOTH BUILT ENTIRELY OF CARBON.

The Bigley Telephone Company of Chicago exhibited a large line of second-hand telephones, switchboards and parts of all standard makes. A 50-line and one 100-line switchboard were exhibited. The exhibit was in charge of J. W. Bigley, J. C. Watters and I. C. Ronney.

Frank B. Cook, Chicago, exhibited for the first time the "Cook universal guy clamp," capable, it is said, of holding twice as much as any other clamp on the market. It can be adapted to any size of strand from three-sixteenths to one-half inch. A complete line of telephone protective apparatus and construction specialties were also on exhibition, including a sectional iron distributing frame equipped with various types of switchboard protectors. Pole cable terminals in many varieties were also to be seen, together with the Cook clip and the Cook self-welding wire joint, the latter being designed in such a way that the mere act of twisting draws the sleeve into the recess between the wires, stretching it absolutely tight around, thus making a perfect self-weld. A land anchor which bores its own way into any depth of earth desired was also shown. There were present at the show Frank B. Cook, H. R. Cook, F. W. Pardee, J. F. Tompkins, E. M. Snow, F. A. Rader, S. C. Harvey, E. W. Moore and H. R. Parker.

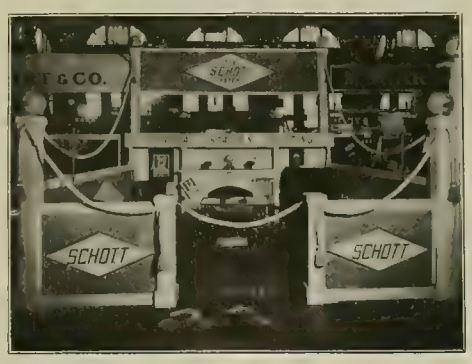
Among the interesting telephone apparatus shown by the Dean Electric Company of Elyria, Ohio, was a 6,400-line multiple section equipped for full four and eight-party harmonic service in full operation. Different types of private-branch exchange boards, self-contained, with the supervisory and live relays mounted in the switchboard cabinet, were also displayed, as was also a small charging panel equipped with instruments and necessary switches for the charging of batteries in exchanges of 500 lines. A magneto section of the unit type having a capacity of 100 lines and equipped for straight-line and harmonic party-line service was also shown in operation. A duplicate set of Dean harmonic converters, which are replacing party-line ringing machines, attracted considerable attention. In connection with the converters was shown a bank of 300 bells connected in multiple, used to demonstrate the efficiency of the Dean harmonic-ringing machine. Samples of the various types of jacks, relays, switchboards, transmitters and other Dean specialties were shown.

V. H. Messenger, secretary and treasurer of the Eureka Electric Company of Genoa, Ill., was in charge of that company's exhibit. M. V. Mehren, superintendent of the factory, spending a day or two at the show to assist in demonstrating the adaptability and novel features of the new "Eureka drop." Mr. Hulroyd of the switchboard department and Mr. Miller, sales agent, were also on hand for a day or two.

The Hepburn Telephone Manufacturing Company of Chicago was paid many compliments by telephone experts on its intercommunicating system of telephones and the new extension desk telephone. The intercommunicating instrument is constructed in such a manner that no switchboard, plug or push-button box is required. Messrs. W. L. and O. N. Davis were present to answer all inquiries. The special feature of the intercommunicating instrument is the extreme compactness, simplicity and durability of construction of the switching device. A 24-station switch has only two screws and two springs in its mechanism. It is about the same in shape and size as the transmitter, has a revolving dial, the numbers of which indicate the different stations of the system. To the stem of the dial is securely fastened a brush-arm, holding a ball-pointed brush that revolves in unison with the dial over a commutator, the segments of which are the terminals of the line wires of the various stations of the system.

The Kellogg Switchboard and Supply Company showed a 100-line express-type magneto switchboard and telephones and a central-energy private-branch exchange switchboard, with common-battery telephones. It also showed the eight-party harmonic selective system operated from a frequency pole-changer and transformers, showing the latest improvements on modern party-line systems. The eight-party system attracted a great deal of attention at the Kellogg booth, as it is entirely new and very successful. The new automatic ringing intercommunicating system embodies all the advantageous features of Kellogg standard apparatus and has been ordered by many factories and offices. All working parts of the telephone and switchboard apparatus are shown, making it possible to give close examination of every piece of apparatus. The following-named gentlemen were present to show the Kellogg apparatus: W. P. Booth, A. S. Hallstrom, C. A. Simpson, R. C. Dyrenforth, L. R. Foote and E. G. Theiss.

The plan followed out by the Stromberg-Carlson Telephone Manufacturing Company in its exhibit at the north section of the building was apparently the showing of the growth of the Independent telephone. A huge map of the United States, exhibiting by differently colored miniature lamps the various operating exchanges built and installed by the Stromberg-Carlson company, attracted a great deal of attention. Each lamp on the map was accurately placed as to geographical position. Omission of nearly 200 lights from Illinois, Ohio and Indiana was found to be necessary by reason of lack of space, showing the large Independent telephone development in the Middle West. A portion of the exhibit consisted of a section of a central-energy multiple switchboard made for the Twin City Telephone Company of Minneapolis, having a capacity of 10,800 lines. Other apparatus exhibited consisted of private-branch exchange switchboards of various types, a generator call visual-signal switchboard, reels of underground and aerial cable, samples of straight-line and selective party-line telephones, street-car and mine telephones and an intercommunicating telephone system. Visitors and customers were looked after by Messrs. E. P. Schafer of Indiana, Paul D. Myers of Illinois, S. W. Menefee of Michigan and Wisconsin, J. O. Oliver of Rochester, and several members of the Chicago office.



BOOTH OF W. H. SCHOTT.

The Swedish-American Telephone Company was one of the leading telephone exhibitors at the show, occupying spaces 11 and 12, section E. Its exhibit consisted of a complete line of its well-known magneto equipment. Those in charge were M. L. Golliday, E. W. Ladd and C. H. Macklin. Many Independent telephone men made their headquarters with the company, where they were cordially welcomed and made to feel at home.

An interesting exhibit was a common-battery board exhibited by the Vote-Berger Company of La Crosse, Wis. The board is of the common-battery ballast type and contains no relays whatever. The exhibit consisted of one section of a 3,000-line board that is being built for the Minot Light and Telephone Company, Minto, N. D. In place of the ordinary line relay, an iron wire ballast is placed in series with the line lamp subscriber's line and central battery. The operation of the ballast is such that on a line of the maximum resistance the resistance of the ballast is 60 ohms. The central-office battery is of sufficient voltage to give a suitable signal under these conditions. On a line of the minimum resistance the iron-wire ballast measures 500 ohms resistance, and hence, absolutely protects the line lamp from overvoltage. The supervisory circuits consist of an ingeniously arranged high-resistance shunt across the cord, and the action is absolutely positive without involving the use of any relays. On account of the great simplicity of the circuits and the extremely low battery consumption, the maintenance expense of the board is said to be below that of other types.

STROMBERG-CARLSON COMPANY'S MAP OF ITS TELEPHONE-EXCHANGE EQUIPMENTS.

The Chicago Telephone Company and the American Telephone and Telegraph Company had a joint working exhibit, which attracted a great deal of attention. In the south end of the space were a number of booths in which Chicago exchange telephone service was given free. The companies also demonstrated (in a booth, in which two telephones were connected) the difference between talking over a line of great distance with and without Professor Pupin's loading coils. The two lines (one loaded and the other unloaded) were connected from Main office to West Pullman, back to Main office and from there to Calumet, a distance of 35 miles, all cable. This gives a very clear and practical demonstration of the difference and shows great improvement in the transmission.

The American Telephone and Telegraph Company had two booths connected direct with its long-distance office, in which it demonstrated long-distance service, giving free conversations to different parts of the country. It also had an operator in attendance and demonstrators explaining the advantages of long-distance telephony and giving away maps showing the many points reached throughout the country by the long-distance telephone. North of the booths were two sections of multiple switchboard at which six operators worked from noon to 11 o'clock at night. The board was actuated by a commutator which lighted 148 subscribers' line lamps every two minutes and a half. These lights burned for one minute, unless the operator plugged in as if she were answering a call. This arrangement was made to more readily demonstrate the methods of operation and not to deceive the public. It would be impossible to give a good demonstration of operating by having the telephones in the building connected on the board and the girls answering the actual calls only.

The above arrangement was worked out very satisfactorily and the people were interested. Mr. Anderson and others acted as service demonstrators, explaining to the visitors the mysteries of telephone operation. The switchboard and talks did much to give a better idea of what an operator has to do to complete a connection, and will be the means of making many subscribers more considerate when using the telephone.

The balance of the space, north of the switch-

board, was furnished handsomely with couches, chairs, palms and plants of different kinds to give a graceful and pleasing effect. Directly north of this telephone exhibit was that of the American Steel and Wire Company, which was connected with the telephone exhibit by a pole line and electrical tower. This tower and pole line were symbolical of the production of metal from the earth, the tower being built of copper and steel, with large strips representing bolts of lightning on the top, conveying the idea of connecting, through the products of the earth and the electricity from the sky, energy which was transmitted over the wires on the poles to the switchboard, which was immediately under the last pole of the line, on which there was a terminal box connecting with the wires and apparently running into the switchboard. This gave a very forcible illustration of what has been accomplished in the art of telephony and other electrical fields by bringing the two elements together, making possible the use of such great conveniences as the telephone, telegraph and electric light.

Wire, Cables and Conduits.

In the spacious booth of the American Steel and Wire Company were exhibited all kinds of cables, including the iron-armored, leaden case, rubber and weather-proof forms, different styles of rail-bonds, comprising the "United States," "Crown," multi-terminal and all types of soldered bonds. Among other things shown were springs of all descriptions, hydraulic tools for rail-bonding, punches, compressors, drilling machines and single and multiple spindle drills for multi-terminal bonds. Trolley wire of all sizes, telegraph wire, music wire, railway fence wire, and concrete reinforcement for building electrical stations, power houses, etc., were features of the exhibit, which was in charge of Mr. George Long of the Chicago office. Others in attendance were Messrs. C. R. Sturdevand of the Worcester office; C. L. Knight, R. W. Van Pelt, B. B. Ayers, A. C. Dumont, Frank Conklin, George Chandler of the Ohio office; O. B. Barrows of St. Louis, and Mr. Doyle.

Electrical conduits were the principal things shown by the H. A. Peterson Manufacturing Company of Harvey, Ill., the object of the conduit being to form a duct or raceway to facilitate the insertion and extraction of the concealed electrical conductors and to protect them from mechanical injury; also to prevent fire caused by the electrical conductors.

The purpose of the American Sewer Pipe Company in establishing a booth at the show was mainly to get in touch with engineers and men connected with underground work. The exhibit consisted of conduits used chiefly by telephone, telegraph and street-car companies. The concern has 36 factories in five states. In charge were J. M. McClave, W. H. Rook and Earl Hawke.

The Clay Products Company of Brazil, Ind., was represented by the Peirce Specialty Company with the exhibit of various sizes and lengths of its vitrified fireclay conduit for use in underground construction. The company was represented by H. H. Fitsworth, president of the company, H. M. Legnard and A. J. Kusel.

The McRoy Clay Works had a comprehensive and interesting exhibit. Manager E. J. Kirkpatrick was in constant attendance during the afternoon and evening and spent much of his time meeting and entertaining his customers. Exhibited in the booth were samples of the McRoy products, but owing to the conduits being so large it was impossible to exhibit more than a few samples. The booth was very prettily decorated and visitors were made thoroughly at home. According to a number of ornamental signs shown, all that was necessary was to "Ask Kirk."

Miscellaneous.

The Vim Company of Chicago exhibited and demonstrated a complete line of electrical apparatus designed for the amusement and instruction of the juvenile electrician. A complete practical telephone that sells for less than half a dollar is one of their latest wonders. Among the interesting demonstrations which were under the direction of L. Eldridge, formerly of Armour Institute, was a miniature dynamo generating 30 candlepower; a complete electric railway in full operation and a complete assortment of flashlights and battery incandescent electric lamps. L. O. Olmsted and W. Tesnow were present at the exhibit.

The Electrical Midway offered amusement for many visitors. Here Professor Clarke's lectures and Anderson's electrical demonstrations were given. Two scenic productions, The Shipwreck and the Aurora Borealis were freely patronized. Ralph Radnor Earle's shadowgraphs were eagerly sought by the visitors, being appropriate souvenirs of the show. The shadowgraph is a reverse silhouette printed on a postal card through the medium of a camera and arc lamp. Mr. Earle was the official photographer of the show, the pictures in this issue, taken for the Western Electrician, being his product. The kicking machine, operated by a "remorse motor" and designed and built by Charles E. Gregory, was also exhibited in the midway.

The Western Electrician's booth, located in section F, space 24, was visited by hundreds of electrical men from all over the country. The booth was tastefully decorated. Illustrations taken from the paper, together with samples of attractive advertisements which have appeared in its pages, were shown. The exhibit attracted the attention of every visitor who passed the booth, and the Western Electrician received many compliments on its showing. Many out-of-town visitors availed themselves of the invitation to make this booth their headquarters.

The Thordarson Electric Manufacturing Company of Chicago made a creditable exhibition at the Show, indicative of the high scientific character of the company's products. On exhibition was a 10-inch Thordarson spark coil, the novel Thordarson slow-speed auto-magneto which attracted much attention, a five-kilowatt high-potential transformer operating at a potential of 60,000 volts, an electric furnace, X-Ray coils and wireless-telegraph transformers, also a fine lot of additional electrical laboratory apparatus. In charge of the booth assisting Mr. Thordarson was Sales Manager J. H. Locke and Secretary and Treasurer J. A. Bennan.

The Swedish Electric Vibrator Company demonstrated its electrical massage vibrator. Many visitors were given relief from various ailments. Mrs. E. Hope was in charge.

Some very convenient diagnostic lamp controllers for physicians and dentists were shown by the M. E. Caven Manufacturing Company of Kansas City. The company also has a practical electric curling iron which operates in series with a 16-candlepower lamp. The exhibit was attended to by Mr. M. E. Caven and F. J. Cowley.

An electric curling-iron heater manufactured by the Rolfe Electric Company Rochester N. Y., designed to be fitted to an ordinary 16-candlepower lamp, was a matter of much interest to the lady visitors. The heater holds heat amounting to 96 per cent. of the current consumed by the 16-candlepower incandescent lamp, so that it can be applied to the iron.

Thomas & Smith of Chicago operated in their exhibit their automatic compressed-air water system, automatic bilge pump and the Economy electric pump. They also exhibit the Economy hot-air engine, triplex and direct-connected centrifugal pump. W. J. Mitchell, sales manager, was present.

[*Continued on page 88.*]

Kellogg Switchboard and Supply Company.
Stromberg-Carlson Telephone Manufacturing Company.
Frank B. Cook.

Vote-Berger Company.
Chicago Telephone Company's Exchange.

Dean Electric Company.
Automatic Electric Company.
Swedish-American Telephone Company.

A GROUP OF TELEPHONE EXHIBITS AT CHICAGO ELECTRICAL SHOW.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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FUNDAMENTALS *are important and always important. It is the fundamental, underlying principles of the art which will be treated in the serial on "Elements of Electrical Engineering," by Mr. George R. Metcalfe, which will be begun in the Western Electrician of February 2, 1907, and run through thirty issues or more. The author is a technical writer of wide experience, and in his series of "practical talks" he purposes to "discuss and explain in as simple language as possible some of the important features of electrical engineering practice, together with descriptions of the construction and design of the machinery and instruments in common use." All beginners, all practical men seeking help, all engineers who want to "brush up" will find this series of real assistance. It will be begun in the issue dated February 2d.*

FEW technical societies, one may be sure, can show such a remarkable record of growth as the Illuminating Engineering Society, which in the first year of its existence has rolled up a membership of 815. Well may the organizer and retiring president, Mr. L. B. Marks, be proud of his work and that of his colleagues. And one can understand, too, the spirit of prudence which induced the new president, Dr. Sharp, to utter a word of warning against over-confidence and over-enthusiasm, which may result in indifference and reaction. But the Illuminating Engineering Society was really and badly needed in the field of artificial lighting, and if judiciously managed—and there is no reason to suppose that it will not be so managed—it may be predicted that the organiation will have a long, prosperous and useful career. Surely there is enough work for the society to do. Our methods of lighting homes, workshops and factories are greatly in need of improvement. The new society has already pointed the way to better things and provided the engineer with some useful helps. Everyone interested in electrical development will wish the Illuminating Engineering Society all possible success.

A BILL has been introduced in the Indiana Legislature which is attracting unusual attention, and the prospect is that it will be enacted into law. The primary object of the measure is to protect from "cut-throat competition" a gas company which is trying to get a foothold in Indianapolis to furnish gas at a rate of 60 cents a thousand feet. The older company now enjoys a monopoly at 90 cents a thousand, and it is apprehended that it may temporarily reduce the price below 60 cents to drive the new company out of existence. At the same time the bill offers similar protection to new or weak telephone companies against the strong ones; to steam railroads against the interurbans, and vice versa. In short, the measure will apply to all corporations operating under public franchises. In effect the bill provides that if a franchise corporation having competition in its home field reduces the price of its commodity, the new figure shall, during the remainder of the life of the franchise, be the franchise price, and the company is prohibited from increasing it. This measure, its author asserts, will prevent rich and powerful corporations from "freezing out" new companies by reducing the price of a commodity and then returning to the old price.

IT IS A SHORT-SIGHTED policy for the steam-railroad companies to antagonize the electric railways, for the public has set the seal of its approval on the clean, healthful, convenient electrics, and these are the days when public opinion is heard, even in railroad circles. Some of the largest of the trunk-line companies have adopted electric power for branch lines or terminals, but so far as business interchange is concerned most of the steam roads still look upon the electric interurbans with a jealous eye. Thus the daily papers report that all the railroads which are members of the Central Passenger Association have entered into an agreement not to exchange business or courtesies with the electric lines. The result of this agreement, it is said, will be an appeal to the Interstate Commerce Commission. The electric lines are reported to be fixing their tariffs with the commission, and are of the opinion that they are common carriers under the law and that the steam roads can be compelled to interchange business. The question came up in the Central Passenger Association because of a report that certain eastern roads are secretly dealing with electric lines. "Some of the passenger men," concludes the account, "believe that it is a foolish policy to try to injure electric roads by boycotting them, recognizing the fact that they have probably come to stay and that the steam roads might as well get what benefit they may out of interchange relations with them." And verily, the railroad men who realize that the electric railway has come to stay are wise in their day and generation.

DESPITE the counter-allurements of the Electrical Show, or perhaps to some extent by reason of them, the Northwestern Electrical Association held a very successful convention last week, although its abiding place was even in the lights, the bustle and the throngs of the electrically transformed Coliseum. Indeed, Mr. Almert, the retiring president, says the convention was the most successful in the history of the association, and he should be a good judge, for he has attended Northwestern conventions for a number of years. The subjects considered—like meter testing, profitable co-operation, single-phase motors, gas engines, steam turbines, waterpower development, modern methods of illumination, sign lighting, accounting, boiler-plant economy and practical problems of operation—were so varied and sensibly handled that no central-station man who attended could fail to be well repaid for the effort of being present. And as a matter of fact, those present enjoyed the benefit of a series of papers and discussions of exceptionally high character and had the Electrical Show thrown in as well. It is to be noted, however, that the association voted to return to its old custom of holding its annual conventions in Milwaukee, although it is to be supposed that most of the visitors at the meeting in the Cream City next January will "take in" the Chicago Electrical Show also.

A year ago the Northwestern Electrical Association seemed to be suffering an eclipse, but under the aggressive yet tactful administration of Mr. Almert, to which Secretary Adams contributed valuable and unselfish help (he refused to take the salary attached to his position—marvel of secretaries!), it has fully regained, apparently, its old prestige. May the new officers carry forward this 15-year-old society of honorable history to still greater things!

THE SECOND annual Electrical Show is closing with another record of entire and gratifying success. This is as it should be, for the exhibition is really representative of the electrical industries, arranged by electrical men and of real value and interest to electrical visitors. Are you interested in new forms of illumination, high-efficiency arc or incandescent lamps, electric cooking and heating, the most advanced form of instruments, recent applications of motor drive, heavier electrical machinery, telephone apparatus, the latest electrical novelties and specialties, new tools, an up-to-date street-railway car, insulating material, construction work, wires, cables and conduits, or, in fact, anything electrical? If so, you can, or could, learn something by attending the Electrical Show.

But the exhibition has a wider scope than that of demonstrating the electrical progress of the year for the benefit of technical men. It is as well a great educational agency for the general public, and to judge from the size, character and interest of the throngs of men, women and children who attended, it also served this purpose admirably. Electricity is familiarized to the layman by these shows as a thing for daily use. To a great extent it is no longer regarded as a thing apart—a something to excite a measure of awe and dread—but is rather looked upon as a useful servant of man. In like manner, ages ago, our progenitors probably gradually lost their fear of fire and adapted it to their own purposes. Like fire, too, electricity is of the greatest value when doing its work within metes and bounds but rather awkward when uncontrolled.

It is when regarded in their broader aspects as popular training schools in familiarity with electricity that the higher value of these shows is recognized. The management of the Chicago Electrical Show is to be congratulated on presenting an exhibition which was dignified and of distinct technical value and yet sufficiently "popular" and attractive to allure the man-in-the-street, who, in the last analysis, is the individual who can get the most out of it.

Northwestern Electrical Association.

In last week's issue of the Western Electrician a brief account was given of the opening day's proceedings of the fifteenth annual convention of the Northwestern Electrical Association, held in the Coliseum, Chicago, during the Electrical Show, on January 16th, 17th and 18th. Following is given the concluding portion of the outline report. Owing to limitations of space, many of the papers and discussions must be reserved for publication in future issues.

On the second day, Thursday, January 17th, Fred W. Insull of the North Shore Electric Company, Chicago, read a valuable and comprehensive paper on "Uniform System of Accounting for Small Companies." The paper was discussed by President Almert of Chicago, Mr. Korst of Janesville, Wis., Mr. Nims of Cedar Falls, Iowa, and the author.

H. H. Scott, engineer for Henry L. Doherty & Co. of New York, read a practical paper on "Some Phases of Management of the Smaller Central Stations." W. B. Jackson of Madison, Wis., Ernst Gonzenbach of Sheboygan, Wis., J. H. Harding of Laporte, Ind., Mr. Allen, O. M. Rau of Milwaukee, Mr. Lord of Waupaca, Wis., the author of the paper, and others took part in the discussion, which was interesting. In the course of it Mr. Scott made this statement:

"I claim that the additional business to the electric-lighting company will tend to reduce your operating cost more than any one thing that you can do. Take the loss in unaccounted-for current, for instance, I had a man come to me from a big central station, and he asked: 'What is your loss in unaccounted-for current?' I said: 'Thirty per cent.' He said: 'That is awful.' I said: 'What is yours?' 'Fifteen per cent.' 'Why,' I said, 'suppose I am selling twice as much current as you are now, what does my loss in unaccounted-for current amount to?'

"It reminds me of an instance where a gas man found the loss in unaccounted-for gas to be 50 per cent. He came to us, complaining, and said: 'I will have to invest a great deal of money in fixing up the distribution to cut out the leakage.' Then Mr. Doherty said to him: 'Why don't you get out and sell a gas stove or two?'"

Homer Honeywell's paper on "Outline Lighting" was read by W. B. Johnson of Madison, Wis., in the absence of the author. Mr. Honeywell is manager of the Lincoln (Neb.) Gas and Electric Light Company, and he gave an encouraging report of the advertising, sign and window lighting in that city. C. A. Parker of Detroit, Mr. F. W. Insull of Chicago, Mr. Almert of Chicago, Mr. Allen, Mr. Lord of Waupaca, and others took part in the discussion.

The next feature was a valuable report on "Recent Developments in Prime Movers," prepared by Harold Almert of Chicago, who took up steam turbines and gas engines. Thomas B. Whitted of St. Louis opened the discussion, and he spoke at some length, advocating the use of the gas engine.

At this point invitations from Mayor Becker and R. B. Watrous of Milwaukee to hold the next convention in that city were read.

At the afternoon session of Thursday C. W. Bergenthal of the Wagner Electric Manufacturing Company, St. Louis, read his paper on "Some Characteristics of Alternating-current Motors." The paper was illustrated by curves and was discussed by Prof. J. W. Shuster of the University of Wisconsin, Mr. Weichsel of St. Louis, Mr. Rau of Milwaukee, and others. The single-phase motor came in for a good deal of attention.

Mr. Watrous of the Citizens' Business League was introduced and asked the association to go "back, back, back to Milwaukee" for its next convention. Milwaukee, he said, is the "Bright Spot" city of America.

Discussion on Illumination.

J. R. Cravath of Chicago read a paper entitled "Some Points on Illuminating Engineering for the Small Central Station." During the reading of his paper Mr. Cravath made this point: "The tungsten lamp, which we all know is coming on the market very soon, seems to be suited for use in a pendant position only. While that difficulty may be overcome later, still, whatever lamp sockets we get in suitable to a pendant now will be suited to the introduction of a tungsten lamp; whereas, if the sockets are placed at an angle, we will have to rip the sockets out and change them over to adapt them to the new lamp, unless it is so perfected that it can be used at an angle."

George Cutter of South Bend, Ind.—an old stand-by of the Northwestern association—opened the discussion. Among other things, he said: "In my own house we have one light in each room under the control of a switch. I prefer the push-button flush switch. The switches are all the same height, and all the same distance from the door jamb, so that when we go into the room when it is not lighted up, pushing the button will turn on the light. These switches being always at the same height and distance from the door jamb, you are not rubbing over the wall decoration to find them, or pawing over your chandelier to find the key socket. You recognize that this cannot be done with gas or any other illuminant, and it will be found that the neighbor's house with these switching facilities and the artistic illumination, which, of course, should be properly constructed on scientific principles (I think illuminating engineering really means the artistic use of the scientific principles in it), will commend the respect of the neighborhood, and of the whole town, more or less."

Following is an abstract of the succeeding discussion:

F. W. Willcox, Harrison, N. J.: Mr. Cutter's remarks prompt a suggestion regarding the number of outlets. In installations already made the greatest difficulty we have met with is in adjusting lamps to the outlets, which are limited in number. We have been too much given to the one-outlet idea, and that is shown by the tendency to utilize some arc combination. We have the electric arc, the Welsbach "arc" and incandescent "arc" or "arc-burst," as it is called, which is all to my mind a mistaken course, but necessary quite frequently because of the limited number of outlets.

One of the greatest advantages in illuminating work is uniformity of lighting. If you can get uniform lighting, you can dispense with intensity to a greater degree than you otherwise could, and the greatest object of completing outlets is to outline your lamp so as to make your lighting uniform.

I urge you to lay out your outlets so as to prepare for general illumination on the ideal basis of uniform effects.

The best example, I believe, of the proper installation of lights, according to the best methods, should be Marshall Field's store. The engineers have taken the precaution to lay out in each panel between the supporting pillars as many as six outlets. So that you can get any combination you want of light, and by that combination you produce an ideal result, which you could not secure under the old method.

Another point that I would like to impress on central-station men, is the importance of having their engineers, their solicitors and employes generally, learn these lighting units so as to become familiar with them. Your solicitors and engineers are today able to tell a man what sized wire is necessary to carry a certain number of lamps, and they ought to be as readily conversant with the terms used in illuminating engineering. For instance, you should get the idea of what a foot-candle is as firmly fixed in your mind as a pound or a foot is. Then, having versed your mind in that knowledge, you can, by practice, experience and tests, soon become proficient in estimating and quickly calculating what amount of energy is required to give you certain illumination values, how many watts per square foot, etc., and you will soon be able to advise your customers as quickly and readily on the illuminating as upon the power proposition. This problem presents no great difficulties, but it has been neglected.

Someone has said there is nothing that central stations supply that is so wastefully used as light. It is certainly true, and that is one detail of your station where you can make greater economies than in any other branch. Many of your managers are busy in pushing for new business and getting additional customers, and are very apt to neglect the old installations, and are jogging along with obsolete and wasteful material that should be in the scrap heap. All those things should be looked into, and you can accomplish a great deal in economic and beneficial results by having your old customers in line and giving them the most up-to-date lighting service.

Take two or three progressive customers, and persuade them to give you an order to put in the best possible installation for them on the most modern lines. Then you can use them as demonstration, showing how much better lighting results can be obtained if the customer will allow you to engineer his installation. Demonstrate to him that you will give him equally inexpensive service with more satisfactory lighting results. You will thus please your customer and secure better results yourself.

The introduction of these high-candlepower lamps with the combination reflectors has furnished a very simple and ready method of solving many engineering lighting problems. It is a very easy matter to lay those lamps out, and the results are very effective.

George Westover, Cadillac, Mich.: How can you educate your solicitors as to how far a candle-power will light? I lighted the Maccabees Hall in our city with 22 lights, which was ample, but they wanted to remodel their hall. The old room was finished in a light wood, but they put a red carpet on the floor, and we had to put in 38 lights, and that room was not lighted as well as before. Light is like water. Light is absorbed by certain objects much as water is absorbed by a sponge.

Mr. Willcox: We will shortly have available what is called a luminometer, which is an instrument weighing four or five pounds, that can be adjusted so as to determine the actual illumination given in any part of a room, the registration being made on a reading scale. Now, you come to a given installation and want to know the illumination, and a few readings with this instrument will show where it is deficient, and you can apply the remedy by so placing your lamps or shading them as to throw the light in the direction where you want it.

Mr. Cravath: To answer Mr. Westover's question a little more specifically, I would say that the difference between a room with very dark walls and one with very light walls may easily be three-fold; that is, it may take three times as much wattage per square foot to light a room with very dark walls as it does a room with very light walls.

Mr. Willcox: I would like to have as many members as can visit Marshall Field's store, and see a practical demonstration of illuminating results on modern lines. The new installation consists of lamps placed directly on the ceiling. You will be struck immediately with the difference in lighting results. Before the new installation was made the clerks complained about headaches, but when the lamps were raised to the ceiling, headaches disappeared. The illumination runs from two to three foot-candles, with a consumption of about one to 1.4 watts per square foot, with the ceiling averaging about 10 feet high. On the lower floor the energy expended averages 2½ watts per square foot, with a value of four to five foot-candles. With figures like that, you will feel perfectly competent to guarantee a customer just what you can do for him under normal conditions, and I would urge the importance of obtaining that data and giving them to the agents for regular use as soon as possible.

Albert Scheible, Chicago: This matter largely rests with the architect, and he usually decides about the coloring that will be used, whereas the central-station man is not consulted at all. One difficulty in making any headway here, with our Illuminating Engineering Society, is, that we get hold of too few of the architects who have that class of work in charge. If, as Mr. Willcox has suggested, you can post your solicitor so that he can talk intelligently on illuminating lines to your customers, ought you not also to let the architect know that you are ready to help him plan the lighting efficiently? If the architect is not taken into account, we will have much the same friction as we did in the old days, when the architects insisted on making all their electrical specifications themselves.

Mr. Oliver, Superior, Wis.: What is the difference between the watts consumed in Marshall Field's new store and in the old?

Mr. Willcox: I think the old chandelier with eight-candlepower lamps consumed 1¼ to 1¾ watts per square foot, the same as the installation of the 125-watt lamps consumes on the second floor of the Wabash Avenue side of the new building. But the illumination results of the old are only one-half the illumination values of the new lamps, and the old lamps are far less uniform in their diffusion of light. They run from a maximum of one-half to three-fourths of the new results, to a minimum of one-fourth, showing great lack of uniformity, and therefore presenting a very bad lighting effect. The new lights consume the same energy, but are twice as uniform and effective.

Concluding Business.

On Friday morning new members were elected as follows: W. N. Alexander, Waseca, Minn.; Bates Advertising Company, New York; P. P. Brueckbauer, Elkhart Lake, Wis.; E. E. Conrad, Victory, Wis.; J. Robert Crouse, Co-operative Electrical Development Association, Cleveland, Ohio; Curtis Advertising Company, Detroit, Mich.; C. J. Davidson, Milwaukee; F. W. Downs, Washburn, Wis.; L. E. Holderman, Fond du Lac, Wis.; S. R. Hubbard, Oconomowoc, Wis.; F. W. Huels, University of Wisconsin, Madison, Wis.; George L. Lorch, Madison, Wis.; F. G. Rodolf, Muscoda, Wis.; W. A. Scoville, Ishpeming, Mich.; W. A. Sherman, Mineral Point, Wis.; Clark E. Smith, Richland Center, Wis.; H. C. Sterling, superintendent municipal plant, New London, Wis.; John B. Tingley, Madison, Wis.

Ernst Gonzenbach of Sheboygan, Wis., delivered an address on "Premiums for Employes," which elicited a good discussion.

After considerable debate it was decided to hold the next annual meeting in Milwaukee next January at the time specified in the by-laws (the third Wednesday in January), irrespective of the Chicago Electrical Show. It was pointed out that many electrical men in the Northwest could arrange to attend both on one trip.

"Tendency in Design of Boiler Plants" was the subject of the paper by A. Bement of Chicago. A discussion of the paper followed, William Bradford of Lincoln, Neb., sending in a written contribution.

On the report of the nominating committee, of which Mr. Lord of Waupaca was chairman, these officers were elected:

President—Edward Daniell, Marinette, Wis.

First vice-president—B. C. Adams, Lincoln, Neb.

Second vice-president—H. F. Pearce, Negaunee, Mich.

Secretary-treasurer—R. U. Kimball, Kenosha, Wis.

Directors—J. S. Allen, Lake Geneva, Wis.; W. P. Putnam, Red Wing, Minn.; George H. Lukes, Evanston, Ill.

Inasmuch as the retiring secretary-treasurer, Mr.

B. C. Adams, had disinterestedly refused to accept the salary attached to his office, it was voted to present him an edition de luxe of the Proceedings of the 1907 meeting as a token of esteem.

After some routine closing business the convention stood adjourned.

Among those present whose names are not previously mentioned were J. Carson, Duluth; J. L. Hecht, Chicago; F. R. Hubbard, Oconomowoc, Wis.; John G. Learned, Evanston, Ill.; W. D. McDonald, Chicago; Charles Retallic, Marquette, Mich.; F. M. Richards, Madison, Wis.; L. L. Tessier, De Pere, Wis.; John B. Tingley, Madison, Wis.; W. B. Voth, Sheboygan, Wis.; C. W. Wiley, Beloit, Wis.; W. F. Collins, Wausau, Wis.; Burton C. Dinius, Zion City, Ill.; C. H. Johnston, Detroit; M. H. Juhl, Ashland, Wis.; E. L. King, Merrill, Wis.; N. Miner, New York; Frank B. Rae, Jr., Newark, N. J.; L. J. Botting, Three Rivers, Mich.; Holmes Ives, Delavan, Wis.; Frank D. Marshall, Delavan, Wis.; John S. Reesman, Highland Park, Ill.; W. H. Winter, Darlington, Wis.; J. E. O'Neill, Chicago.

Chicago Electrical Show.

[*Continued from page 85.*]

Dr. Emil H. Grubbe of Chicago had an interesting exhibit to which only the medical profession was invited. He showed a sample of each of the appliances he has devised for the application of electricity to medicine and surgery. Dr. Grubbe's demonstrations were of an educational nature. A complete office equipment was installed. Assisting Dr. Grubbe were Mrs. Grubbe, Dr. J. R. Clute and C. E. Rohrer, representing the W. Scheidel Coil Company. Jove Senior, the emblem of the Sons of Jove, was exhibited in this booth and attracted much attention.

The Chicago Pneumatic Tool Company exhibited a very complete line of portable electrical tools in operation. These comprised the Duntley electric drills, grinders, blowers and hoists, wound for direct and alternating currents. The company was represented by C. B. Coates, C. E. Severin, C. W. Hayes, B. Rosenheim and N. Aplin.

The Peabody Coal Company, Chicago, showed a number of photographs and diagrams illustrative of various forms of furnaces in which coal is burnt to the best mechanical advantage. The company has recently issued a large book which contains much information concerning the coal industry.

The American Electrical Novelty and Manufacturing Company's exhibit consisted of "Ever Ready" dry batteries, voltmeters and ammeters, bulldog battery connectors, flashlights, portable electric novelties, electric clocks, etc. Of the 5,000,000 batteries said to have been sold by the company last year, nine-tenths went to the ignition trade, the telephone companies also buying many. The company also had a display of decorative lamps. Mr. E. G. Weed was in charge, assisted by Messrs. E. R. Behrend, M. Israel, H. Mandel and R. E. Bain, manager of the Chicago branch.

W. H. Schott, Chicago, had a very handsome booth near the center of the building. Though Mr. Schott did not have any exhibits, many inquiries were received by D. T. Wallace, sales engineer, who explained to visitors the merits of the Schott system of central-station heating for light and power plants.

The line of clocks shown by the American Clock Company, Chicago, was very complete. It included a number of automatic self-winding electric clocks. The operation of the company's synchronizing system demonstrated the practicability of synchronizing clocks over telephone wires. More than ordinary interest was manifested by all who saw an electric time stamp which dates papers to the minute if so desired. Representing the company were H. O. Jackson, E. A. Eves, G. T. Randall, Robert Dick, P. J. Hertz and G. A. Kellenberger.

Not the least attractive of the various exhibits was a new 160-horsepower car shown by the Chicago City Railway Company and built in Philadelphia. A new system of ventilation for winter use is one of the chief features, the vents being at the ends of the car and of such a character that drafts are obviated. The car is fitted with 20 electric heaters, 27 electric lights, of which 20 are 16 and the others 32 candlepower. Each seat is equipped with its own heater and call bell. The car which cost $6,800, weighs 26 tons. The wheels weigh 500 pounds each, and when in motion are comparatively noiseless, being of rolled pressed nickel steel.

The Joseph Dixon Crucible Company, Jersey City, N. J., showed a fine line of crucibles as well as a complete line of resistance rods of all sizes and resistances. Its graphite motor brushes are self-lubricating and are noted for their long life, another feature being that their losses from friction on the commutator are less than with carbon brushes. The concave and convex mirrors in the booth evoked much laughter from all who looked into them.

The Western Insulation Company, which had an exhibit in the north end of the building, is a new concern, having been in the field since last October only. Its specialty is insulating products. The company represents among others the Chicago Mica Company, the Mica Manufacturing Company, the American Conduit Manufacturing Company and the Consumers' Rubber Company. The booth was in charge of F. T. Finney, manager, with S. H. Finney as assistant.

The booth of W. J. Burns, Chicago, was particularly attractive to visitors young in years, who worked hard attempting to pull a piece of steel from a Remy magnet. Another feature of the Burns display was the imported carbon, granular and in disk form, for telephone transmitters. Mr. Burns imports a variety of material used in the construction of telephones, switchboard and electrical instruments.

Samples of metal plates were shown by the Electrochemical Engraving Company of Brooklyn, N. Y. A. H. Cassidy, the Chicago representative, was in charge of the exhibit. The company which has, it is said, the largest and finest factory of its kind in the United States, supplies consumers of name plates, including prominent electrical houses.

The Shelton vibrator, shown by the Shelton Electric Company, Chicago, attracted unusual attention as daily demonstrations were given of the therapeutic use of this instrument. The device weighs but three pounds and can be regulated while in motion from a mere tremor to a half-inch stroke. Besides displaying this instrument the Shelton Electric Company also displayed the new Shelton junior vibrator, which is designed for home use and massage parlors. Vibratory treatments were given by Drs. J. M. Peacock, A. A. Grimes, A. J. Crowley and B. B. Willis.

A big U bend of 12-inch pipe formed an arched gateway to the interesting exhibit of the Crane Company. Once under this novel entrance the visitor had an opportunity to examine at leisure many interesting examples of pipe, valve and fitting work. Among the special features were an eight-inch electrically operated gate valve, a 24-inch hydraulically operated gate valve with electric-controlling device and complete lines of steam and oil separators and welded joints. Considering the heavy character of many of the units of this exhibit the arrangement reflects much credit upon Mr. J. A. Minwegen of the company's engineering department and his assistants. Mr. Minwegen was assisted by Mr. John Collier.

At the booth of Erwin & Co., Chicago, was shown a portable, self-contained, prismatic, electric fountain, placed upon a table, and while the fountain was sending forth its perfumed waters the prismatic shade continually rotated under the falling jets of water. The device is intended to keep the air fresh, cool and perfumed. An automatic electric pumping device that makes the use of a roof tank unnecessary was also shown. It is already installed in many of the city schools, hotels, office buildings and scores of flat buildings. H. O. Erwin was present to receive callers.

The American Vibrator Company of St. Louis, Mo., was represented by Messrs. W. H. Gibson and F. S. Temple, who declare that their vibrator is the lightest and strongest one on the market. The Western Electric Company is the manufacturer.

Thompson & Read, Chicago, exhibited a new idea in an adjustable fixture which created not a little interest among practical men. T. J. W. Vanwart of Newfoundland, representing the Reid Newfoundland Electric Company, was a caller at this booth. The fixture is simple in construction, being without screws or friction joints, and is adapted to ceilings of any height.

Some Visitors' Names.

It is of course impracticable to give a list of the names of the thousands of electrical visitors at the exhibition. The names of some of these were given last week; a large number are mentioned as those of attendants in the descriptions of the various exhibits given in this issue, while still others are printed with the report of the convention of the Northwestern Electrical Association on this page. In addition the following partial list is given. It is made up mainly of such callers at the Western Electrician booth who heeded a request to leave their cards.

California—Fred J. Travis, electrical contractor, San Francisco.

Canada—C. H. Abbott, Northwest Electric Co., Calgary, Alberta; Frank E. Norton, Norton System Telephone Co., Toronto; Charles S. Shipman, Shipman Electrical Supply Co., Winnipeg.

Chicago—Glenn Allen; George S. Berger, National Battery Depot; Robert Blaske; A. D. Blocker, Electric City; William E. Bock; R. A. Brenke; B. D. Buell, Chicago Edison Co.; W. S. Burgess, Imperial Brass Manufacturing Co.; Errett L. Callahan, General Electric Co.; Frank A. Chapman, Nernst Lamp Co.; H. G. Cleaveland; E. R. Corwin, Corwin Telephone Manufacturing Co.; George E. Darche, Darche Electric Clock Co.; F. L. Davis; Alfred L. Eustice; Herman Flechsig; J. W. Forster; Edward H. Fox, Phœnix Glass Co.; W. M. Gordon, Chicago & Alton Railway; Charles E. Gregory, Guarantee Electric Co.; W. J. Guntz, Nernst Lamp Co.; J. E. Haschke; Paul Herbst, Mathias Klein & Sons; C. F. Hinman, The W. R. Garton Co.; J. P. Johnston, Johnston & Co.; Herbert E. Kerber, Crocker-Wheeler Co.; Frank E. Kerr, Pullman Co.; Wm. Laird; Frank S. Lampert; A. F. Leetz; C. O. Lindstrom, Lindstrom-Smith Co.; H. Lochner, Globe Electric Co.; C. T. McDonald, Chicago Fuse Wire and Manufacturing Co.; P. F. O'Donnell, The Gould Co.; C. E. Pavey; E. R. Pennell; Robert K. Preston, American Mica Co.; Charles Rabun; George Risberg; M. J. Rowan; William M. Searles; A. J. Seifert; H. Stratford, General Telephone Equipment Co.; J. H. Struve; Arthur G. Vestal, The Scientific Shop; J. S. Werremeyer; Alfred White; Charles Wilkens; S. W. Winetraub; Prof. P. B. Woodworth, Lewis Institute.

Colorado—R. Cadwell, Boulder.

England—Walter F. Burgess, London.

Georgia—C. W. Fussell, Atlanta.

Illinois—F. W. White, Aurora; Wm. B. Mathews, Austin; J. F. Rhodes, Austin; Harry A. Havens, Cullom; J. C. Adams, John H. Barnes and L. B. Greenwalt, Tanner Electric Co., Danville; J. W. Kidd, Fisher; J. E. McMeen, The McMeen Electric Co., Galesburg; E. C. Dickinson, Burgess-Norton Manufacturing Co., Geneva; W. H. James, Harvey; H. H. Bristol, Hinsdale; John B. Hess, Hinsdale; G. A. Sieber, Jacksonville; George Bohnstengel, Economy Light and Power Co., Joliet; C. Frank Miles, Joliet; B. O. Bourgeois, La Grange; Albion Viall, Manteno; S. J. Hammerquist, The Electric Construction Co., Moline; Harry E. Hastings, Moline; F. B. Handwerk, Morris; Theodore Trecke, Odell; E. C. Peterson, Sandwich; Frank Graves, Rockton; Clarence A. Gouty, Springfield; Roy Ray, Virginia Electric Light Co., Virginia; C. W. Dennis, North Shore Electric Co., Waukegan.

Indiana—C. M. Poor, Clinton Electric Light and Power Co., Clinton; R. R. Scott, Farmers Mutual Telephone Co., Columbia City; James R. Thomas, Crawfordsville; E. Kuhlman, Kuhlman Electric Co., Elkhart; Leo Sieffert, Evansville; J. Austin McGowan, United States Metals Refining Co., Grasselli; R. S. Watena, Hammond; E. C. Brown, Electric Appliance Co., Indianapolis; J. D. Harris, Peoples Light and Heat Co., Indianapolis; E. P. Shafer, Stromberg-Carlson Telephone Manufacturing Co., Indianapolis; William Hornberger, Lafayette Electric Manufacturing Co., Lafayette; William H. Sinks, Duncan Electric Manufacturing Co., Lafayette; S. P. Wolever, Wolever Electric Co., Lafayette; William Fraser, Logansport; George H. Coxen, Peru Electric Manufacturing Co., Peru; Charles G. Burton, Peru Electric Manufacturing Co., Peru; Ivan J. Carson, Rensselaer; F. E. Champaigne, South Bend; John L. Putnam, Central Union Telephone Co., South Bend.

Iowa—E. C. Hunt, Belle Plaine Electric Light Co., Belle Plaine; Harry Ritter, Burlington; P. B. Sawyer, Des Moines Edison Light Co., Des Moines; Frank S. Wiemeyer, Ft. Wayne Electric Works, Des Moines; L. D. Mathes, Union Electric Co., Dubuque; C. J. Fulton, Fairfield; M. A. Harrison, Nevada Electric Co., Nevada; Gilbert J. Johnson, New London Electric Light Plant, New London.

Kansas—J. W. Cabel, Water, Light and Gas Company, Hutchinson; J. A. Richards, Wichita.

Massachusetts—Kurt R. Sternberg, Dickinson Manufacturing Co., Springfield.

Michigan—Tom Kenske, Alpena; A. J. Dunn, Citizens Light Co., Battle Creek; Frank Weaver, Charlotte; Sam W. Menefee, Stromberg-Carlson Telephone Manufacturing Co., Detroit; Charles A. Parker, Curtis Advertising Co., Detroit; D. E. Connine, Dowagiac; H. A. Chase, Hart Municipal Electric Light and Waterworks, Hart; A. M. Dailey, Lansing; James Madison Hopt, Muskegon; A. O. Derby, Sturgis.

Minnesota—Samuel E. Holmes, St. Cloud; August A. Monson, Monson Automatic Telephone Co., St. Paul; J. M. Anderson, Monson Automatic Telephone Co., St. Paul; J. I. Bennett, Sleepy Eye Milling Co., Sleepy Eye.

Missouri—H. S. Janes, Bluff City Telephone Co., Hannibal; M. E. Caven, Kansas City; John G. Boyd, The Columbia Incandescent Lamp Co., St. Louis; W. N. Matthews, W. N. Matthews & Bro., St. Louis.

New Jersey—Frank B. Rae, Jr., The C. W. Lee Co., Newark, N. J.

New York—Morris W. Sheldon, United Indurated Fibre Co., Lockport; M. Lobenthal, The Economical Electric Lamp Co., New York city; A. P. Munning, Cutler-Hammer Manufacturing Co., New York city; H. N. Powers, Gould Storage Battery Co., New York city.

Ohio—Jay W. Stanley, Alliance; E. T. Kulas, The Brilliant Electric Co., Cleveland; L. P. Sawyer, Buckeye Electric Co., Cleveland; B. G. Tremaine, National Electric Lamp Association, Cleveland; J. A. Gauthier, The Sterling Electric Motor Co., Dayton; T. H. Golding, Dayton Lighting Co., Dayton; H. Alexander Hibbard, The Globe Engineering Co., Dayton; H. H. Wollaston, The Charles Q. Tyson Co., Dayton; W. P. Engel, P. G. & E. Co., Defiance; R. C. Henderson, The Manchester Telephone Co., Manchester; A. E. Hawkins & Co., Springfield.

Wisconsin—L. A. Briggs, Beloit; Holmes Ives, Delavan Light and Fuel Co., Delavan; F. D. Marshall, Delavan Light and Power Co., Delavan; F. L. Pearce, Edgerton; W. T. Pomeroy, Edgerton Electric Light Co., Edgerton; E. S. Cary, Evansville; Ernest B. Korst, Janesville Electric Co., Janesville; Howard A. Baker, Chicago-Kenosha Hosiery Co., Kenosha; Edw. S. Lamb, Kenosha; Otto Kney, Northern Electrical Manufacturing Co., Madison; Fred Ellingson, Menomonee Falls; Frank H. Petrie, Mechanical Appliance Co., Milwaukee; Maurice E. Northrop, Wells Building Co., Milwaukee; F. W. Van Ness, Mechanical Appliance Co., Milwaukee; J. W. M. Burton, North Fond du Lac; F. R. Hubbard, Oconomowoc; C. D. Leck, The Wisconsin Chair Co., Port Washington; William B. Voth, Sheboygan Light, Power and Railway Co., Sheboygan.

The New Helion Lamp.

Prof. H. C. Parker of Columbia University, New York, working with W. G. Clark, has invented a new incandescent lamp which he hopes will revolutionize electric lighting. He says that it has 45 times the efficiency of the ordinary lamp with carbon filament. The particular feature about the new lamp is the new filament, which Professor Parker calls helion, because its spectrum is similar to helium. It looks much like the filament in an ordinary light. Another claim for the new filament is that its life is nearly twice that of a carbon filament. In the tests made the lamps have burned steadily from 485 to 1,270 hours, with an average of 1,000 hours.

At a current density that will give only a dull red color to the carbon filament the new lamp burns with a bright white light, which increases in intensity as the current is increased. When the ordinary current is running the illuminating intensity is said to be four times that of a carbon lamp, while there is much lower consumption of current per candlepower. The lamp has the further advantage that it will carry a large overload without breaking.

The adaptation of the metal tungsten to lamp filaments is of quite recent date and undoubtedly marks a valuable improvement in the art of producing light from the electric current. Now Professor Parker has apparently gone several times better, and it may be that between tungsten and helion, or still newer forms, the familiar carbon filament has about reached the limit of its usefulness.

Annual Meeting of the Illuminating Engineering Society.

The annual meeting of the Illuminating Engineering Society was held in the rooms of the Electrical Club, New York city, on the evening of January 14, 1907. The business session was preceded by a dinner, participated in by all the gentlemen present at the meeting.

President L. B. Marks called the business session to order at 8:15 o'clock and announced the first business to be the report of the secretary.

Mr. Percy S. Millar read the report of the secretary, which outlined the organization and growth of the society.

The report of the treasurer was presented by the treasurer, V. R. Lansingh, and showed receipts during the year of $4,030, with expenses of $3,590, leaving a balance of $440.

The report of the finance committee, in the absence of Mr. W. D. Weaver, the chairman of the committee, was read by Mr. W. R. Boyd. This report detailed the expenses of the society month by month and also included a summary of expenses under the various headings.

A communication was read from Mr. Thomas A. Edison regretting his absence from the meeting and stating that he would be pleased to become a member of the society.

The president then read his annual address.

President Marks' Annual Address (in Abstract).

In reviewing our progress it may not be amiss to pause for a moment and consider the conditions that prevailed from an engineering standpoint in the science of illumination before the organization of this society. I think it will be generally admitted that while questions concerning the generation and distribution of electric current and of gas for lighting purposes received most careful attention, the problem of obtaining the best illuminating result from the electricity or gas produced was neglected. The wasteful methods that have prevailed in the distribution of illumination need no comment by me. The injury that has been wrought on our eyesight by improper lighting layouts is a matter of common knowledge.

The society in endeavoring to place the art on a new basis has collected and placed on record much available information relating to this field of engineering. It has brought together to discuss these questions electrical engineers, gas engineers, architects, designers of globes, reflectors and fixtures, oculists, chemists, physicists, manufacturers of and dealers in lighting apparatus, appliances and material—in fact, representatives of almost every field of endeavor in which the question of illumination plays a part. By the co-operation of these various interests a start has been made in the collection and publication in the Transactions of invaluable papers, discussions and data which would otherwise be widely scattered and little accessible, and advances in the art have been inaugurated that would otherwise be practically impossible.

The society has published and spread broadcast papers and discussions on illumination by electric light and by gas. Both indoor and outdoor illumination have been treated. We have heard the point of view of the architect and have considered the physiological side of the question. For the first time probably in history a meeting was held at the instance of this society between oculists and illuminating engineers for the purpose of discussing questions of artificial illumination.

We have studied what type of lamp, what size of light unit, what location and character of fixture and what kind of globe, shade or reflector is best suited to meet the demands of individual conditions in lighting.

We have noted that in the course of the year many old installations of gas and electric-light fixtures have been modernized, and that in many of the new installations the design and the equipment has been vastly improved from an illuminating standpoint. Central stations are now giving more attention to this subject than before, and in some cases are employing specialists to take charge of this important end of their work. Even the architect, who for years has held out firmly against the engineering side of illumination, is gradually succumbing to this wave of progress.

Perhaps one of the most important points that has been dwelt upon by the society in its papers and discussions is the urgent need of reducing the intrinsic brightness of light sources, and particularly of such sources as are necessarily within the ordinary field of vision. Happily we have tangible evidence of improvements in this regard made during the past year.

I had hoped by this time to have had the data showing the results of the investigation of Mr. J. E. Woodwell regarding the lighting of postoffices in the country. We have the records of one of the postoffices in which 12 of the force are now able to get along very well without their eyeglasses, whereas up to about six months ago they were compelled to wear them. The change is due to the improvements brought about by modern illuminating engineering. As a matter of fact, the change has been due very largely to removing the bright sources of light from the ordinary field of vision.

The general acceptance of definite nomenclature and standards will be of immense service in furthering the systematization of illuminating engineering. At the present time our terminology is at best crude, and very often we are unable to avail ourselves of the benefits of valuable work done by others, because the terms used in published reports of such work are open to misinterpretation. To secure uniformity the co-operation of the members of the lighting fraternity not only of this country but of foreign countries is necessary. Much has already been done by committees to bring about the standardization desired.

I have pleasure in announcing this evening the appointment of the following international committee of the society:

Committee on Nomenclature and Standards (Members of the Illuminating Engineering Society).—Dr. Alexander C. Humphreys, chairman, Stevens Institute, Hoboken, N. J.; Dr. Louis Bell, Boston, Mass.; Prof. Blondel, Paris, France; Dr. Hans Bunte, Technische Hochschule, Carlsruhe, Germany; Mr. John W. Howell, Harrison, N. J.; Dr. E. P. Hyde, Bureau of Standards, Washington, D. C.; Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.; Prof. Vivian B. Lewes, Royal Naval College, Greenwich, England; Dr. Edward L. Nichols, Cornell University, Ithaca, N. Y.; Dr. F. Schniewind, New York city; Dr. C. H. Sharp, New York city; Mr. W. D. Weaver, New York city; Mr. J. E. Woodwell, secretary, Washington, D. C.

At the date of writing the total membership of the society is 815. Twenty applications for membership have been received but have not yet been acted upon by the council.

[There are 252 members in New York, 239 in Pennsylvania, 81 in Massachusetts, 80 in Illinois, 37 in New Jersey, 33 in foreign countries and 21 in Ohio. The remainder are scattered throughout the United States.]

In order to distribute as equitably as possible the benefits and privileges of membership in the society the council authorized the organization of sections in any city or locality in which the local membership is 50 or more.

A section was organized in Boston almost immediately after the first regular meeting of the society in New York. Then followed the organization of sections in Chicago, Philadelphia and Pittsburg, respectively. Subsequently the membership in New York and vicinity was organized as a separate section, so that we now have five sections of the society, all conducted on the same general plan and all receiving practically the same benefits of membership in the society. Papers that are accepted for presentation before the society are submitted to all of the sections for reading and discussion. The papers, together with the discussion thereon at the various sections, are printed in the following number of the Transactions of the society and distributed to the membership at large.

While each section is an independent unit having its own by-laws, board of managers and committees for conducting the local work, the regulation of the conduct of the sections is intrusted to the general council of the society. And this must necessarily be so in a national organization such as ours. Co-operation between the different sections is absolutely essential for the welfare and for the life of the society. It is the purpose of the federal organization to vouchsafe for the society through the medium of its general officers and council the full benefits which can be derived only by such co-operation.

Since the organization of the society the New York section has had nine meetings; the New England section seven; the Chicago section four, and the Pittsburg section three. The total attendance at New York for the year was about 675, the minimum 40, the maximum 200, and the average about 75. No figures are at hand for the attendance at the other sections, but from reports received the interest manifested in the meetings has been marked.

With the changed conditions that have been brought about by the formation of sections since the date of organization of the society the present constitution is wholly inadequate for the proper government of the society. When the present constitution was drawn up we had a strictly local organization. Today we have a federal organization with local sections. The underlying idea of the new constitution is to keep the federal organization intact. To accomplish this purpose the constitution provides for the general government of the sections and clearly defines the relation of the local sections of the federal body.

The council has authorized the lease of an office in the Engineering Societies' Building, New York city, for the general headquarters of the society. This office will be opened within a few days, with Miss E. Westervelt, the assistant secretary, in charge.

It is my sad duty to report the death on November 21, 1906, of Mr. Alexander MacAndrew, who was a member of this society. For the last six years he was connected with the lamp works of the General Electric Company at Harrison, N. J.

In conclusion I wish to thank the officers and council of the society and of the sections for the valuable assistance given to me in the work of the year. The manifold duties of the society have in a large measure been intrusted to committees, the membership of some of which has found no place in the publications of the society. To the members of these committees I would extend my thanks, and in particular to Mr. W. D. Weaver, who, as chairman of three committees, has indeed borne a heavy burden. The work of the treasurer has extended far beyond the financial side of his position and merits special recognition, as does likewise that of Dr. Sharp, the chairman of the committee on papers. I looked to Dr. Elliott and Mr. Brown of the council for advice with regard to the gas interests, and take this opportunity of thanking them for their valuable assistance.

On behalf of the society I desire to tender thanks to the New York Edison Company for the use of its auditorium for a meeting room for the monthly meetings of the New York section and to the Consolidated Gas Company for the use of quarters in its building for the office of secretary. Our thanks are also due to the Electrical Club for its courtesy in placing its rooms at our disposal for the dinner and meeting of this evening.

To the technical press we are indebted for valuable co-operation and for the wide publicity given to our proceedings.

The new administration which is to be inaugurated this evening will have upon its shoulders a task by no means light. The past year has witnessed only the beginning of the movement to give to illuminating engineering a recognized status. The real work of placing the art of illumination on a new basis and systematizing the practice of illuminating engineering is yet to be done and will require years to accomplish. To bring about the desired results, cordial co-operation between the sections of this society is a prerequisite. With the close relation between the general council of the society and governing body of the local sections, as contemplated by the new constitution, nothing should stand in the way of such co-operation.

General Business.

With Vice-president A. A. Pope in the chair, V. R. Lansingh moved a hearty vote of thanks to Mr. Marks, the retiring president. This motion was carried unanimously. P. H. Barnard spoke of the work of the Philadelphia section, which held four meetings during the year. Mr. Lansingh said that there was prospect of a section in San Francisco.

Officers Elected.

Tellers consisting of H. R. Nelson, H. W. Terry and Ralph W. Pope reported the election of these officers:

President—Dr. Clayton H. Sharp, New York.

Vice-president—Dr. Louis Bell, Boston.

Managers—E. L. Elliott, New York; J. E. Woodwell, Washington, D. C.

Secretary—V. R. Lansingh, New York.

Treasurer—Dr. A. H. Elliott, New York.

There were 144 votes for the proposed constitution and 23 votes aaginst it.

In a brief speech, Dr. Sharp, the new president, said: "We have had a surprising degree of success in the first year of our existence—a most remarkable degree of success. If the ardor and enthusiasm which have been manifested during the year which has passed can be sustained during the year that is to come the success of the society for many years, I think, will be assured. If, under the new constitution which has just been adopted, and which represents in many respects a very radical change in the methods of conducting the work of the society, we can get the proper co-operation between the various local sections we will make this thing go; otherwise it will lapse, and it will be unfortunate if it does so. There is no doubt we are working on a very live subject, and the field which lies before us to go over is large and important. It would be a great pity, if this society, having had the splendid start which it has had, should not continue to flourish and increase in membership and usefulness; but this is largely a matter of our getting together, all pulling together and trying to make it a success.

"The meeting of the board of nominations, which is provided for under the new constitution, will be held very soon for the selection and election of additional officers, particularly the offices of vice-presidents, which are provided for in the new constitution. You must elect three vice-presidents of the society, and you must also elect three additional directors. The by-laws, which are provided for under the new constitution, will come up for discussion and probable adoption before the council at its next meeting."

A bill has been introduced in Congress to give to the Los Angeles Interurban Railway Company the right-of-way for the construction of an electric railroad over the United States military reservation at San Pedro, Cal., on terms which would be determined by the secretary of war.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER VI. (*Concluded*).

Aerial Conductors.

An important detail of the transmitting apparatus is the circuit-breaking key in the primary circuit of the transformer, and this key, to give satisfactory results, should have heavy platinum anvils, which latter should be kept so trimmed that contact is made over the entire surface, and not from a few uneven projections.

The question is frequently asked why wooden poles are used in preference to iron ones in the

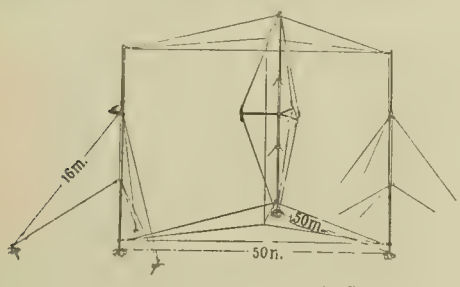


FIG. 49. PORTABLE AERIAL SYSTEM.

construction of aerial masts and towers. The fact that the destruction, by storm or otherwise, of the aerial plant would render an important installation inoperative for weeks makes it very important that the aerial supports be constructed of the stoutest permissible material. Doubtless, iron or steel towers would withstand greater wind strain, would offer greater resistance to wilful destruction, and would deteriorate less rapidly. But there is to be considered the transparency or opacity of the structure to Hertz waves.

The radiating and intercepting conductors are within the space formed by towers or masts in relation to the radiation from certain directions. The employment of metal columns interposes an obstacle both to the outgoing and the passing waves, so much so that reflection and refraction produce interference which seriously interferes with satisfactory operation. Were it possible thoroughly to insulate the aerial wire supports from the earth this objection would not exist, for then the entire structure could be used electrically.

Fig. 49 shows a view of a portable aerial system recently constructed for use in German Army maneuvers. The equipment consists of three masts,

FIG. 50. MAST AND ANTENNAE (DE FOREST).

each 10 meters long when extended and 3.8 meters in length when telescoped. Each of the three masts is fitted with iron plates and is supported by six steel cables connected with hooks fastened into the ground in the manner shown. The conducting aerial is made up of a cable consisting of eight copper wires, tinned, four millimeters in diameter. The insulators used are glass.

Fig. 50 shows a neat arrangement of aerial used by Dr. De Forest in his experiments between Ireland and England in 1904.

Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

In army maneuvers, where the transportation of heavy equipment is undesirable, it has been customary to use kites or small balloons in place of masts for the support of aerial wires. When there is even a slight breeze blowing, the Blue Hill box kite (Fig. 51) has been found to serve the purpose admirably. On account of its lightness, aluminum wire is generally used for the conductor when the means of elevation is the kite method. During the summer of 1906, at Washington, D. C., some long-distance wireless experiments were made, using Dr. Alexander Graham Bell's tetrahedral kites. The kite used was a large one, having 230 cells. It was sent up 2,000 feet in the air, the antenna used being a steel wire 400 feet long.

Major George O. Squier of the United States Signal Corps has recently shown that living trees may be utilized as aerial conductors for wireless signaling over short distances. Fig. 52 shows the connections. (N) represents a common nail driven

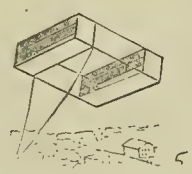


FIG. 51. BOX KITE FOR SUPPORTING AERIAL.

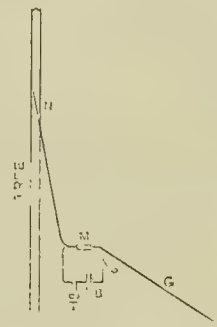


FIG. 52. CONNECTIONS FOR A LIVING-TREE AERIAL.

into the tree near its top; (M) is the wave detector, (S) switch and (G) ground connection. That trees may be used in this manner will be of great service for temporary uses in wooded localities.

CHAPTER VII.

Syntonic Wireless Telegraphy and Directed Waves.

The fact that electric waves are radiated from the aerial conductor in all directions suggested to Mr. Marconi early in his work that some

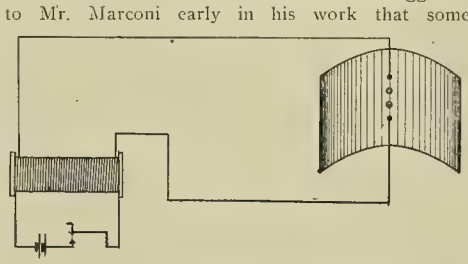


FIG. 53. PARABOLIC REFLECTOR OF MARCONI.

means should be employed to concentrate the energy so that the waves could be directed to any desired point instead of being dissipated in all directions. With this end in view he constructed reflectors of parabolic form. Fig. 53 shows the arrangement of the apparatus employed for this purpose. While these reflectors gave fairly satisfactory results over short courses, they added very little to long-distance possibilities.

The fact that electric waves may be generated and propagated long distances over the surface of the earth and that these waves can be arrested at any desired point is all very wonderful, but wonderful things in order to be of service to mankind must be applicable to existing requirements. Wire telegraphy has been in operation throughout the civilized world during the last 60 years, and during this time those responsible for the efficiency of the service have had ample time to set certain standards. Before wireless telegraphy can hope to compete in the same field with older and well-established methods it must needs be in a sufficiently perfect state to render equally reliable service; to take care of an unlimited volume of telegraphic traffic with equal or more rapid dispatch than is possible with wire methods. This is notwithstanding the fact that wireless operation would be at a reduced cost and that the public would be given the benefit of the reduced operating expenses. We have become accustomed to a certain standard of efficiency, and the utility of the telegraph is directly connected with the machinery of commerce so that the adoption of a cheaper if less efficient service would be a step backward and would be demoralizing to social and commercial progress.

The Marconi parabolic reflectors referred to above constituted the first attempt at selective signaling, but there were grave objections to the use of devices of this construction, for while the rays were by this means directed in any desired direction it was found that the greater the energy em-

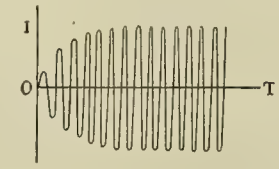


FIG. 54. VIBRATIONS IN TRANSMITTING SYSTEM.

ployed at the transmitter and the longer the wave length used, the larger the reflector had to be, so that for long-distance working the reflectors would be of such huge proportions as to be impracticable.

For the purpose of clearing our minds regarding the necessity of tuning in wireless telegraphy, let us consider the circumstances of four persons located in a room in this position:

A may converse with B without interfering with the conversation being carried on by C and D, but should A undertake to hold a conversation with D, and B at the same time commence a conversation with C, there would be a confusion of sounds and the conversations could be carried on only with the greatest difficulty. In other words, there would be interference of the waves of sound.

Should the four persons in the room undertake to overcome the difficulty by using reflectors in the form of speaking trumpets, the interference

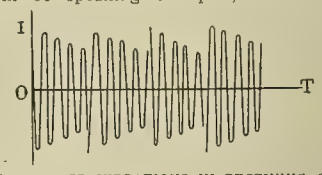


FIG. 55. INDUCED VIBRATIONS IN RECEIVING CIRCUIT.

would not be eliminated. This is the case of parabolic reflectors in electric-wave propagation, for while the waves may be sent in a certain direction and directed to a certain point, say 100 miles distant from the transmitter, the signals could be tapped at any point within the hundred miles or beyond, provided the person doing the tapping had his receiving instrument in a direct line with the two stations conducting the communication.

In wireless operation an untuned or open system is one in which the transmitter is so adjusted in regard to its electrostatic capacity that the oscillations die out very rapidly. A tuned system is one in which the natural oscillations of the aerial conductor are the same as those of the receiving aerial system, so that the oscillations of the latter may be strengthened before they die out by rapidly succeeding impulses sent out by the former. If sending and receiving aerials are properly adjusted with regard to each other, theoretically the receiver will not respond to waves of some other frequency, and the sender will not

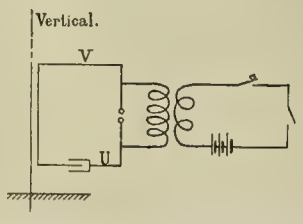


FIG. 56. OSCILLATIONS INDUCED IN VERTICAL WIRE.

cause a receiver of different attunement to respond.

In order that we may have an accurately tuned sending system it must be so arranged that the oscillations be persistent and the alternations of the wave-generating current must be sharp and rapid so that the trains of waves will succeed each other promptly. Fig. 54 represents the vibrations in the transmitting system, the waves being sent out having regular frequency. It may be seen that before an oscillation dies out another impulse is given and that the train of waves succeed each other rapidly.

Fig. 55 represents the vibrations induced in the receiving circuit. It shows the cumulative effect of all the separate waves which build up the oscillations in the receiving circuit until they finally break down the resistance of the coherer and the signal is reproduced.

If, close to the rectangle (V) (U), Fig. 56, a vertical wire be placed, as shown, the oscillations of that transmitting system would be induced in the vertical wire.

We may also, as in Fig. 57, introduce a transformer coil having the terminals of its secondary circuit (S) connected into the vertical wire and

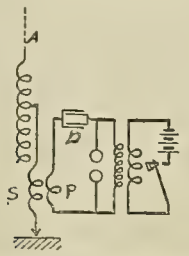


FIG. 57. TRANSFORMER IN TRANSMISSION CIRCUIT.

its primary circuit (P) in the condenser circuit. In order to tune a transmitter so arranged the oscillations in the vertical wire (S) must harmonize with the oscillations in the condenser circuit (P) (D).

In order to accomplish this, Mr. Marconi connected into the vertical wire (S) an adjustable inductance and an adjustable condenser, as shown in Fig. 58. It is evident that these two circuits may be tuned to harmony by properly adjusting

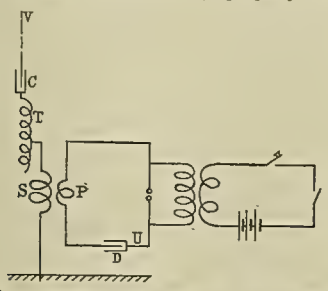


FIG. 58. ADJUSTABLE INDUCTANCE AND CONDENSER.

the capacity (D) and (C) and by altering the inductance (T).

Fig. 59 gives a diagram of a tuned receiving circuit. The aerial (V) is connected through an adjustable condenser (C) to a variable inductance (T), thence to the primary of a transformer coil (P), the other terminal of the primary being grounded. The secondary terminals (S) (S) are connected to the terminals of the coherer which is in parallel with the adjustable condenser (D). The terminals (a) (b) of the secondary coil may include any required inductance or capacity. This

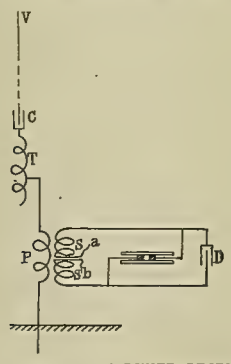


FIG. 59. DIAGRAM OF TUNED RECEIVING CIRCUIT.

arrangement of receiving circuits theoretically fulfills the requirements of a persistent oscillator and is capable of having its attunement altered at will.

If the action taking place around an aerial conductor were visible, one could see the magnetic lines in circles around the conductor, decreasing in number toward the top, and the lines of force along which flow the displacement currents would be seen to be parallel to the conductor. Moreover, we would observe that the line at right angles to these two lines at the point of intersection is perpendicular to the conductor and parallel to the earth, which latter is the direction of wave propagation. The effective radiation depends upon the value of the product of the two forces. In order that the maximum radiation be obtained, it is essential that we have the maximum amount of forces at right angles.

Resonance may be obtained by selecting a proper length of aerial conductor which harmonizes in electrical dimension with the transmitter and spark-gap used, or in other words resonance is accomplished when the spark frequency accords with the natural oscillation period of the aerial wire employed. A mechanical analogy would be that of a steel rod eight or 10 feet long with one end tightly clamped in a vise. If we strike the rod with a hammer the former will vibrate, and the vibration frequency will entirely depend upon the length of the rod. It is of course evident that the frequency at all points of the rod will have the same rate, but that the amplitude of vibration will vary from nil at the clamped end to the maximum at the upper end.

In a similar manner a wire with its upper end insulated and with its lower end having a constant potential by virtue of being earthed will have an oscillation frequency dependent upon the length of the wire above the ground while the vibration amplitude will vary from nil at the earthed end to maximum at the free end.

At the present time there is no subject connected with wireless telegraphy receiving more attention than that of selective signaling. Various devices and arrangements have been suggested and experimented with to bring about the desired end, but the ultimate solution of the problem is still far from solved, notwithstanding that some admirable work has been done in the proper direction.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Racing of Hoisting Motor.

W. F. A., Chicago: A motor on a hoisting machine races when you throw in the reverse from the controller. What is the cause? It has been found that we have a complete field either way it runs.

ANSWER.

The motor on the hoisting machine probably races when you throw in the reverse from the controller owing to the time element in magnetization of field. The time required to get full field may be very short, and may have been so short that it was not noticed.

Batteries for Telephone Work.

B. H. S., Belleville, Pa.: Which is the better for telephone work, a dry battery of eight or one of 20 amperes, and why?

ANSWER.

Presumably the inquirer means that the first battery is capable of giving eight amperes on short-circuit and the second battery 20 amperes. Assuming that both cells have the same electromotive force, and that this is 1.6 volts, for instance, it follows that the internal resistance of the eight-ampere battery is 0.2 ohm $\left(R = \frac{E}{C}\right)$ and hat the internal resistance of the 20-ampere battery is 0.08 ohm.

Ordinarily it is desirable in telephone work to use for supplying current to the transmitter a battery with as low internal resistance as possible, as the lower the total resistance in the transmitter circuit the greater is the relative change in current flow produced by a given resistance variation in the transmitter. It, therefore, would seem that if the two batteries are otherwise on a parity the one having an internal resistance of 0.08 ohm—or, as it is stated, the 20-ampere battery—would be somewhat better adapted for use in a telephone transmitter circuit than the one with an internal resistance of 0.2 ohm.

Reconstruction in San Francisco.

It is marvelous, when one considers the extent of the reconstruction done and the results accomplished by the electric-light, and power, gas, street-railway and telephone companies. It is not as if each or any of these public-utility corporations were able to immediately proceed with their new construction, but from the very first, business greater than ever before had to be carried on at the same time the new construction was being prosecuted. Nor was there a moment's delay. No one even queried whether the restoration of all such public service was to proceed or not. It was taken for granted from the very beginning that these installations were not only to be rebuilt, but the new plants were to be better than ever before. —From the Journal of Electricity, Power and Gas, San Francisco.

Chicago Illuminating Engineers Dine and Elect Officers.

The members of the Chicago section of the Illuminating Engineering Society held their regular monthly meeting during the Electrical Show in the restaurant of the Coliseum on Thursday evening, January 17th, when the officers for the ensuing year were elected. The meeting was an unusually interesting one, for the members of the Northwestern Electrical Association were present also at the dinner, for which more than a hundred covers were laid. Promptly at 6 o'clock the chairs were filled.

After dinner the business of the evening was taken up. Mr. George C. Keech was the chairman, and appointed Messrs. E. D. Alexander, Albert Scheible and Harold Almert as a nominating committee. Officers were elected as follows: Chairman, George C. Keech; secretary, J. R. Cravath; managers, H. V. Von Holst and E. W. Lloyd; board of examiners for new members, W. R. Bonham and C. E. Ummach.

A discussion on street lighting was taken up, and the following subjects were presented:

1. Large versus small units in street lighting.
2. Globes and reflectors for street lamps.
3. New street lights.

Among those who spoke were Albert Scheible, W. D'A. Ryan of Lynn, Mass., Frank McMaster, W. E. Daniels of the South Park commissioners, F. W. Willcox of Harrison, N. J., Harold Almert, John Allen, J. R. Cravath, A. J. Marshall of New York, and Mr. Tompkins of the City of Chicago electrical department.

R. W. Bingham gave a very interesting and instructive talk on gas lighting. The result of the meeting was the effecting of a permanent organization of the Chicago section of the Society of Illuminating Engineers.

Illuminating Engineers in Boston.

The Boston section of the Illuminating Engineering Society met at the American House on January 15th, with President Campbell in the chair. Mr. Cowles of the Edison Electric Illuminating Company gave a talk on the progress of electrical illumination, during which he gave a brief history of the early arc lamps, beginning with the Brush apparatus, and coming down through the carbon-filament incandescents to the metal-filament lamps and high-efficiency arcs. He pointed out the attractive features of the tantalum and tungsten lamps, and also discussed the mercury lamp and the Moore vacuum tube. Mr. Cowles was followed by Mr. J. S. Codman, whose subject was "Aids to Progress in Lighting." Mr. Codman rehearsed the difficulties that formerly beset an illuminating engineer, say, six or seven years ago—he being obliged to do his work without any assistance such as he now receives in the shape of distribution curves, which are now published in technical papers, etc., and also by calculation tables, which save a vast amount of figuring in working out problems of lighting. At the close of these talks, a general discussion followed, participated in by Professor Adams, Dr. Bell and Messrs. Campbell, Gifford, Clark, Hale, King and others, in which the osmium, helion and other lamps were commented upon. Forty members were present.

Institute Meeting at Purdue.

The meeting of the Purdue branch of the American Institute of Electrical Engineers, held in the new lecture room of the Electrical Building at Purdue University, Lafayette, Ind., on January 15th, was addressed by Prof. C. P. Matthews, director of the school of electrical engineering. Preceding a discussion of Mr. C. H. Sharp's New York paper, on "New Types of Incandescent Lamps," Professor Matthews gave some very interesting facts on the development of the carbon filament, together with the requisites an electric lamp should possess if it is to fill the requirements properly.

Among the requisites of the electric lamp brought out and discussed were low specific power consumption, good light distribution, good quality of light, long life and sustained candlepower. The individual units should have suitable intensity—that is, should not be of too high or too low a candlepower—should work equally well on either direct-current or alternating-current circuits, and should be capable of rugged construction. The different types of lamps, including the old and the new types, were taken up, and the points of merit, as well as the points that invited improvement of each, were brought out.

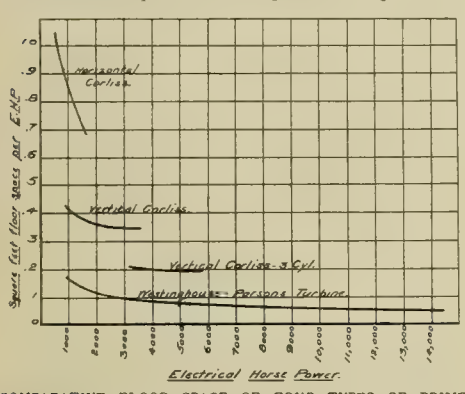
Interest in the meetings seems to be steadily on the increase, as shown by the increased attendance and membership of this year over preceding years.

Representative Maynard has introduced a bill to provide that the Norfolk and Portsmouth Traction Company shall have the right to maintain an electric road across the military reservation at Willoughby Spit, Norfolk County, Va.

The 10,000-kilowatt Westinghouse Turbo-generators for Brooklyn.

As recently told by the New York correspondent of the Western Electrician, electric generating units of 10,000 kilowatts capacity, complete in a single machine, are stipulated in the contract recently executed between the Transit Development Company of Brooklyn and the Westinghouse Machine Company of Pittsburg. As this transaction is distinctive in carrying not only what is said to be the largest single order ever placed for power generating machinery, but also for units of the largest size contemplated at the present time, additional details will be of interest. The new equipment will consist of five 10,000-kilowatt turbo-generator units and a large amount of converting, transforming and controlling apparatus, all manufactured by the Westinghouse interests.

In compactness the new unit establishes a new standard. Over all the turbine measures 24½ feet in length, 15 feet in width, and 12¼ feet in height, above the floor level. This is equivalent to 3.8 brake horsepower (rated) per square foot occupied, or 5⅔ brake horsepower maximum. Conversely, the turbine requires 0.026 square foot per rated



COMPARATIVE FLOOR SPACE OF FOUR TYPES OF PRIME MOVERS, ALL OPERATING CONDENSING.

brake horsepower, or 0.018 square foot per maximum brake horsepower. The combined unit measures approximately 48½ feet in length, equivalent to 0.075 square foot per kilowatt rated, or 0.049 square foot per kilowatt maximum. That a striking advance has been made within recent years toward securing greater compactness in prime movers is shown by the accompanying curve, and the end is not yet.

The turbine equipment is designed for a steam pressure of 175 pounds at the throttle, 100 degrees superheat and 28 inches vacuum. Under these operating conditions assumed, the units are capable of sustaining their full rated load continuously with a temperature rise of 35° C., with power factor ranging from 90 to 100 per cent. In the event of loss of vacuum, accidental or otherwise, the turbines will automatically "go to high pressure," carrying their full rated load without the assistance of a condenser. This feature will be obtained through the use of a secondary admission valve of construction similar to the primary valve and operated by the governor in such a manner as automatically to come into operation when the overload upon the machine reaches a certain point. The action of this valve is to raise the pressures in the various stages, and thus increase the capacity of the machine.

Speed variation may be adjusted to a nicety by a distant-control mechanism attached to the governor and operated from the switchboard. Close regulation may be obtained, if desired, when running alone, and when running in parallel with other machines the regulation may be changed to three per cent. or four per cent. if found desirable.

In the construction of the generator the standard rotating-field design will be employed with frame entirely enclosed, so as to facilitate forced ventilation and incidentally obviate the noise emanating from high-speed turbines. Current may be delivered at 6,600 or 11,000 volts, according to the method of connecting the windings.

A good feature of the horizontal-type turbine is the excellent disposition which may be made of the condensing apparatus. In spite of the compactness of these large units, the surface condenser will be located, as usual, directly beneath in the power-house basement, together with all of the condensing auxiliaries, thus giving a clear engine-room floor.

This arrangement likewise permits of the carrying out of the "unit system" in power-plant design, which is important in securing the best arrangement of boiler plant.

This new power equipment will be eventually installed in the new Kent Avenue station, Brooklyn, where three large turbine units have been in operation for some time. This station will thus be distinctively devoted to turbine machinery.

COMMUNICATION.

Comparative Efficiency of Arc and Incandescent Lamps.

To the Editor of the Western Electrician:

I was very much interested in the article on "Street Illumination by Arc Lamps," by Mr. Daniels, in your issue of January 12th. There was one statement, however, made in this article which is undoubtedly a misstatement, and should be corrected, as misstatements of this nature are apt to create erroneous ideas which will ultimately result to the detriment of the electrical business.

In Mr. Daniels' article he says that "An incandescent lamp uses 3½ watts per candlepower and the arc lamp gives 3½ candlepower per watt." I will concede to Mr. Daniels that the ordinary incandescent lamp uses 3½ watts per candle, but for street lighting the use of such a lamp would be as much out of date as the old type of suspension of arc would be compared with the beautiful form of support shown in his article. The comparative cost should be at least on the basis of the "Gem" type of lamp, or 2½ watts per mean horizontal candlepower. This would give a mean spherical candlepower of about three watts per candle.

Coming now to the question of the arc lamp, I take it for granted that the arc used is of the enclosed type and that the upper carbon is the positive, as I believe direct current is employed. Taking the most favorable case as regards globes, namely, clear inner and no outer, as is probably used inside of the 20-inch sphere, and supposing that the lamp burns 5¼ amperes on approximately 115 volts, we find that in this case, according to the tests made at the Electrical Testing Laboratories, the mean spherical candlepower is in the neighborhood of 213 for a consumption of about 600 watts. This gives an efficiency of about 2.8 watts per candle, or only a few per cent. greater than the incandescent lamp. Such statements of candlepower of the arc lamp as given in the article mentioned, namely 3½ candlepower per watt, or any such statement, can be based only on the old nominal rating of an arc lamp, which, as everyone knows, is entirely erroneous, and tends to do more damage than good. I am not holding a brief in favor of the incandescent lamp as compared with the arc lamp, although I think that with the advent of such lamps as the tungsten, the arc lamp for such work will be superseded; but I wish to call your readers' attention to the facts in the case.

V. R. LANSINGH.

New York, January 17, 1907.

National Convention for the Extension of the Foreign Commerce of the United States.

On January 14th in the Willard Hotel at Washington, D. C., delegates to the National Convention for the Extension of the Foreign Commerce of the United States, more than 1,000 in number, met at the call of the New York Board of Trade and Transportation.

The opening address was delivered by E. A. S. DeLima, who stated that the meeting was called for the purpose of considering and devising measures for the enlargement of our foreign trade, and to promote the demand abroad for American products.

Following Mr. DeLima's speech Frank S. Gardner of New York was chosen temporary secretary, and James W. Van Cleave temporary chairman of the meeting. The latter made a few brief remarks in which he said that the real outcome of the convention would be the effort to find out what was our capacity as manufacturers.

William McCarroll, of the New York Board of Trade and Transportation, was appointed permanent chairman, and in accepting the chairmanship stated that the convention was the most important commercial gathering that the country had ever seen. There were a number of other speakers.

The speech of Secretary Elihu Root abounded in valuable thoughts and his remarks were listened to with attention. The relation of the United States to foreign countries, and especially to those countries bordering on the Caribbean Sea were dealt with fully. The annexation of Cuba, the speaker said, would never take place so long as the people of that island would make an effort to govern themselves.

Other speakers were President Schurmann of Cornell University, Mr. Estes of Tennessee, Chas. J. Connant of the American Bankers' Association, Hon. J. Barrett of the Bureau of American Republics and Hon. Mr. Straus, secretary of commerce and labor.

Annual Meeting of the Indiana Engineering Society.

The twenty-seventh annual meeting of the Indiana Engineering Society was held in the Commercial Club rooms Indianapolis, on January 17th, 18th and 19th. The meeting was called to order by Robert P. Woods of Indianapolis, president of the association, and C. C. Brown, secretary, read his report. The society was shown to be in a prosperous condition; the membership has materially increased during the year.

President Woods delivered his annual address, which took the form of a talk on "Engineering of Interurban Railway Construction." Mr. Wood said that the years of 1888 and 1899 stand out conspicuously in the history of electric-railway construction. After classifying the numerous lines and describing the newest type of electric transportation, power, etc., he said it would be interesting and instructive to know the number and length of the interurban lines now in operation, but the task was too great, and he would confine himself to Indiana. He said the eight years of interurban progress have not brought uniform standards of construction, but progress was being made in that direction. In no other branch of engineering, perhaps, can one so well combine the use of technical ability, knowledge of higher mathematics, principles of mechanics, analysis of stresses and strength of materials, design and construction as in the comparatively new field of interurban railway engineering. Mr. Woods described in outline the principal factors and elements entering into the building of interurban railways from the organization of the company until fully constructed and in operation. The paper was complete and instructive and was well received.

The report of the committee on interurban development was next presented by Mr. J. P. Moore of Indianapolis. The committee said few people realized the rapid development that was being made in electric railways in Indiana. There are now 1,650 miles in operation. During the last year 273.95 miles of interurban road were constructed, 533.33 miles are under construction and 573 miles are projected.

"Paving Between Street Car Tracks" was the subject of a paper presented by B. J. T. Jeup. Mr. Jeup described what he considered the best kind of rail, foundation, tie and paving material for city lines, and concluded a very interesting talk by recommending the "T" rail, concrete foundation and brick for paving between the rails.

This paper brought out considerable discussion and some difference of opinion as to the best paving material.

Union B. Hunt, president of the Indiana Railroad Commission, addressed the meeting at length, and earnestly advocated certain changes in the laws governing the commission and limiting its powers of action. He said the commission was asking the Legislature to give it power to require the railroads of the state to report any accident within five days after its occurrence, that the commission may determine its cause, and to provide a preventive if possible against a similar accident in future.

A number of papers dealing principally with technical subjects, some of them metrical, were read and discussed. The convention was the best attended in the history of the society. The meeting closed with a banquet and speechmaking.

Storm Damage at Niagara Falls.

Niagara Falls, January 21.—A terrific windstorm swept the Niagara locality yesterday. The water in the river, both above and below the Falls, was raised to an unusual height. Large sections of the roadbed of the Niagara Gorge road were swept away by the high water in the lower river, ties, rails, poles and feeder wires all going with the flood. It was stated last night that the road would be shut down some time. The extent of the damage could not at that time be fully estimated, as considerable of the roadbed below the Whirlpool was still under water. However, it was evident that much damage had been done about the rapids section. The site of power house No. 3 of the Niagara Falls Hydraulic Power and Manufacturing Company was flooded. Gill Creek backed up and flooded acres of the land of the Niagara Falls Power Company. Several manufacturing plants lost sections of their roofs. Heavy damage was done to boathouses and launches. The Three Sister Islands were flooded. The water in the hydraulic canal was never before so high.

On Sunday afternoon, as John L. Harper, chief engineer of the Niagara Falls Hydraulic Power and Manufacturing Company, was returning from the power house, where he had been to note the storm effects, he was picked up by the wind as he walked along the platform adjoining the aluminum works, and blown across several railroad tracks, when he fell to the ground. Friends hurried to his assistance, and it was found that he was so badly hurt that he had to be taken home in a carriage. Dr. Wilson, the attending physician, found his back badly strained, with severe bruises. On Monday Mr. Harper suffered much pain. His injuries are quite serious. D.

The Niagara Falls Power Question.

Secretary of War William H. Taft has rendered a decision in regard to the transmission of electric power generated on the Canadian side of the river at Niagara Falls to the United States. He has granted four permits to transmit, and the total power covered by them is 160,000 electrical horsepower. Of this total, the International Railway Company will be permitted to transmit 1,500 electrical horsepower; the Electrical Development Company, 46,000 electrical horsepower; the Canadian Niagara Power Company, 52,500 electrical horsepower, and the Ontario Power Company, 60,000 electrical horsepower.

The Canadian Niagara Power Company will deliver its power to the Niagara Falls Power Company over transmission lines across the Niagara River at Niagara Falls and Buffalo.

The Ontario Power Company will deliver power to the Niagara, Lockport and Ontario Power Company, whose transmission line crosses the Niagara Gorge below the Whirlpool and extends eastward to Rochester and Syracuse.

The Electrical Development Company will deliver power to the Niagara Falls Electrical Transmission Company, which company has yet to build its transmission line across the river. However, plans are made for a crossing over a new steel bridge, to be erected close up by the Falls.

The International Railway Company asked for 8,000 horsepower, the Ontario Power Company for 90,000 horsepower, the Electrical Development Company for 62,500 horsepower, and the Canadian Niagara Power Company for 121,000 horsepower.

The Niagara Falls Hydraulic Power and Manufacturing Company is now using 4,000 cubic feet of water per second on the New York side, but as it had contracted for the sale of a large block of power to the Pittsburg Reduction Company long before the Burton bill was passed, the company is given a permit to divert 6,000 cubic feet of water per second, which will supply its new power station now in building.

The secretary says as the object of the act is to preserve the scenic beauty of Niagara Falls, he conceives it within its power to impose conditions upon the granting of these permits, compliance with which will remedy the unsightly appearance on the American side of the canyon just below the Falls, where the tunnel of the Niagara Falls Power Company discharges and where the works of the Hydraulic company are placed. To assist him, the secretary will appoint Charles F. McKim, Frank D. Millet and F. L. Olmstead, as a committee to advise what changes can be made, at an expense not out of proportion to the extent of the investments, which will put the side of the canyon at this point from bottom to top in natural harmony with the Falls and the other surroundings, and will conceal, as far as possible, the raw commercial aspect that now offends the eye.

In conclusion, the secretary treats of the charge that these companies intend to combine, which charge is denied. He says that if evidence of the existence of such a combination should be brought before him it will be given careful consideration.

Wisconsin Electrical Contractors Meet in Milwaukee.

The annual winter convention of the Association of Electrical Contractors of Wisconsin was held in Milwaukee on January 15th and 16th. Representatives from all of the principal contracting companies in Wisconsin were in attendance. After the transaction of routine business, and the discussion of subjects of mutual interest, officers for the ensuing year were elected. The following-named gentlemen were selected:

President, W. F. Meter of Oshkosh; vice-president, W. G. Pauli of Racine; secretary, Albert Peterman of Milwaukee; treasurer, George Knoerr of Milwaukee; directors, J. D. Warden of Oshkosh, A. C. Langstadt of Appleton and A. R. Schmidt and G. F. Rohn, both of Milwaukee.

The delegates chosen to represent the Wisconsin association at the annual convention of electrical contractors, which is to be held in New York city next July, are W. F. Briggs of Fond du Lac and Chris Sarau of Oshkosh; alternates, A. C. Langstadt of Milwaukee and W. G. Pauli of Racine.

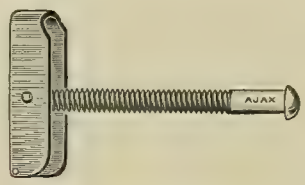
It was decided to make the next summer convention of the association partake of the nature of an outing, the place of meeting selected being a chartered steamer, which will take the delegates on an excursion up the Fox River, in Wisconsin.

On the evening of the first day of the convention the delegates enjoyed a banquet at the Hotel Blatz. Following adjournment on Wednesday, January 16th, the delegates visited the works of the Allis-Chalmers Company, the Cutler-Hammer Manufacturing Company and a number of other large plants, devoted in part, or exclusively, to the manufacture of electrical appliances.

Mr. V. B. Burgess of the Burgess Electric Company of Duluth attended the convention as a delegate of the Electrical Contractors' Association of Minnesota.

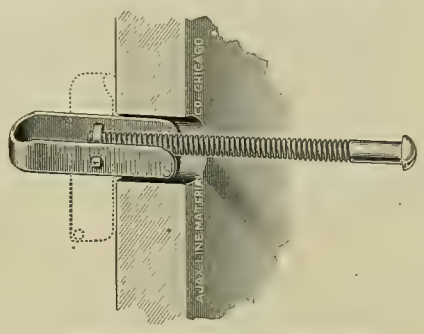
The Ajax Toggle-bolt.

If ordinary wood screws held firmly in hollow tiling, the heating, plumbing and electrical contractors doing work in modern buildings would find their work somewhat simplified; but the crumbling of the tiles makes the use of screws prohibitive. The next best method is to punch a hole in the tile with a screwdriver and insert a so-called toggle-bolt, i. e., a bolt having a pivoted bar or head-



AJAX TOGGLE-BOLT.

piece to catch inside the tiling. The bolts commonly used for this purpose have the anchoring bar pivoted to the head of each bolt, so that tightening the device exposes the surplus of thread. If this is cut off, it still exposes the rough end of the bolt and the square nut, neither of which makes a finished looking job. Besides, it takes time to cut off the extra thread, and with the pres-



MANNER OF INSERTING AJAX TOGGLE-BOLT.

ent high cost of labor this means quite an item of expense.

To save this labor and to give the work a neater finish, the new type pictured herewith has been devised by Mr. Albert Scheible and is being marketed as the "Ajax" toggle-bolt. Unlike the older forms, it has the headpiece (which is U-shaped) pivoted to the nut, with an ingenious provision for keeping this head parallel to the bolt when it is being inserted, as shown in the larger of the two accompanying cuts. Then a half-turn of the bolt drops the head across the opening, so that the bolt can be quickly tightened, leaving the screwhead exposed, while the surplus of thread is hidden in the wall. The new bolt is made in eight sizes by the Ajax Line Material Company of Chicago.

Additional Equipment for the West Jersey and Seashore.

Because of the increased traffic on the Camden-Atlantic City electric trunk line it has become necessary to add to the present rolling stock some 21 cars. Both the new cars and the generating apparatus necessary to care for the extra load are similar to the present equipment. Each of the cars will be driven by a GE-69 (200 horsepower) double-motor equipment and will be fitted with the Sprague-General Electric type M control. At the Westville power house a fourth 2,000-kilowatt 6,600-volt 25-cycle three-phase Curtis steam turbo-generator will be installed. Additional boiler capacity with the necessary condenser and feed pumps, switchboards, etc., will also form a part of the new equipment, as well as a 75-kilowatt 125-volt horizontal Curtis steam turbo-generator for excitation purposes. Three extra 700-kilowatt air-blast transformers will step up the generator voltage to 33,000 volts for transmission.

Six 1,000-kilowatt rotary converters will be distributed in the sub-stations, one each at South Camden, Glassboro, Newfield, Mizpah, Atlantic City, and one at the Westville power house. The air-blast transformers for these machines have a capacity of 370 kilowatts each, three being installed with each of these rotaries. The Pennsylvania Railroad has ordered all the additional apparatus, as outlined, from the General Electric Company, which also furnished and installed the initial equipment.

Starting of a 3,000-Horsepower Gas Engine.

Something over a month ago there was started at the Edgar Thompson works of the Carnegie Steel Company, Pittsburg, the first large gas-power installation in America, using blast-furnace gas and a double-acting, four-cycle gas engine of a large capacity. This event is of rather unusual importance, as it marks the commencement of a new regime in methods of power generation of the United States Steel Corporation, which has already taken so prominent a stand in favor of the internal-combustion type of prime mover. The starting of the Carnegie engine also is of further interest for the reason that it furnished an effective demonstration of the capabilities of the Westinghouse design for the work in hand. This design, however, was by no means an untried one, as a number of gas-engine units of similar design, but smaller capacity (500 horsepower), have been in operation elsewhere with success; but the Carnegie engine represents the first of the series of 12 large units (3,000 horsepower), which are now being built by the Westinghouse Machine Company.

The Carnegie blowing unit was started for the first time on December 7th, and after a trying-out period of only two days, was then put into regular commercial service. Since then the unit has carried commercial load during the regular daily run without developing external or internal defects either in structure or operation.

In design the gas engine follows the same general lines as those of smaller Westinghouse units, previously described in the technical press. It is of twin-tandem double-acting style, with center-hung flywheel and with two air tubs arranged in "vis-a-vis" fashion opposing the two engine frames. The gas cylinders are 38 inches in diameter by 54 inches in stroke, and air cylinder 60 inches in diameter; normal speed, 60 to 75 revolutions per minute. Engines of the same size are being constructed for electric work, in which case the air tubs are removed and a generator mounted upon the shaft next to the flywheel. The generator will have a rated capacity of 1,500 kilowatts, running at 75 revolutions per minute. Such a unit is now under construction for the Edgar Thompson plant. The generator will be solid coupled and will deliver direct current at 250 volts.

Although this gas-engine unit furnishes an uninterrupted supply of air for blowing purposes, the duty imposed upon it is by no means uniform. Owing to changes in the compactness of the furnace burden the air pressure must vary in proportion. The usual range is 14 to 20 pounds per square inch, except when the furnaces are tapped, when the pressure reduces to five pounds. On the other hand, when the furnaces are closely packed the pressure may increase to 20 pounds. These variations in pressure delivery are accompanied by corresponding variations in the quantity of air delivered, all of which is taken care of by the valve gear, while the speed of the engine is entirely under the control of a sensitive centrifugal regulator designed upon the relay principle, but controlling the gas inlets individually and directly at the point of gas supply. A speed-changing mechanism provides means for manual control of the speed of the blowing unit when desired.

Compressed air is employed as usual for starting, and it is a point worthy of note that this large unit has been started and placed under full load in 53 seconds from the time of turning on the air, while one minute is ordinarily sufficient. As the starting is automatic, only gas and air valves require attention of the operator at the time of starting, no other parts of the engine needing manipulation.

Much experience has developed during the past two or three years in the operation of large gas engines on natural gas. It is, however, a point worthy of note that the use of "dirty" gas, either producer or blast furnace, is a very different problem, so difficult as to establish a narrow margin between success and failure, where the necessary experience in its use has not previously been acquired. But in adopting the large gas engine as a standard form of prime mover in steel plants, the Carnegie Steel Company has not been blindly dependent upon skill of gas-engine designers. For a long period a 500-horsepower Westinghouse gas engine of design similar to the large unit was maintained in daily operation at the steel plant for purposes of experimentation. Experience derived from the operation of this smaller unit gave unusual promise, which seems to have already been fulfilled in the operation of the large unit.

Damage to Electrical Interests in Jamaica.

Writing on January 19th the Ottawa (Ont.) correspondent of the Western Electrician says that a cable message from the manager of the West India Electric Company, the Canadian concern operating in Kingston, Jamaica, states that the earthquake destroyed the controller's office and most of the records. The power house is all right, but the transmission line is damaged. The damage to the dam and pipe line has not yet been fully ascertained. The sub-station in Kingston is

badly cracked. Five cars which happened to be running in the affected district were burned. The electric-light station was also damaged, but all the machinery is apparently undisturbed. It is expected that everything will soon be in full operation again.

Annual Report of Chicago Telephone Company.

Dated January 16th, the directors of the Chicago Telephone Company present the following financial statement of the business at the close of the year 1906:

REVENUE AND EXPENDITURE

	1906
Gross revenue	$7,907,567 95
Gross expenses, operation, taxes, maintenance and reserve for deferred maintenance	6,289,423 57
Net earnings	$1,618,144.38
Dividends	1,400,000.00
Surplus for year	$ 218,144.38

BALANCE SHEET AS OF DECEMBER 31, 1906.

RESOURCES.

Invested in plant	$16,706,425.90
Invested in real estate and buildings	1,764,281.40
Other investments	93,876.74
Bills and accounts receivable	605,618 92
Material on hand	388,132.75
Furniture and fixtures, and tools and teams	214,015 55
Cash	19,084.94
	$19,791,436.20

LIABILITIES.

Capital stock	$14,000,000.00
Reserve for deferred maintenance (to provide for renewal of switchboards and apparatus and for continually accruing depreciation of cables and plant)	1,651,535.76
Reserve for depreciation on buildings	40,530.48
Reserve for taxes	232,388.65
Reserve for insurance fund	175,000.00
Reserve for uncollectible accounts	82,362.30
Reserve for directory expense	22,892.76
Reserve for unearned rentals	34,242 31
Reserve for outstanding toll tickets and car tickets	3,854.06
Bills and accounts payable	2,475,291.21
Surplus	1,073,338.67
	$19,791,436.20

Following are extracts from President Arthur D. Wheeler's report:

Payments to employes for services during 1906 amounted to $3,553,212.98.

In 1906 $451,480.98 was paid to the city of Chicago on account of the city's demands under the ordinance of 1889, which provided for the payment to the city of three per cent. upon the gross receipts from the telephone business done within the city. The city was clearly entitled to $133,410.76. This makes a total of $1,393,986.94 paid to the city on claims under that ordinance.

The net increase in telephone stations in service is 27,611, 18,789 being in the Chicago exchange system and 8,822 in the suburban and rural districts, partly within and partly without the Chicago limits, connected with the various other exchanges which the company operates in Illinois and Indiana. To produce and provide for this net growth, 135,951 "orders" relating to particular telephones have been treated by the company in the departments. The necessary voluminous detail of dealing with telephone stations through plant changes and the company's books and records is one of the serious and peculiar features of the telephone business. The grand total of telephones in service for subscribers at the end of 1906 is 170,834 (Chicago exchange system, 123,177; suburban, 47,657), of which 101,398 are upon some one of the several forms of measured or message-service rate basis provided by the company. Seventy-eight per cent. of the stations in the Chicago exchange system are upon measured-service basis.

On January 22, 1906, a prolonged warm rain had softened the ground so that it would not hold poles well, cold brought sleet, weighting the wires, and a high wind following, blew poles over, heaving the butts out of the earth. Toll and long-distance service was almost suspended. Water and freezing bring their special troubles to underground construction. The damages and loss amounted to over $100,000. The forces engaged in service restoration worked with most praiseworthy skill, courage and zeal during the following days and nights.

The school for operators has been continued with increasing efficiency. Approved applicants receive wages while being trained at the company's expense. A school for repair men has been opened.

Underground construction from Chicago to Kenosha, as a part of an underground system to Milwaukee, was carried forward during the year. The use of underground cables for such distances becomes possible through the use of loading coils embodying the great invention of Professor Pupin.

The real-estate operations of the company during the year have included the erection of exchange buildings at Irving Park, LaGrange, Wilmette, Blue Island and Wheaton and for the Chicago subexchanges to be known as Edgewater and Kedzie. Buildings for barns and storage have been nearly completed in Chicago for the North and South Division headquarters, and ground purchased for similar quarters for the West Division. Substantial barns and storage quarters have been erected at West Pullman and Blue Island. Lots have been secured for an addition to the Oakland exchange and for an exchange site at Glencoe. Additional land adjoining Oak Park exchange has also been secured, as well as land for storage purposes at Glencoe and Chicago Heights. Plans were completed and bids received for the erection of a large building adjoining the main office on Washington Street, Chicago. The building is needed for new toll switchboard apparatus and to provide opportunity for growth of the Main exchange. The building has not been commenced.

The company submitted proposals to the council committee for new rate and service conditions during an ordinance extension. The changes proposed involved material alterations of the company's plant, large additional investment and a material reduction in revenue from the existing body of subscribers. Pending action by the City Council, the stockholders have not been asked to invest additional money in the plant, as it has seemed reasonable that the terms of the ordinance under which such investment could be made should be ascertained. The plant increase, therefore, has been made by the expenditure of practically all the reserve funds, your surplus, and borrowed money. It is obvious that further extensions should not be made until warranted by the investment of additional capital.

The operating efficiency of the company in its Chicago exchange system has, with great difficulty, approximated the company's high standards. The business activity of the year, particularly as the holiday season approached, has thrown a great burden of message traffic upon the company. The facilities of the company in switchboards, cables and other necessary materials have been taxed to the utmost, and in some cases exceeded by the demands of customers. Normally the company should proceed as stated in the report to you last year—"with reference to the demands which may be made upon it not only in a current year, but five, 10 or more years in the future."

The disturbances and uncertainties of litigation and of negotiation with the city have compelled the company to fall behind that ample margin of provision for the future which it has always sought to maintain. At the lowest estimate, $6,000,000 should be expended in 1907, if the changes and extensions contemplated should be necessitated by the passage of an ordinance upon the basis now under consideration by the committee of the Chicago council.

Test of Wireless Telephony in Germany.

Under a Berlin date line of December 28th, a correspondent of the London Times Engineering Supplement gives additional data of the experiments in wireless telephony between Berlin and Nauen, a distance of about 25 miles. The facts are mainly derived from the report of Mr. Sydow, the assistant under-secretary for the Post and Telegraph Department, and Professor Slaby, who were present at the first tests, which took place on December 14th. The Nauen signaling station was only provided with suitable apparatus for the reception of messages and had not the means of transmission, and therefore the experiment could only take place in the direction from Berlin to Nauen. The flame arcs employed were formed between a row of electrodes, which were cooled by means of water, and toward these arcs the vibrations of the microphone circuit were then directed. The microphone employed was a so-called "stentor-microphone," made by Messrs. Mix and Genest, and the instrument was enclosed in a pasteboard speaking trumpet. As a check on the accuracy of the signals, an ordinary telephone wire was employed, which was laid between the station at Nauen and the Berlin office of the company, and this was connected with an instrument in an adjoining room. After the attention of the Nauen operator had been secured by striking with a rod of metal on the metal mounting of the microphone, beginning with the customary "Halloo!" a series of numbers were called out into the microphone. At first single numbers, such as 1, 7, 9, 10, were used. These numbers were repeated several times into the speaking trumpet attached to the microphone, and then by an adjournment to the next room it was possible to receive by means of the ordinary telephone the numbers called back from Nauen. Next, sets of figures were selected and these speedily came back correctly by ordinary telephone message. There were occasional interferences or interruptions which caused the suppression of whole groups of figures, but when these were repeated correct results were obtained. Subsequently tests were made by calling numbers and letters, both singly and in groups, as also consonants and vowels, and lastly, the attempt was made to transmit an entire sentence, and this was, on the whole, intelligibly and correctly conveyed. Mr. Sydow is of opinion that the possibility of transmitting speech to great distances without the aid of wires has been practically demonstrated by these experiments.

Senator Fulton has introduced a bill to provide for the appropriation of $5,000 for the establishment of a telephone line from the Umpqua River life-saving station, Oregon, to a point at the mouth of the Suislaw River.

Indiana Telephone Items.

Three new telephone companies have incorporated to construct and operate telephone systems and exchanges in this state. The Wilmot Telephone Company, capitalized at $20,000, will establish an exchange in Leesburg. John E. Armstrong is chairman of the board of directors. The Jefferson Telephone Company is to operate a plant in Jefferson and throughout Clinton County. William H. Engle and others are directors. The Mill Creek Telephone Company of Salem will construct and operate rural telephone lines and exchanges in Washington County. Louis C. Carter and others are directors.

The Indiana telephone companies have begun war against Cupid. Managers say they have suffered so much annoyance by reason of their "hello girls" getting married, that they are now exacting a contract with their telephone girls that they will not marry.

The people in Marion have been made acquainted with what would be the conditions if they were to go back to the days when no telephones were in existence. A fire completely destroyed the United Telephone Company's exchange switchboard and put the system out of commission. Of the 2,500 subscribers, nearly one-half came to "Central" to register their complaints. The fire was the result of crossed wires, borne down by a heavy coating of ice. The company began at once to remedy the breaks and is putting about 200 telephones in operation each day.

A bill has been introduced in the Legislature which provides that when a telephone company reduces its rates to kill off competition or other purpose, the reduced rate shall prevail, and no going back to the old rate will be permitted. This bill is said to be aimed at the Central Union Telephone Company. S. S.

Southeastern Telephone Developments.

The Kentucky Telephone Securities Company has offered to take control of the Louisville (Ky.) Home Telephone Company's plant and to guarantee a five per cent. dividend payable semi-annually, with a cash guarantee deposit of $50,000 to insure dividend payments. The Securities company was organized by George B. Cox of Cincinnati and associates. It requires 6,551 shares to carry over control of the Home Telephone Company.

The strike of operators and other employes of the Cumberland Telephone Company at Memphis, Tenn., this month has unusual features. A temporary injunction was issued against those who went out on strike, but on the other hand the Cotton Exchange adopted resolutions pledging its support to the strikers. The situation at last accounts was being carefully investigated by the officers of the telephone company, who took hold of the trouble with the determination to bring matters to a satisfactory adjustment. The County Court also instructed attorneys to look into the charter of the telephone company, and if it were found defective to have the company's poles removed.

A statement from Jackson, Miss., declares that the railroad commission will be forced to take up the question of complaints against the Cumberland Telephone Company at its next meeting. The company has been boycotted in several Mississippi towns, it was said, and charges alleged are in reference to rates charged by the company and to service. The officers are expected to attend the meeting to give their side of the issue. L.

Michigan Telephone Matters.

The Wolverine Telephone Company, which is backed by the Stromberg-Carlson Telephone Manufacturing Company, has filed articles of incorporation and is planning to put in exchanges at Benton Harbor and St. Joseph, despite the fact that the councils of the two cities have refused it franchises. Another effort will be made, however, to secure a franchise. The company is capitalized at $200,000.

W. C. Sterling & Co. of Monroe have been awarded the contract to supply the Home Telephone Company of Detroit with 5,000 poles. The contract price, it is said, was $40,000.

At the annual meeting of the Southern Michigan Telephone Company, held at Burr Oak, the capital stock of the company was increased from $300,000 to $1,000,000. The increase is treasury stock, and is to be used for improvements and extensions. The old board of directors was re-elected.

At the annual meeting the Traverse Bay Telephone Company of Traverse City elected the following-named officers: President, Theodore Guyer; vice-president, Elias Burns; secretary, T. N. Chapin; treasurer, Leonard Armstrong. President Guyer acts as manager of the company.

At a joint meeting of the Farmers' Telephone Company and the West Antrim company, held at Morrice, it was agreed to construct a line from Morrice to Bancroft, each company to build half the distance. B.

Telephone News from the Northwest.

The Greenwood Prairie Telephone Company has purchased the exchange located at Plainview, Minn.

The South Dakota Telephone Association, which is made up of the Independent telephone companies of that state, held its annual convention at Sioux Falls on January 9th and 10th. Over 100 representatives of the various companies were in attendance. The next meeting will be at Mitchell.

The Northwestern Telephone Exchange Company will rebuild its exchange at Yankton, S. D. When this announcement was made the City Council ordered the marshal to instruct the local manager that all proceedings must stop, the company's franchise having expired.

The Independent Telephone Company of Milwaukee has purchased a site on Fourth Street for its new exchange building.

The Northwestern Telephone Exchange Company will extend its line from Jamestown, N. D., to Ypsilanti, Montpelier and other neighboring towns.

Independent telephone companies throughout Wisconsin were represented at the state meeting held at Madison, Wis., January 16th and 17th.

The Norwalk (Iowa) Telephone Company has sold its entire system to the Southern Iowa Telephone Company. A number of important improvements are contemplated. R.

Cook's Junction Box.

Frank B. Cook of Chicago is putting out a new junction box—new, that is, in the method of manufacture. Mr. Cook says this new junction box is better in every way than the types made heretofore. In the first place, the new one is made of sheet steel, heavily galvanized, this construction making it much lighter than the old painted cast-iron boxes. The difference in weight is so great that it will effect a material saving in freight. It

COOK'S JUNCTION BOX.

also makes it much easier to handle on the pole.

Cook's junction box furnishes an economical and simple means for installing and splicing main leads of cable and extending branches of smaller cable to other distributing points. It renders sleeve splicing or wiped joints unnecessary. It makes cable testing a simple matter, as the box can be opened more easily than can a cable joint. It is moisture-proof, and has a sliding galvanized sheet-metal cover, which furnishes added protection. It is equipped with self-soldering nozzles, and is made, as noted above, of galvanized sheet steel, a rubber gasket rendering the joint between the cover and the box moisture-proof.

The box is galvanized after being formed up, so that the galvanizing will fill all the joints and make the box airtight. In order to make sure that the joint is moisture-proof, the junction box is subjected to an air-pressure test before leaving the factory.

The bottom of the box is about two inches deep, so that paraffin or a compound may be poured in to that depth, after the cable has been brought in and spliced. This is an additional protection to the cable against moisture.

The Cook junction box can be furnished separate, or combined with terminal, if desired. One new and original feature is that it may be installed alone originally, and the terminal can then be added at any future time. All Cook junction boxes are equipped with self-soldering nozzles. Self-soldering nozzles are a great convenience and save the services of an expert cable splicer or of a plumber to make wiped joints. All that is necessary is to scrape the lead-cable sheath bright and clean before inserting it into the nozzle. To solder the cable to the nozzle, a blow-torch is applied to the outside of the nozzle, first wrapping tape or paper around the bottom of the nozzle to prevent the solder from running out. The necessary amount of solder and flux is inside of each self-soldering nozzle.

BOOK TABLE.

How to Build a Direct-current One-kilowatt Dynamo or a One-horsepower Motor. By A. E. Watson, E. E., Ph. D. Lynn, Mass.: Bubier Publishing Company. 1906. Pp. (5 by 6¾ inches), 100. Price, $1.

The author has already published a book describing the construction of a one-horsepower dynamo, but in this work he describes a machine which is more modern and in which is incorporated the more recent ideas which may be readily adopted by the general builder. The drawings and directions are clear and explicit and reasons are given for doing the work in a certain manner. Careful directions are given for the mechanical construction and winding and the final chapter is devoted to the detailed calculations upon which the design is based. Altogether the instructions and diagrams are sufficient to enable any one who has a little ability and the necessary tools and materials to construct the machine.

Electric Wiring and Construction Tables. By Henry C. Horstmann and Victor H. Tousley. Chicago: Frederick J. Drake & Co. 1907. Pp. (4¼ by 6 inches), 118. Price, $1.50.

The book is bound in leather and is intended for a pocket handbook. It presents a large number of the tables that are the most useful to the contractor or the man engaged in the active work of electrical wiring. Among other things it contains tables for direct and alternating-current calculations, showing at a glance the currents required in any of the systems in general use for any voltage, efficiency or power factor and the proper size of wire for any loss. All of the tables are simple and many of them are accompanied by charts. A chapter is given on the economy of conductors, and in the latter part of the book is a table of carrying capacities allowed by the National Electrical Code and the rules of the city of Chicago, which are the only ones in the larger cities that differ from the National Code rules.

Electrical Engineering. By E. Rosenberg. Translated by W. W. Haldane Gee and Carl Kinzbrunner of Manchester, England. Revised by Edward B. Raymond, B. S., Schenectady, N. Y. New York: John Wiley & Sons. 1907. Pp. (5¾ by 9 inches), x., 347, with 333 illustrations. Price, $2.

This valuable book covers a wide range in the field of electrical engineering and is written from the practical point of view. It is an excellent work both for the working electrical man and students in electrical and mechanical engineering. It may also serve a useful purpose in the hands of the staffs of electrical manufacturing concerns.

Mathematics have been generally avoided, and on the other hand several subjects which to the mathematical mind could have been explained in a very few words have been gone into quite fully. In the case of alternating currents mathematics have been introduced to some extent.

The book deals with the fundamental principles of electricity and magnetism, then takes up the application of these principles to direct and alternating-current machinery. There is a chapter on storage batteries and another on electric lighting; electric traction is considered under "The Electric Motor." Alternating-current working is treated with considerable detail, one chapter being devoted to polyphase apparatus.

Mr. Rosenberg is an electrical engineer of Hanover, and his book, originally published in German, grew out of a number of lectures which he delivered to the employes of a large electrical manufacturing concern. Published in 1902, the work was translated into English by two Manchester professors the following year. Mr. Raymond has brought it down to 1906, in revising the book for American readers, although the tantalum and tungsten lamps do not seem to be mentioned.

Self-propelled Vehicles: A Practical Treatise on the Theory, Construction, Operation, Care and Management of All Forms of Automobiles. By James E. Homans, A. M. New York: Theo. Audel & Co. 1907. Pp. (5½ by 8 inches), 598, with 399 illustrations besides a frontispiece portrait of Daimler and several inserted plates. Price, $2.

This is an all-round automobile book, and it is an excellent one. Mention was made of the work in the Western Electrican several years ago, but the present is the fifth edition, and it has been entirely revised. In his revision the author has emphasized the practical aspects of motor vehicles of all powers, confining his space to the discussion of subjects fundamental in construction and management. Theoretical matters—important almost wholly to designers and builders—are introduced only where good explanations require them, and at no point is the reader's mind burdened with material on experimental and obsolete construction.

Eight chapters are devoted to electrical apparatus, but naturally the bulk of the book is given to the gasoline machine. A valuable chapter on "Gasoline Engine Management" covers, apparently, all forms of difficulty liable to occur under service conditions. Anyone reading this chapter should derive an intelligent conception of the requirements for an expert driver, and will find numerous points of valuable information. All the accessory parts of an automobile, as carburetters, igniters, transmission gears, are fully explained by typical examples. The author properly assumes that an adequate knowledge of the principles upon which these devices are constructed will enable the reader to understand variations for himself.

The book is handsomely bound, with gilt top, and copiously illustrated. It is entitled to cordial recommendation.

Engineering Periodicals and the Card Index.[1]

By H. Wade Hibbard.

Among the most valuable members of the engineering profession today are the moving spirits of the engineering press. Much matter of great value is regularly to be found in the current periodicals of a profession growing so rapidly and in so many directions as is mechanical engineering.

Books, monographs upon particular subjects, necessary as they are by their gathering within one cover all the required material of years and many places, and by their orderly classification, logical discussion and evolving of principles, are, by very necessity of their production, always and inevitably behind the times. The reason for existence of the engineering press is to collect all recent valuable information—news, if you please—and present it weekly or monthly, less or more digested, to as large a circle of readers as possible. The American papers, representing special branches of the profession, far surpass in numbers and variety and excellence the like papers of the old world. Their general use proves that they have a most important place. With these may be grouped the published transactions of the many engineering societies and clubs. Unthinkingly or deliberately to neglect forming acquaintance with so great a source of engineering knowledge is not fitting for the student who has his own future to make in a country where ruts and old fashions are only for the failures.

A good engineering paper should be one of the life partners, ready at hand when moments of leisure permit its instruction and enjoyment, better understood and liked as the years roll on, acquaintance or perhaps friendship formed with editor, contributions made, suggestions given and taken, some share had in its mighty influence in the engineering world.

The Card Index.

But what of that dimly remembered life-preserver which could not be found when there was dire need? Editors of papers, engineering and otherwise, are frequently in receipt of letters like the following: "A number of months ago I read an article in your paper, or one like it, bearing upon such-a-subject. At the time of reading I recognized its value. Not only did I think that I had its essential items impressed upon my memory, but I recall making some record in my notebook. I find now a problem has come up in my practice for which I greatly need, and at once, the information contained in that article, but I can find neither it nor my note, the latter being evidently hidden in the midst of other material. If it appeared in your paper, will you give me the date and if possible send me the copy? I am willing to pay a good price for it." Even when one has the annual indexes of his engineering papers bound up with the volumes, it may be a search of hours to unearth an article whose general subject or whose most valuable details are more strongly impressed upon the memory than its title as appearing in the index. The average subscriber does not get the full value out of his paper, because of this very inability to find again what he has read.

The card index will obviate the difficulty, giving ready access to what has been read by its maker, recording information in the form best adapted to his professional needs and to his own peculiar habits of mind and memory, and following his own pet system. The speaker gave up the note-books 10 years ago and commenced a card index or, as it is sometimes called, "Index Rerum" (Index of Things), making it really a written memory of everything which "might come in handy some time," of reading, of experience, of oral information; engineering, household, athletic, religious; references to catalogues, drawings, clippings; lists, future plans, addresses—everything.

Sometimes one is uncertain how to index some piece of information. Remember then that almost everything will have two parts—the thing and its function; and if the thing is the more prominent, catalogue it under the thing; or if the function, then under the function; but, and the following is called "cross-indexing," be sure and make out a card for the other and write on it: See the main card (giving its subject). A liberal use of cross-indexing is no fault; one's mind does not always

1. Extracts from an address delivered before the students of the Society of Mechanical Engineers, Sibley College, Cornell University. Mr. Hibbard is a member of the American Railway Master Mechanics' Association and the American Society of Mechanical Engineers.

work on the same lines, and data might be buried even in a card index. Five years later one may not be able to recall just the one heading under which he indexed an article, but is sure to remember one out of the several headings of the cross-indexing.

After the subject is written on the card, add the name of the paper, with year and page. The card is as yet practically worthless. Add a short description of the article with your opinion of its value or applications. Perhaps you can place upon the card all of the article that is of value. At least enough must show on the card to give the future searcher after information some discriminating idea of the article and whether it will pay to read it again to aid him in his engineering problem.

If the card is made out of information not in print, it should of course be full. A note-book may, however, be needed, and in that case the card will refer to the note-book by number or date upon the cover and the drawer number where finally deposited.

The card should be filed away in proper alphabetical order the same day it is made. No accumulation should be allowed, for it soon clogs the work and makes untold disorder. Later in life the busy engineer should handle his papers like his morning mail, reading them as soon as received, marking important articles, and turning them over to an accustomed clerk for index cards and filing.

Electric Motors for Louisiana Saw Mills.

The Great Southern Lumber Company will install a complete electrical equipment in its new mills at Bogalusa, La. The company controls various properties in different lumber centers, and the new mill will be not only the largest in the United States, but also will have the most complete electrical equipment. As a result of this latest industrial center, a new town is being built within the confines of the old, which before had not even a postoffice.

The electrical equipment will be furnished by the General Electric Company, individual induction-motor drives being used on all of the machines, the total motor equipment aggregating some 2,400 horsepower. Having neither commutator nor brushes, there is no sparking from the motor; therefore, it will operate without fire risk in the dust or shavings incidental to sawmill work.

At the new mill the generating equipment will comprise three generating units, direct-connected to steam engines. Two of these units have 500-kilowatt generators, while the third unit will be of smaller capacity, generating about 300 electrical horsepower. All three units will be of the three-phase, revolving-field type, running at 100 revolutions per minute, and generating current at a potential of 2,300 volts, and a frequency of 60 cycles. The power house will also contain two direct-connected marine generating units, each consisting of a 30-kilowatt generator, driving at 305 revolutions per minute, by a direct-connected vertical engine. These machines will supply direct current at 125 volts for exciting the fields of the generators. A complete switchboard will also form a part of the power-plant equipment.

From the power house the current will be transmitted to small transformer stations outside of each building. Here the voltage will be stepped down from 2,300 volts to 440 volts for operating the motors at the individual machines. The motor connections to the transformer stations will be made by means of cables insulated with varnished cambric and laid in unlined steel conduit.

Electric Music in New York.

Telharmonic Hall was opened to the public of New York last week by the Eastern Cahill Telharmonic Company, which has fine quarters on Broadway and Thirty-ninth Street, flanked by the famous old Casino and fronting the Metropolitan Opera House, in the very heart of theatrical and musical New York. Regular performances are now being given to the public twice daily, and as a price of admission is charged, a fair test is now being afforded of the value of this invention as a money-making attraction. It has, of course, to compete with the music halls, variety shows and free concerts of the Æolian, but on the score of a clever invention it has an appeal of its own which may induce a fairly large portion of the public to part with the requisite admission fee. Noted in the Western Electrician a year or two ago, this invention during the last twelve months has been the subject of a skilful and clever publicity campaign, which has utilized every channel and opportunity to impress the public with the marvel of this new electrical invention. This publicity work, it is only fair to state, has been performed and worked out in its entirety by Mr. George H. Guy of the Manhattan Bureau of Publicity, and Miss Carmelita Beckwith, who has had so much to do with the editing of bulletins in New York for the central-station interests.

CORRESPONDENCE.

Continental Europe.

Paris, January 8.—The Benrath Machine Company has recently built a large electric crane for the Weser Docks in Germany. It consists of a main tower, some 115 feet high, running upon the track rails. On the top of the tower is a revolving part, which carries a horizontal beam, forming two arms of unequal length. The longer arm carries the crane carriage with the suspension chain and hooks, while the short arm carries a counterweight. The total weight of the crane is about 70 tons, and with a load of three tons the carrying distance is 60 feet, while for a 6½-ton load the distance is 20 feet. A direct-current motor is used for the lifting, and it is rated at 50 horsepower. A load of 6½ tons is lifted at the rate of 60 feet per minute, while the speed is 150 feet per minute for a three-ton load. The upper part of the tower is turned about by a 10-horsepower motor placed in the base of the tower, along with the transmission mechanism, and it causes the rotation of the tower at a circumferential speed of 240 feet per minute for the end of the large arm. To run the whole crane along the track there is a 60-horsepower motor, which drives it at the rate of 200 feet per minute.

A French engineer, Mr. Decoeur, has planned a new system for utilizing the force of tides. This he proposes to illustrate in three plants to be erected on the coast of England. One of these, to be located at the port of Chichester, would cost $1,500,000 and give an average of 8,000 horsepower. A second plant, located at the Menai Strait, would cost $3,000,000 and yield 15,000 horsepower. A still larger plant, planned to be erected on the Bristol Channel, would cost no less than $50,000,000. This sanguine inventor uses a system of two reservoirs, which are connected by a short canal containing the turbines. The first reservoir would be filled during high water, while the second would empty at low water. In the first-mentioned plant the system of reservoirs would occupy an area of 3,000 hectares.

Among the recently erected hydraulic plants in Italy I may mention the station of Trezzo, which is situated on the Adda stream in the northern part of the country. In this plant there are now installed 12 main turbine and alternator sets, which work at high voltage and deliver 13,500 volts at 42 cycles for 10 of the machines and 50 cycles for the other two. The alternators are built by the Italian firm of Gadda & Co. and have a fixed interior armature and outer revolving field, with a total diameter of 20 feet.

A provisional steam plant has been lately installed by the Societa Lombarda, which contains steam turbines and steam engines. This company, which already possessed the plants of Vizzola and Turbigo, giving 20,000 and 5,000 horsepower, respectively, made a contract a few years ago with the Brusio Power Company to secure a large amount of hydraulic power in the Grisons Canton, this being estimated at about 20,000 horsepower. It is now erecting a large plant in this region which will operate upon a 100-mile transmission line, and the plant no doubt will be set running in the early part of the present year. In order to give a supply of current in the meantime, the company has erected a steam plant at Castellanza, where it already had two reserve groups of 3,000 horsepower. The two new groups are turbo-alternators of 5,000 kilowatts each.

The new electric railway which is running between Blankenese and Ohlsdorf, near Hamburg, is of interest from the fact that it is equipped on the single-phase system, using the Winter-Eichberg motor. Owing to the good working of the single-phase system upon the line between Spindlersfeld and Niederschöneweide, which was installed a few years ago and is still running, the German Railroad Department decided to adopt single-phase motors for the above-mentioned line. Each motor-car unit is formed in reality of two short cars which are coupled together. A double-axle truck and a second carrying axle support each car. The long trains are made up of several motor cars of this type; turbines are not used. One of the short cars is equipped with motors upon the truck, and has five third-class compartments and two second-class; also the high and low-tension apparatus placed in a special compartment, besides the motorman's cab. The second car has four third-class and three second-class compartments, one for low-tension apparatus, and a motorman's cab, which is placed in the rear of the train. Only one axle of this car is fitted with a motor. The overhead line is operated at 6,000 volts single phase, and a transformer placed on the car lowers the voltage to 750 volts for the motors. Some 120 horsepower each is given by the motors. The present system, which I hope to describe in greater detail later, is installed by the Allgemeine Elektricitäts Gesellschaft of Berlin.

At the last colonial congress, held at Marseilles, Mr. Duffart brought out some points relating to rubber production in the principal regions. Statistics show that the production at the present time reaches 56,000 (long) tons, or 36,800 for America, 17,500 for Africa, and 1,700 for Asia and Oceania. The French colonies produce in all 6,600 tons, and figure in the second place in the total. A. DE C.

Great Britain.

London, January 9.—The Manchester Corporation recently advertised for tenders for turbo-generating plant. In response, offers were received from all the principal makers of such plant in the United States, Great Britain and the Continent. Such an embarrassment of riches did these present, that a special visit was made by one of the councilors, accompanied by the corporation electrical engineer, to British and continental generating stations, with the result that the work went to Willans & Robinson of Rugby, England.

In about six months Londoners will witness the realization of the grand scheme of railway and tramway intercommunication of which the late Mr. C. T. Yerkes was the originator, in so far as he brought together a number of scattered proposals and made one harmonious whole of them. In spite of the very influential financial support which the undertaking has had, unfavorable money and stock markets forced the directors of the London Underground Electric Railway Company to make a call last summer upon the shareholders to the extent of 50 shillings per share, and the unfavorable conditions still continue. It may so happen that the whole of the company's capital will have to be called upon in order that the various undertakings may be completed.

The severe snowstorms throughout Great Britain during the last fortnight created a condition of affairs here not experienced for many years, and for which many engineers were not prepared. Thus it came about, for instance, that the surface-contact tramway system was put out of use at Wolverhampton. The studs had become frozen through the snow and frost, and at no time during the severe weather were all the lines in operation. But in other parts the trolley tramways were interfered with, while in London the conduit lines did not escape; but the latter were soon at work again. Naturally, telegraph and telephone lines suffered considerably.

The traffic manager of the Liverpool Corporation tramway system has invented a new sanding appliance. The corporation is having 50 of its cars fitted with the device, which consists of an auxiliary hopper, enabling a driver to augment the ordinary supply of sand in case of emergency. At a speed of 12 miles an hour, a car has been stopped in three yards when using the auxiliary supply, whereas, with the ordinary arrangement only, a car ran some 20 yards before coming to a standstill.

Further tests have been carried out at Hull on the stability of wooden poles for telegraph, telephone and power transmission lines. A full report is shortly to be issued, giving most exhaustive information, gleaned from the later trials, together with those carried out in August, last year.

The Board of Trade is conducting a most exhaustive inquiry into the circumstances surrounding the disastrous boiler explosion just before Christmas at the works of the South Metropolitan Electric Light and Power Company. The accident is unique, in that it is the first explosion of a thermal storage drum. The adjourned inquest was held today, and the somewhat startling theory was advanced by the chief engineer of the insurance company that there had existed for some time a crack right across the inside of the dished end of the drum, which was five feet in diameter. This had only shown itself on the outside of the plate to the extent of two inches, and it was in response to a communication from the central-station company that the insurance company's inspector—who was blown to pieces—was on the premises. Whether such a flaw did exist, and whether it was due to a defect in manufacture, the Board of Trade inquiry will probably show. The plates underwent a tensile test of 25-28 tons per square inch, and an elongation test of 20 to 25 per cent.

The annual report of the British Westinghouse Electric and Manufacturing Company has always been an interesting document, and this year is no exception. The actual trading profit during the financial year ended July 31st last—for which the report is just issued—is some $40,000, but the interest on the four per cent. mortgage debenture stock, the adjustment of working assets, etc., leaves a debit balance. Since January, 1906, there has been a complete change in the methods and management of the company. A readjustment of trading territory has been negotiated with the American companies, and the company has acquired the right to sell in South America. Offices have also been opened in Buenos Ayres and Johannesburg.

A meeting of the debenture holders of the South Wales Electrical Power Distribution Company has been held, with the object of arriving at some satisfactory conclusion with regard to the affairs of the company. There is an accruing loss on the undertaking, mainly owing to the methods adopted originally. The result of the meeting was that the debenture holders' committee was given cart blanche to do the best in its power. G.

Dominion of Canada.

Ottawa, January 19.—The movement for Independent telephones is meeting with great success in the easterly portion of the Niagara district of Ontario. The Welland County Telephone Company already has a line in commission, and has expended $10,000 on construction work, and the Niagara District Telephone Company is making rapid progress.

Application will be made to the Dominion Parliament for an act incorporating the Bonaventure and Gaspo Telephone Company, with power to construct and operate lines of telephone and telegraph in the provinces of Quebec and New Brunswick.

Further evidence that electric energy can be sold at the low rates quoted by the Ontario Hydro-electric Commission is furnished by the fact that the Cataract Power Company of Hamilton, Ont., has just paid six per cent. dividend on its preferred stock and three per cent. on common stock. It is said that the bonded indebtedness represents the actual capital invested in this concern. The city is taking steps to compel the company to bury its wires. W.

Winnipeg, January 19.—The settlers of the Pelly district, about 50 miles northwest of Swan Lake, have established a record in the line of progressiveness that is hard to beat. Although the district has hardly been settled four years, and there is no market within 20 or 30 miles, the farmers have already installed their own telephone system, using barb-wire fences for that purpose. H. L. Probst, an American, is responsible for the innovation of the barb-wire-fence telephone, which, he says, has been operated successfully in rural districts in the United States.

The complete vote on the telephone question gives 14,072 in favor of the Manitoba government building and operating its long-distance lines and 10,302 against. In the 114 municipalities 54 carried the by-law by 60 per cent. and seven more gave majorities for it, 53 giving an adverse vote. The Manitoba government has already called for tenders for the necessary poles and is now arranging for the other materials necessary for the construction of a thousand miles of line.

The Alberta government has decided upon a third government-owned long-distance telephone line. It will run between Lacombe and Stettler, a distance of 51 miles. W. H. Cushing, minister of works, Calgary, Alberta, may be addressed for further particulars.

The Rocky Mountain Power and Development Company, Calgary, Alberta, has made an offer for a franchise to light and supply electric power to that town.

That the Edmonton (Alberta) City Council means business in connection with the building of a municipal street-railway system is shown by the fact that it has already ordered 470 tons of 87-pound steel rails from Pittsburg.

The Kakebeka Falls and Mount McKay Power Company, Fort William, Ontario, will at once call for tenders for the material necessary for the construction of an electric street-railway system to Slate River, a distance of seven miles.

A company is shortly to be incorporated in Winnipeg, Manitoba, for the purpose of building an electric street railway from that city to Oak Bluff, Sanford, Denore, La Salle and St. Norbert. R. F. R.

New England.

Boston, January 19.—The Pittsfield Electric Company's employes have organized the Electric Workers' Club of the Pittsfield Electric Company, and it will hold meetings every Thursday evening for the discussion of electrical subjects and to listen to lectures on electricity and its application, with demonstrations by the apparatus in the company's testing room. The officers are: President, J. E. Bridges; vice-presidents, A. G. Desmond and W. W. Hamlen; secretary, W. M. Ackerman; treasurer, E. J. Welch; finance committee, E. J. Welch, W. W. Hamlen and H. L. Tallmadge; committee to select topics for discussion, W. M. Ackerman, A. G. Desmond and Edward Dittman.

The Easthampton Electric Company has petitioned for authority to locate poles and wires in the streets of Easthampton, Mass. It has a capital of $50,000 and it proposes to buy and sell electricity for heat, power, lighting, etc. It is believed that it will obtain the electricity from Turners Falls, Mass.

Arthur L. Dunham, a workman in the General Electric Company's River Works plant in West Lynn, Mass., fell against a large generator on January 12th and received a shock of 6,500 volts. He was rendered unconscious and was burned on the hands and leg, but he will recover.

Dr. Charles E. Locke read an interesting paper on gas engines at the monthly meeting of the Boston branch of the American Institute of Electrical Engineers in the Lowell Building of the Massachusetts Institute of Technology on the evening of January 9th. Dr. Locke spoke on the regulation of gas engines, gave a summary of the development of the gas engine and called attention to the greater use of such engines in generating power for electric plants.

Mayor Grimmons of Somerville, Mass., has again appointed Melvin F. Underwood as commissioner of electric wires and lights. Mr. Underwood was twice appointed last year, but the aldermen refused to confirm his appointment. He held the office during the year, however, and the mayor increased his salary.

The Connecticut Valley Street Railway Company has been granted permission to carry freight and baggage in Deerfield, Whately and Hatfield, Mass.

The Massachusetts Lighting Company has bought control of the Northampton (Mass.) Electric Light Company, paying $275 per share, the par value being $100. The payment is made with $175 in cash and $100 in the Massachusetts Lighting Company's stock. The latter company controls electric-light plants in a number of cities and towns in the state.

Philip Cabot of Boston and his associates have bought control of the Greenfield (Mass.) Electric Light and Power Company. They also own a large amount of the Turners Falls company's stock. This company controls the waterpower in the Connecticut River at Turners Falls, Mass. B.

New York.

New York City, January 21.—Alexander Orr, president of the Rapid Transit Commission, has been empowered to appoint a special committee to consider the question of getting rid of the tracks of the New York Central Railroad on the west side of the city and to determine whether the company should be compelled to build a subway or elevate its tracks. While the company does not take the position that an elevated structure is the only solution of the question it urges that as between an elevated and a subway an elevated structure along the marginal street is the method best calculated to meet the transportation requirements of the company and of the commercial interests of the city.

With the transfer of all the Croton local trains of the New York Central to the new Lexington Avenue terminal, the latter has taken on a very busy appearance and there is less congestion at the old Grand Central Station. Of the 37 trains moved to the new terminal, 24 are motor trains, and with the Yonkers locals 40 trains driven by electricity now leave the Lexington Avenue Station. One hundred and fifty trains are now operated from the new terminal, and of the remaining 213 trains at the Grand Central Station 137 are trains on the New York, New Haven and Hartford Railroad.

A new 7,500 horsepower turbo-generator was put in operation in the Brooklyn Rapid Transit Company's Kent Avenue power house last week. There are two such generators in this power house besides the new acquisition, and another one of 10,000 horsepower is to be installed soon. When finished the five new turbine generators, already contracted for, will be installed, each of 12,500 horsepower, and said to cost $500,000.

The Interborough-Metropolitan Company is about to erect a monster repair shop which will cost over $2,000,000 at Ninth Avenue and Two-hundred-and-eighteenth Street, Bronx, with frontage on the United States Ship Canal. The company has already acquired title to all the property required for the purpose and will soon commence to build.

The first recital of telharmonic (electrical) music was held recently in Telharmonic Hall at Broadway and Thirty-ninth Street. By the telharmonic, electrical vibrations corresponding to the sound waves which compose a musical note can be transmitted over wires to any number of places and there turned into music as from a piano. It is said that any musical sound known to the human ear can be produced. After Carl Herbert, manager of Telharmonic Hall, had explained the theory of the invention and the method of creating scientifically pure musical tones, selections were played representing the music of both wind and string instruments. As powerful currents are required for the bass notes and lighter currents for the high notes, an incandescent light placed in the circuit glowed brightly or shone dimly in rhythm with the music. The overture from "William Tell," emanating from an arc light and penetrating to the remotest recesses of the hall was weird and startling in its effect. D. E. P.

Ohio.

Cleveland, January 19.—All the directors and officers of the Lake Shore Electric Railway Company were re-elected at the annual meeting a few days ago. The reports of the officers show the property to be in good condition, with a good increase in the business over the preceding year. The gross earnings for the year were $806,970 and the net surplus $136,514. President Moore's report showed that $500,000 had been spent during the year for double-tracking, making extensions and purchasing new power equipment and rolling stock. The local roads at Lorain have been taken over and the Avon Beach line completed.

Five new passenger cars have been ordered by the Lima and Toledo Traction Company, which is now in operation between Lima and Leipsic. The cars will be built by the Cincinnati Car Company. When the road is completed to Toledo, 10 cars will be used on it.

The Girard Water and Light Company has been incorporated by Charles F. Brotherton and others, with a capital stock of $100,000.

It is reported that negotiations have been entered into for merging the Home Light, Heat and Power Company and the People's Light, Heat and Power Company, both of Springfield. E. S. Kelly, the rubber manufacturer, owns the greater part of the Home company, while the stock of the People's is largely owned by Columbus men.

The annual report of the superintendent of the municipal light plant at Niles shows that the net profits for the last year were $8,977.24.

All the old officers and directors of the Columbus Edison Company, Columbus, were re-elected at the annual meeting held a few days ago. The property of the company is operated under a lease by the Columbus Railway and Light Company, so the meeting is a matter of form.

So far as the local street-railway situation in Cleveland is concerned, the last week has been taken up mainly with speculation as to what will be the outcome of the proposition to turn the lines of the Cleveland Electric over to a holding company. It is thought that the matter will be easily worked out if Mayor Johnson will be willing to allow a holding company to put the valuation of the stock and franchises upon a basis high enough to suit the old company. On Monday evening a letter from the Cleveland Electric was sent to the City Council, formally agreeing to enter negotiations with a holding company, but saying that the proposition of seven tickets for a quarter, made by the company, in the opinion of the officers, is better than a three-cent fare, or will in the end prove more satisfactory. The truce formed between the companies was approved by the council, as was the plan of the Cleveland Electric for arriving at the amount due the city for the use of the streets on which the franchises have expired.

W. M. Gates a creditor of the Eastern Ohio Traction Company, now in the hands of a receiver, has asked the court to order a sale of the property, subject to certain mortgages. O. M. C.

Michigan.

Grand Rapids, Mich., January 21.—At a meeting of the stockholders of the Menominee and Marinette Light and Traction Company the officers elected were: President, Augustus Spies; vice-president, S. M. Stephenson; manager, Edward Daniell; treasurer, Harry J. Brown.

Attorney M. F. Lillis of Pontiac has been engaged by a number of Detroit men to prepare a franchise for a gas and commercial electric plant in Pontiac, which is soon to be submitted to the City Council.

The proposed electric road between Ludington and Grand Rapids is again under consideration. Chief Engineer Gifford and Mr. Vanwey traveled over the proposed route from Grand Rapids to Ludington. The route proposed is from Ludington, south to Pentwater, Crystal and other points. The surveying is already completed, and it is hoped that the construction will commence early in the spring.

The conditions at Berrien Springs are considered favorable to the commencement of operations early this spring on the big dam that is to be erected by the Berrien Springs Power Company, of which Charles A. Chapin is the financial head.

It is reported that the Pere Marquette Electric Company has disposed of its bonds and expects to resume construction work on its dam, situated on the Pere Marquette River, near Carrs, Mich. The plans are to put in two dams, seven miles apart, at the cost of $200,000, of which $20,000 has already been expended on the upper dam. It is expected to furnish electrical power to Manistee, Hart and Shelby.

The Flint Light and Power Company of Flint, Mich., has installed a new Ball engine, switchboard and Stanley generator. More new machinery will be put in.

Bert Sellers is asking for a franchise in South Range for the installation of a lighting plant, at a cost of $18,000.

Harry Sawyer of the Electric Crane Works at Muskegon has invented an electric controller for use on cranes, and it will be manufactured by the Electric Crane Works. L. W. B.

Indiana.

Indianapolis, January 19.—The Indiana interurban lines operating in the Wabash and Ohio valleys are being crippled in their service by the flood. The Aurora, the Louisville and Southern Indiana, the Evansville and Newburg, the Evansville and Princeton and the Wabash Valley lines have been more or less damaged in service and property.

The commissioners of Clinton County, Frankfort, have ordered an election for February 12th to vote on a subsidy proposition to give $50,000

to aid in the construction of the Tipton, Frankfort and Attica Traction line.

The members of the City Council of Hartford City have returned the free mileage books that were sent to them by the Indiana Union Traction Company January 2d. The councilmen are conscientious and say they could not do the city and traction company justice while holding free passes. This is the first time in the history of the traction business in this state that free passes have been returned.

Movements during the last week indicate that Hugh J. McGowan of Indianapolis and his associates, together with the eastern interests they represent in Indiana, are gradually developing their plans for a consolidation of various traction properties which have heretofore been operated by separate syndicates. The deal now being closed involves a merger of the syndicate lines out of Indianapolis and the lines of Northern Indiana and of Southwestern Indiana, which will involve the Stone & Webster property in Terre Haute and the interurban lines to Brazil, Sullivan and Paris, Ill., the latter branch in course of construction. When this deal is consummated, and there is little doubt but it will be, the gaps between Sullivan and Vincennes and between Peru and Warsaw will be completed, thus connecting up the greatest interurban system in the world.

During a sleet storm in Marion the street-car and interurban service was badly crippled, because the ice and sleet bore down the telephone and electric-light wires onto the high-tension wires of the electric lines, making conditions so dangerous that the electric-light company shut off the current and put the city in darkness.

The Indiana Appellate Court has held that a street-railway employe riding home after work on one of the "red tickets" which the company issues its employes is a passenger and entitled to recover damages for an injury due to the negligence of the motorman. The court held that he was as much entitled to protection as if he had paid his fare in cash and that he was not subject to the rules which apply when a servant is injured by the carelessness of a fellow servant. S. S.

Illinois.

Peoria, January 19.—The Interstate Telephone and Telegraph Company has sent to the city treasurer of Peoria a check for $1,000, as payment, according to the ordinance, for the right-of-way occupied by it in the streets of this city. This is the first that the company has paid and is for the year 1906.

The American Electric Sign Company of Chicago has been incorporated with a capital of $2,500. Incorporators are C. Scheiner, Julius Gans and Charles H. Jackson.

The Decatur, Taylorville and Litchfield Traction Company has been incorporated with a capital of $5,000. The principal office is to be in Chicago. It is to construct a railway from Decatur to Litchfield. The incorporators and first board of directors are Dudley Taylor, Frederick W. Job, Thomas B. O'Connell, Alma L. Dorothy and W. W. Taylor.

The Christian County Telephone Company has purchased the interests, formerly held in Chicago, of the Milligan and Stokes lines at Edinburg. The company controls the exchanges of Stonington, Taylorville, Morrisonville, Owaneco, Tower Hill and Pana. The capital stock will be increased from $160,000 to $200,000.

An ordinance has been introduced in the Springfield City Council to compel the various companies now having overhead wires to place them underground.

The Springfield council has passed an ordinance granting Mr. McCreecy the right to furnish electric light to business houses on both sides of the street on which his hotel is situated.

Delegates from all street-railway unions in the state and also members of the International union met in Springfield this week to discuss legislation in the interest of street-railway employes, with the intention of incorporating them in a bill to be introduced in the State Legislature to obtain for them better working conditions.

The Illinois Traction Company may establish a heating system in Jacksonville.

A force of surveyors has been started to survey the line the McKinley syndicate proposes to build between Bloomington and Lincoln.

The sale of the Venice, Madison and Granite City electric lines in East St. Louis to the McKinley syndicate (Illinois Traction Company) has been affirmed.

The Citizens' Railway Company, organized under the laws of Illinois, filed its incorporation papers at Edwardsville. The principal office is to be at Venice.

The severe snowstorm of this week, followed by a cold rain that froze as soon as it touched the wires, proved a serious handicap to the various electric companies in this part of the state. The various railways experienced much trouble from the sleet and had to take some of the trolley wheels out of the hasp and let that scrape the sleet off.

The Springfield Consolidated Railway Company followed its annual custom of presenting to each employe who has been in the service five years a suit of clothes or its equivalent.

A law to permit cities to sell light, heat, gas and power is being agitated by the Illinois Association of City Attorneys and Clerks. Lloyd Painter, city attorney of Streator, is preparing notices calling a meeting for the purpose of drawing up the bills. V. N.

Northwestern States.

Minneapolis, January 19.—An application for a franchise has been filed at Darlington, Wis., for the proposed electric line to be built from Madison, Wis., to Dubuque, Iowa.

The Omaha and Council Bluffs Street Railway Company hopes to build a line from Omaha to Plattsmouth, Neb.

Stock is being rapidly subscribed at Mankato, Minn., for the projected street-railway system, and it is thought that at last the construction of a system is assured.

It is proposed to double the capacity of the electric-light plant at Thief River Falls, Minn. The improvement would cost about $20,000. The Duluth (Minn.) Engineering Company is preparing estimates.

It has been voted at Ashland, Wis., to expend $80,000 for a power dam across the White River and for a new municipal lighting plant.

The City Council at Owatonna, Minn., has granted the requests of the Minneapolis, Rochester and Dubuque Electric Railway Company regarding street privileges and a 20-acre site.

It is proposed to install an electric-light plant at Rock Valley, Iowa.

The Minnesota Legislature will be asked at the present session to pass a law which will permit the city of Duluth to issue bonds for a municipal electric-lighting system.

The LaCrosse (Wis.) Gas and Electric Company will shortly build an addition, 70 by 100 feet, to its power plant and will install considerable new machinery.

Pacific Slope.

San Francisco, January 17.—The natural result of the unsatisfactory lighting service furnished by the Pacific Gas and Electric Company since the great fire has transpired. A competing company has been formed, which will install a 10,000-horsepower steam-power electric plant in the city. The projectors estimate that the generating plant can be installed near the bay shore, and the underground distributing system equipped for use in about seven months. The City Electric Company is the name under which the new concern has been incorporated. The capital stock is $5,000,000, of which $9,000 has been subscribed. The directors are Adolph Mack, J. J. Mack, Henry Steinbach, Mortimer Fleischhacker and others. Mortimer Fleischhacker denies that the new concern has anything to do with the San Francisco Coke and Gas Company merger, and declares that the company is entirely independent of any other organization. Some of the machinery for the new plant has been ordered and work on the plant will begin soon. It is the intention of the company to manufacture all its electricity in San Francisco by the use of oil fuel. Steam turbines, the first to be introduced in San Francisco, will be used for the generation of the current. A. M. Hunt, the electrical engineer who built the successful opposition electric and gas plants here a few years ago for the Independent Electric Light and Power Company, controlled by Claus Spreckels, is now in the East arranging for the rapid filling of orders for machinery for the new plant. The San Francisco Coke and Gas Company, backed by Leopold Wallach and other New York capitalists, announces its intention of installing soon a local steam-power electric-lighting plant, so that there will be three electric companies in the field within a year.

The question of wages and hours for inside wiremen is still causing trouble in the city, but a great deal of work is going on just the same. The members of Local Union No. 6, who struck on January 2d for $6 a day of eight hours, were ordered to return to work by the Building Trades Council, which held that they broke the regulations of their own union by failing to give their employers 90 days' advance notice of their contemplated action. The union, in turn, brought suit against the Building Trades Council to prevent its suspending the union from that body, and the issue is still in doubt. At the last meeting of the Electrical Employers' Association it was learned that 205 electricians were at work at $5 a day. President Robert Martland of the association reported that electricians applied for work every day, many of the newcomers hailing from Southern California, and that he expected to have enough men by January 21st to fill all places vacated by members of Electrical Workers' Union No. 6.

The United Railroads of San Francisco has opened several new street-railway lines since the beginning of the new year, making considerable improvement in the situation, but there is still complaint of overcrowding on certain lines, owing to lack of sufficient cars, and there are many delays from lack of sufficient power during the peak loads of the day.

The Northern California Power Company has sent out specifications for the electric generating equipment for its new hydro-electric plant on Battle Creek. Three direct-connected units are called for. The waterwheels will operate under a head of 360 feet. Current will be generated at 2,200 volts and stepped up to 66,000 volts for transmission. There will be two 4,000-kilowatt units and one 2,000-kilowatt unit, making the total capacity of the plant about 12,500 horsepower. Only four miles of high-tension pole line will be needed to connect the new plant with the Chico branch of the company's extensive system of transmission lines. An additional pole line, 11 miles in length, will enable the new line to tie in with the company's Palo Cedro line.

San Bernardino (Cal.) advices say that the Arrowhead Reservoir and Power Company's incline in Waterman Canyon, lifting from the head of the canyon to the Skyland Cliff, is to be operated by electricity as soon as possible. The power is to be obtained from the Edison Electric Company, which already has a power line completed in Waterman Canyon to the point where the line bends to the Arrowhead Hotel. From the former point the Arrowhead Reservoir and Power Company will take it and carry the line up to the foot of the incline which is at the head of the canyon, just across from the foot of the switchback grade. It is inferred that an overhead-trolley system will be installed along the extension. A tunnel, 338 feet in length and with a cross-section of seven by eight feet, will be driven by the company.

The city electric-light plant at Grass Valley, Cal., has been totally destroyed by fire. Insurance of $4,000 was carried. The citizens contemplate the erection of a larger and more efficient plant.

The burning of the electric sub-station at Reno on January 14th left the city in darkness. Fuel was very scarce at the same time, and there was a probability of the water supply being turned off. The burned transformers, switchboards, etc., will be replaced as soon as possible.

Engineer Clark has presented a report to the Water Board of Portland, Ore., outlining a plan for the installation of an electric pump, with capacity of elevating 500,000 gallons a day to the Heights. The cost is estimated at about $6,050. A second 12-inch pipe line at a cost of $19,200 and the purchase of site and construction of a reservoir at a cost of $9,550 are also recommended.

Plans have been completed by the Navy Department for a central electric power plant at the Puget Sound navy yard, at Bremerton, Wash. It will be built by contract, largely, at an estimated cost of $308,000. A.

PERSONAL.

Fred W. Godfrey has been appointed district manager at Cincinnati of the Bryan-Marsh Company. Mr. Godfrey for the last two years has been traveling out of Chicago.

George Glass, the manager of the Citizens' Telephone Company of Pekin, Ill., has declined the offer of a western telephone company to become its manager and will remain at Pekin.

A. V. Schroeder, manager of the Utilities Company at Decatur, Ill., has tendered his resignation, to take effect on March 1st. Mr. Schroeder will be succeeded by W. H. Owens, formerly manager of the Madison County Lighting Company at Edwardsville, Ill.

Theodore P. Shonts of Chicago has resigned as chairman of the Isthmian Canal Commission and, it is understood, will become president of the Interborough-Metropolitan Company of New York—the Belmont-Ryan syndicate, that controls the subway and elevated-railway systems of Greater New York.

President J. C. Fish of the National Electric Lamp Association came to Chicago last week to attend the Chicago Electrical Show, and was in nearly constant attendance at the booth of the National Electric Lamp Association, at the Coliseum, where lamp men were as thick as the traditional leaves in Vallombrosa.

State Representative Eugene C. Hultmann of Quincy, Mass., consulting engineer for the Boston Elevated Railway Company and auditor of the West End Street Railway Company, and Miss Elizabeth Blake, daughter of Judge H. S. Blake of Helena, Mont., were married January 15th at the home of Dr. and Mrs. Herbert Nichols in Chestnut Hill, Boston.

Mr. L. E. Holderman, superintendent of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., attended the convention of the Northwestern Electrical Association at the Coliseum last week and "took in" the Electrical Show. Mr. Holderman is especially interested in demonstrations of this kind, his company being the first in the smaller cities to attempt a similar show, last year, which proved popular with the public and profitable to the company. The new primary battery being exploited by a company formed in

Fond du Lac and for which the inventor claims great things, is still being tested, but nothing startling has yet developed.

Charles D. Walcott, director of the Geological Survey, has been elected secretary of the Smithsonian Institution by the board of regents. Dr. Walcott is a geologist and paleontologist of recognized distinction. He has been director of the Geological Survey since 1894 and secretary of the Carnegie Institution since 1902. He is a member of the National Academy of Sciences and of the American Association for the Advancement of Science, and is the author of important scientific works.

Readers of the Western Electrician will be interested in the accompanying portrait of Mr. D. McNicol, the author of the serial on "Wireless or Radio-telegraphy" now appearing in the Western Electrician. Mr. McNicol is a young man, having been born in Canada in 1875. Nevertheless his practical experience in telegraphy has been varied and extensive, for he was a telegraph messenger at the age of 12 and an operator at 15. His writings, therefore, are not alone those of a student—which he is—but of a practician as well. For 10 years the young telegrapher was engaged in the service of the Canadian Pacific "Soo" system, rising from night operator to manager of the head office in Minneapolis. For four years he was in the office of superintendent of telegraphs of the Northern Pacific Railway at St. Paul. More recently he became connected with the Postal Telegraph-cable Company, and is at present manager of the important office at Salt Lake City, Utah. For years Mr. McNicol has been interested in "wireless," while he has not neglected other topics of railroad and telegraph administration. In September, 1901, he lectured on "Wireless Telegraphy," with practical demonstrations, at the annual meeting of the Northwestern Railway Club in St. Paul, and in February, 1905, at the meeting of the Northwest Railway Association, he read a comprehensive paper on "The Principles of Signaling and the Importance of Signal Protection in Railway Operation." This paper was appreciatively discussed by a number of the prominent signal engineers of the Northwest. Mr. McNicol also demonstrated his study of the large problems of railroading by his paper of June, 1905, before the Iowa Railway Club at Des Moines, on "Some Considerations of Operation Involved in Changing from Steam to Electric Power on Railroads." He has of late become an esteemed contributor to the technical press, and in former articles as well as in the present serial readers of the Western Electrician have benefited by his experience.

D. M'NICOL.

PUBLICATIONS.

A new booklet entitled "Just a Few Condulet Suggestions," issued by the Crouse-Hinds Company of Syracuse, N. Y., contains 23 diagrams which will prove of value to the electrical trade. The wide application of condulets is certainly interesting. This is only one of several pamphlets recently issued by the company.

The Minneapolis Steel and Machinery Company, Minneapolis, Minn., has issued a new and very attractive catalogue treating of the Munzel gas engine and gas producer. It is replete with information descriptive of the engine and producer, which is the invention of Max Munzel, managing director of the G. Luther Company, Brunswick, Germany. The Minneapolis firm takes pleasure in announcing it has secured the drawings and exclusive rights to manufacture in America the engines referred to. A saving of from 50 to 75 per cent. in fuel over that of any gasoline or steam plant is what the company claims is possible with its Munzel outfit. The catalogue, which is a fine piece of work, contains a large number of half-tone engravings and diagrams which show up to advantage the component parts of the machinery.

"Electrical Instruments—Type Designation" is the title of a booklet just issued by the Wagner Electric Manufacturing Company of St. Louis. It is well worth reading. Beginning with a general introduction on the subject of instruments, the reader is invited to consider, in order, principles of operation, housings or cases, flush type of instruments, damping, special instruments, series transformers for instruments, potential transformers, portable instruments, etc. The illustrations, although small, are excellent, and in 20 3½ by six-inch pages much valuable information is condensed. The conclusion relates to the guarantee—"most liberal on the American or European market"—given with Wagner instruments. The booklet is to be commended as a valuable contribution to the high-class technical-commercial literature of electricity.

MISCELLANEOUS.

On February 8th a meeting of the New York section of the Illuminating Engineering Society will be held in the Edison Auditorium, 44 West Twenty-sixth Street, New York, for the election of officers of the New York section for the ensuing year. Thomas J. Litle, Jr., of the Welsbach Company, will present a paper on the "Photometry of Incandescent Gas Lamps."

Chicago Sanitary District trustees have just received the report of the engineering commission appointed a month ago to examine the strength and durability of the waterpower-development improvement being constructed at Lockport and Joliet. In nearly every instance the expert commission refutes the charges made by city officials of Joliet that the work is improperly done and unsafe. The only criticism offered by the commission in its report is in regard to the gravity wall, which it recommends be re-enforced and strengthened. In regard to the other walls constructed, it is found that the seepage complained of is not dangerous and that the fear in regard to the foundations is unwarranted. A number of minor repairs are recommended in several of the walls, and the work is now being done, having previously been ordered by Chief Engineer Randolph.

The Year Book of the Electrotechnic Club of Fort Wayne, Ind., for 1907, neatly printed, has made its appearance. The object of the club is the interchange of ideas in "the science and practice of design, manufacture and sale of apparatus and appliances used in the electric arts." Many instructive lectures have been delivered before it. Many, perhaps all, of its members are connected with the Fort Wayne Electric Works. E. A. Barnes is president and W. A. Braun secretary.

TRADE NEWS.

In accordance with custom, the salesmen of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., were called in annual session at the general offices of the company on December 28, 1906. These meetings continued for a period of about 10 days and were highly instructive both from the points of view of the salesmen and the engineering force. The various pieces of "S-C" apparatus were thoroughly discussed. A sales campaign was outlined for 1907 and much enthusiasm was expressed by all present. The meetings were conducted by Sales Manager J. P. Cracraft.

On account of the great increase in demand for the staple specialties manufactured by the Chase-Shawmut Company of Newburyport Mass., and the consequent need of more room and machinery in its factory, it has sold out its entire patented theater-switchboard interests to James S. Pennefather of New York. The Chase-Shawmut Company asks for Mr. Pennefather a continuance of the liberal patronage heretofore bestowed upon itself. With more space and machinery, the Chase-Shawmut Company is better equipped than ever for giving prompt attention to the orders it may receive.

BUSINESS.

The Frederick Pearce Company of 18 and 20 Rose Street, New York city, noting that about a year ago it purchased the business carried on by the Willyoung & Gibson Company, New York city, announces that it is now ready to turn out in its own shops a full line of electrical and scientific instruments of precision of the highest grade and best design possible in the present state of the art. The company invites the patronage of engineers and scientists generally and wishes the names of all such on its catalogue-mailing list. The Pearce company has also had for some years a department dealing in general electrical supplies of all kinds.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 15, 1907.

841,105. Recording Signal Transmitter. Rollin A. Baldwin, New Haven, Conn., assignor to the Baldwin & Rowland Switch and Signal Company. Application filed November 10, 1905.

This signal transmitter has a pair of coaxial contact wheels by means of which their relative movement is effective to transmit a signal. Two ratchet wheels are secured to contact wheels with feeding and locking pawls co-operating with the ratchet wheels, and a pair of solenoid magnets operatively connected to the feeding and locking pawls.

841,168. Annunciator for Hotel Letter Boxes. Frederick Muschenheim, New York, N. Y. Application filed September 8, 1906.

The device is a combined letter box and annunciator for hotel use.

841,186. Alarm Signal for Boilers. Hermann Sandvoss, Neuss, Germany. Application filed February 23, 1906.

An attachment for a boiler having two concentric tubes, immersed in the water of the boiler, is described. The inner tube contains mercury with electrical contacts which complete the alarm circuit on rise of temperature. There is also a steam connection which operates electrical contacts, which in turn give the alarm on rise of pressure.

841,188. Device for Detecting Subterranean Waters. Adolf Schmid, Berne, Switzerland. Application filed October 14, 1904.

The device is a combination of a spool made up of a winding of annealed iron wire, the turns of which are separated electrically one from the other (the circuit of the winding being electrically open at all times) with a feebly magnetized needle rotatably mounted in the proximity of the spool.

841,215. Electric Regulator. William S. Andrews, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 5, 1902.

A circuit making and breaking device consists of a magnet, a divided or two-part armature therefor carried by a piece of sheet metal under tension, and co-operating contacts, one fixed and the other secured to the piece of sheet metal at a point between the divisions or parts of the armature, the latter contact being movable in response to movement of the armature.

841,226. Electric Time Switch. James M. Chappel, Dallas, Tex. Application filed April 25, 1905.

Features are an electric switch, a spring-arm fixed at one end and having its opposite end pivotally connected with the movable part of the switch and provided with a detent intermediately of the ends, and an intermediately pivoted lever having a notched end to be engaged by the detent to hold the spring-arm under tension. The switch is actuated by a clock mechanism at a predetermined time for releasing the lever.

841,232. Electric Rheostat. William F. Dana and Henderson W. Knott, New York, N. Y. Application filed July 26, 1905.

In this rheostat there is a series of resistances composed of graphite and clay, alternating with interposed metallic contact plates, the surfaces of which are sufficiently recessed to receive and rigidly hold the resistances in superficial contact, and to protect them from shock or other external injury.

841,233. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 23, 1904.

In a telephone system, the combination with a telephone line, of a cord circuit to establish connections therewith for conversation, a line relay and a line signal, the tip line conductor branching to the tip contacts of the spring-jacks and to one side of the line relay.

841,234. Rotary Switch. Frank C. De Reamer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1904.

A snap switch with a U-shaped spring contact is described.

841,244. Listening Apparatus for Telephones. William W. Grigsby, Lawhon, La. Application filed June 12, 1906.

In listening apparatus for telephone exchanges are a movable contact carrier and contacts arranged to be successively engaged thereby and connected in circuits that are inductively related to the telephone line, in connection with a telephone receiver electrically connected to the movable contacts.

841,257. Control of Alternating-current Motors. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 9, 1905.

In combination with a compensated series motor for alternating currents there is a local circuit comprising the motor armature and a source of voltage of proper phase for producing in the local circuit a current for producing a commutating field in the regulation and control of the alternating-current motor. (See cut on next page.)

841,270. Electric Motor Drive. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 21, 1904.

A differential booster driven by a shunt motor has its shunt field connected directly in shunt to its armature and adapted to raise the voltage impressed on the motor up to a certain limit as the load on the motor increases. (See cut on next page.)

841,292. Telephone System. Alfred H. Weiss, Evanston, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 3, 1904.

Characteristics of this invention are a magneto-signaling generator at the telephone sub-station and a relay at the central office adapted to be actuated by current from the generator.

841,339. Incoming Trunk Line. Howard M. Post, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 14, 1906.

There is in combination with a trunk line a cord circuit at the A exchange to connect with the outgoing end thereof, and a called subscriber's line terminating at the

B exchange with which its incoming end is adapted to be connected. A supervisory relay is associated with the cord circuit energized over a circuit local to the A exchange when a connection is made with the trunk line.

841,344. Sectional Pole for Telephone, Telegraph and Trolley Wires. Henry M. Sciple, San Francisco, Cal. Application filed February 10, 1906.

The pole sections are formed with angle irons with the angular portions projected inwardly, the members being converged in an upward direction and separated by intervening spaces. A cap plate fits the upper end of the pole and provides means for attachment of wires.

841,377. Electric Signal for Speaking Tubes. Charles M. A. Costello and Frank H. Hart, New Haven, Conn., assignors to C. Cowles & Co., New Haven, Conn. Application filed August 24, 1906.

In connection with a speaking tube an electric bell is used for signaling.

841,380. Wireless Telegraphy. Lee De Forest, New York, N. Y. Application filed August 27, 1906.

An electrical oscillation selecting device comprises a vessel, a filament sealed in the vessel, a source of electric current connected in series with the filament and a means for varying the amplitude of the current whereby the device is rendered selective of electrical oscillations having a given electrical frequency.

841,397. Trolley Head. Otto Hoffmann, Berlin, Germany. Application filed August 22, 1905.

An auxiliary wheel mounted on a clamp-like yoke on the axis of the trolley wheel is one feature.

Direct Line General Telephone Company, San Francisco, Cal. Application filed August 30, 1901.

The following instrumentalities are described in combination: A source of electrical energy, a telephone instrument connected with one pole thereof, a switching device, means for connecting the telephone instrument with the switching device whenever such instrument is taken down for use, and means controlled by the switching device for making connection between the other pole of the source of energy and another line leading to the selected station.

841,491. Telephone. Fred Edwards, Jefferson, Iowa. Application filed May 9, 1905.

In a telephone having an independent transmitting circuit there is the combination of a switch in the circuit automatically cut in when the receiver lever is at its lower limit of movement and capable of being manually cut out when the receiver lever is in its elevated position.

841,497. Automatic Trolley Base. Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. Application filed November 23, 1905.

A pivoted trolley pole has a swivel plate supporting the trolley pole and toggle levers to hold pole in straight position when the trolley pole is depressed below its dropped position.

841,543. Dynamo-electric Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1905.

The machine is of the commutator type. It has a slotted armature core and two parallel windings are carried in the slots at equal distances from the periphery of the armature core, each winding being connected to alternate commutator segments and the windings having coil widths differing from each other by the distance between adjacent slots.

841,544. Alternating-current Motor. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 25, 1905.

Features are a slotted armature core, a commutator carried thereby, a plurality of independent windings distributed in the slots, each slot containing coils belonging to a plurality of the windings, and leads from the coils to successive commutator segments, these leads being so connected to the coils that the phase of the induced voltage at each lead corresponds to the angular position of the commutator segment to which it is connected.

841,557. Automatic Electric Fire Alarm. William G. Meddings, Remuera, near Auckland, New Zealand. Application filed March 6, 1906.

In an automatic electric fire alarm there is a disk or piece of metal made of a mixture of bismuth, tin and lead, which will soften in a temperature of 150 degrees Fahrenheit. The softening of this mixture opens the circuit and actuates the alarm.

841,566. Sparking Plug for Explosion Engines. Israel C. Orswell, Amesbury, Mass., assignor to the Orswell Igniter Company, Boston, Mass. Application filed January 25, 1906.

A spark plug carries sparking electrodes and has a non-magnetic metallic casing containing an induction coil, to the secondary of which the electrodes are connected, the casing having its walls cut away at separated intervals lengthwise the axis of the coil.

841,572. Process of Preparing Carbon for Electrical Resistances. Edward G. Rivers, Richmond, England, assignor of one-half to the Electric and Ordinance Accessories Company, Ltd., Birmingham, England. Application filed December 22, 1905.

The process of preparing carbon for electrical resistances consists in mixing powdered carbon with an alkaline silicious agglutinate and setting and hardening the resultant paste by subjecting it to a high temperature.

841,579. Aerial Transportation System. George G. Schroeder, Washington, D. C. Application filed May 16, 1904. Renewed June 25, 1906.

One claim describes an electric system of transportation consisting of an elevated track passing waystations and having a trolley-wheel guide located below the track and braking devices located at the waystations below the track and trolley-wheel guide.

841,583. Marine Electric Wharfage. George G. Schroeder, Washington, D. C., assignor to the Industrial Transportation Company. Application filed February 28, 1905. Renewed June 25, 1906.

A marine wharfage system consists of a track extending from the shore out over the water, a carrier adapted to travel upon the track, current wires following the track and adapted to supply electric current to the carrier.

841,599. Combined Dynamo-magneto Ignition Device. Joshua A. Struthers, Youngstown, Ohio, assignor of thirty-four one-hundredths to W. R. Beard, seventeen one-hundredths to J. Howard Parker, and twenty-four and five-tenths one-hundredths to C. F. Duchanois, Youngstown, Ohio. Application filed August 10, 1906.

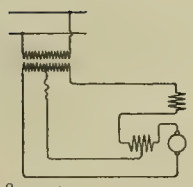
This electric-spark generator is the combination of a dynamo comprising permanent magnets, field coils and a revolving armature carrying a friction disk, of a governor comprising an electromagent and armature and electrical connections, whereby a portion of the current generated passes directly to the igniter, while another portion is shunted through the field coils and electric connections between the magnet and the brushes, and between the magnet and the field coils whereby the magnet will be energized when the current in the field coils is unduly increased, to attract its armature and cut out the field coils.

841,607. Railway Signaling Mechanism. Edwin J. Adams, Waco, Tex. Application filed May 3, 1906.

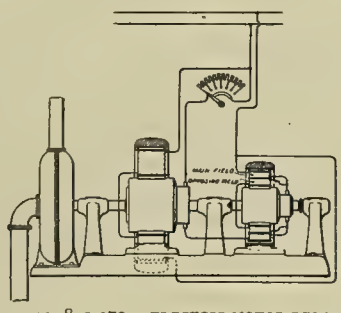
The system is a combination of circuit-controlling devices arranged along a railway track with a fixed contact-maker having a number of independent contacts in electrical connection with the controlling devices.

841,609. Motor Winding. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 23, 1903.

A winding for a multispeed alternating-current motor has its conductors connected so as to form three or more groups, in one of which the direction of current flow is the same for all speeds of the motor and in others of which the direction of current flow is the same for some of the speeds and reversed for the remaining speeds, and means for changing the relative connections of the several groups for the different speeds.



NO. 841,257.—CONTROL OF ALTERNATING-CURRENT MOTORS.



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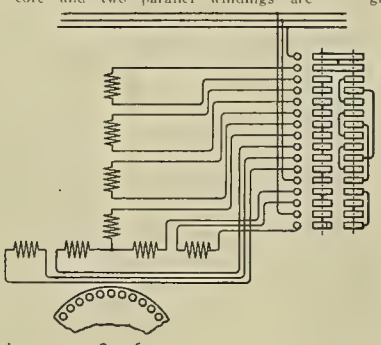

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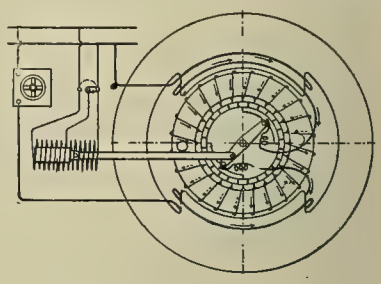

NO. 12,595.—ALTERNATING-CURRENT MOTOR.

841,399. Compound Telephone. Carl G. F. Holmgren and August E. Brahm, Stockholm, Sweden, assignors to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. Application filed August 24, 1906.

A receiver, a microphone and a handle bar connecting the receiver and the microphone are in combination. There is an imperforate cover in front of the diaphragm of the microphone.

841,407. Electrical Switch. John A. Kennedy-McGregor, Birmingham, and Harry Wren, Bexhill, England, assignors to Harry William Cox, Nottingham, England. Application filed August 18, 1905.

This is an electrical switch provided with a spring so that on movement of the operating lever quick action will be given to the connecting bridge of the switch.

841,435. Swivel Truck for Electrically Propelled Cars. Daniel M. Pfautz, Germantown, Pa., assignor of one-half to William H. Tigerman, Philadelphia, Pa. Application filed June 1, 1906.

In an elevated-railway system there is a car having on its roof a swivel truck, comprising two superposed disks, the upper disk adapted to carry the axles and driving wheels of the car, and the lower disk adapted to carry the car and having brackets surrounding the upper disk and carrying rollers engaging the upper disk. The brackets and rollers in conjunction with the upper disk are adapted to support the lower disk and car.

841,438. Electromagnetic Apparatus. Armin H. Pikler, Montclair, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed April 30, 1906.

In an apparatus of the class described patent is allowed for the combination with a core and windings thereon of clamping frames for the windings. Brackets are adjustably supported by the core, and connections between the brackets and clamping frames are provided.

841,449. Fuse Box. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 21, 1903.

The bottom of the box is provided with integrally formed supports, in combination with enclosed fuses resting upon the supports.

841,467. Trolley. Joseph Tetlow, Saco, Maine, assignor of four-fifths to Herbert R. Jordan, Saco, Maine. Application filed January 19, 1906.

This is a trolley wheel having side members provided with chambers having insulating bushings mounted therein and terminating above the bottoms of the chambers and having their adjacent ends spaced apart from each other, the bushings being provided with oil cups.

841,476. Electric Calling Apparatus for Telephones. Charles Adams-Randall, New York, N. Y. Application filed December 22, 1903.

There are two independent local circuits, one of the local circuits including an electromagnet, an induction coil having its primary connected in the local circuit not including the electromagnet and having its secondary connected to line, and a resilient vibrator arranged to make and break the local circuits alternately. A suitable receiver in the line circuit is arranged to control the local circuit at the receiving end, the local circuit including a suitable call receiving apparatus.

841,478. Secret-service Telephone System. Albert K. Andriano, San Francisco, Cal., assignor to

841,610. Alternating-current Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 9, 1905.

This motor has a distributed winding with a number of coils in a phase which, divided by the number of poles, gives a quotient having a remainder. The coils forming the remainder are distributed among a portion of the poles and all the coils are connected in the circuit. (See cut.)

841,640. Method of Harmonic Selective Signaling. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Original application filed April 17, 1905. Divided and this application filed August 0, 1905.

A method of selectively ringing telephone bells is described. The bells respond only to certain frequency of current which is sent over the circuit.

REISSUE.

12,595. Alternating-current Motor. Robert Lundell, New York, N. Y. Application filed September 29, 1906.

This is an alternating-current motor having a stationary field magent and an armature of the ring or drum type, the coils of which are connected to a commutator, and means for causing the armature to rotate from the propelling effect of the torque. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 21, 1907:

419,618. Electric Railway System. T. E. Adams, Cleveland, Ohio.
419,633. Galvanic Battery. W. Burnley, North East, Pa.
419,642. Insulator for Electric Wires. I. P. Connog, Philadelphia, Pa.
419,645. Telephone Circuit and Apparatus J. N. Culbertson, Buffalo, N. Y.
419,660. Electric Commutator. L. Gutmann, Fort Wayne, Ind.
419,661. Dynamo or Motor. L. Gutmann, Fort Wayne, Ind.
419,662. Electric Commutator. L. Gutmann, Fort Wayne, Ind.
419,663. Method of Producing Alternating Electric Currents. L. Gutmann, Fort Wayne, Ind.
419,664. Alternating-current Motor Regulator. L. Gutmann, Fort Wayne, Ind.
419,673. Electrical Railway System. T. H. Hicks, Detroit, Mich.
419,674. Shield or Protector for Electric Conductors of Combined Gas and Electric Fixtures. J. C. Hillings, Boston, Mass.
419,709. Electric Railway System. C. Richter, Camden, N. J.
419,710. Electric Protective System. A. C. Robbins, Brooklyn, N. Y.
419,727. Method of Treating Secondary Battery Plates. C. Sorley, New York, N. Y.
419,728. Electrode for Secondary Batteries. C. Sorley, New York.
419,730. Galvanic Battery. L. T. Standley, Brooklyn, N. Y.
419,731. Portable Faradic Battery. L. T. Standley, Brooklyn, N. Y.
419,740. Electro-thermal Current Regulator. F. C. Wagner, Ann Arbor, Mich.
419,753. Electric Locomotive. W. H. Darling, New York, N. Y.
419,774. Galvanic Battery. W. E. Irish, Cleveland, Ohio.
419,776. Electrical Clock. A. P. Jones, Cleveland, Ohio.
419,808. Electric Motor. L. S. White, Waterbury, Conn.
419,841. Electric Railway. M. W. Dewey, Syracuse, N. Y.
419,862. Secondary Battery. J. F. Mehren, Chicago, Ill.

WESTERN ELECTRICIAN

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Inland Empire Electric-railway System in the State of Washington.

By Frank C. Perkins.

The accompanying group of illustrations depicts clearly some of the buildings and equipment of one of the most interesting electric-railway systems in the United States, the Inland Empire Electric Railway System of Washington.

The Spokane and Inland Empire Railroad Company was organized in the state of Washington, to own, construct and operate electric properties, owning two valuable power sites on the Spokane River and also a franchise for the distribution of electricity. It has also acquired the Spokane Traction Company, which operates in the city of Spokane and also the Spokane Terminal Company, owning freight yards, passenger and freight terminals and rights-of-way in Spokane.

The Inland Empire System also has acquired the holdings of the Cœur d'Alene and Spokane Railway Company, which operates an electric railway between Spokane, Wash., and Cœur d'Alene and Hayden Lake, Idaho, as well as the Spokane and Inland Railway Company, which is building an electric railway between Spokane and Colfax, Wash., and the city of Moscow, Idaho.

An electric power development of between 20,000 and 30,000 horsepower is owned by this Inland Empire System, the two power sites being on the Spokane River, one at Nine Mile Bridge, now being developed, and the other, the "Bowl and Pitcher," at the city limits.

The Nine Mile Bridge power plant has a capacity of 12,000 horsepower, and it is stated that the location is ideal on account of the canyon's narrowness and rocky formation at this point. There is a lake made by the dam which is useful for regulating the flow of water. This lake is about five miles in length.

Until this power development is completed electric power is obtained from local power circuits under a 10-year contract. This electric power is to be used as auxiliary to the main power stations when the latter are in complete operation. The price paid for electric power is said to be $20 per horsepower per year for 24-hour service.

The frequency-changing station shown in one of the illustrations of the accompanying group supplies current to the Spokane and Inland Railway and the other lines, and is located at Spokane on the former line. The booster sets in this sub-station are used in connection with the storage-battery plant and the direct-current machines. These motor-generators, the motor-driven exciter sets and main motor-generator sets, together with the switchboard equipment, were constructed by the General Electric and Westinghouse companies.

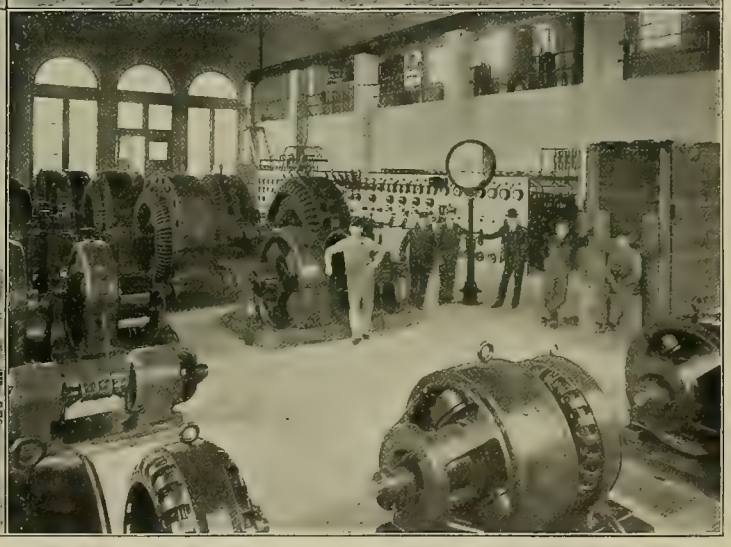
There are four main motor-generator sets in this station, with three machines mounted on the same base. These sets include a direct-current shunt-wound generator, utilized in connection with the storage battery to take off peak loads, the same as in standard direct-current practice.

The 60,000-volt high-tension oil switches are located in the gallery, the main switchboard being used in operating the four 1,000-kilowatt motor-generator sets of the frequency-changing station. There are panels also on the main switchboard, with apparatus for handling the storage-battery current in connection with the direct-current machines to control the peak loads.

In the rotary-transformer sub-stations used on the Cœur d'Alene and Spokane electric railway there are also storage-battery plants for regulation purposes and also for controlling the peak loads, and employed also in emergencies in case of accident or trouble on the alternating-current system. In these sub-stations the rotary converters employed are of 200 kilowatts and 400 kilowatts capacity, the usual electric-railway practice being employed in connection with these installations.

The current is conducted along the lines by overhead feeders and tapped in to the overhead-trolley wires in the usual manner. In the case of the passenger trains ordinary trolley poles are used to take the current from the trolley conductors, but on the electric freight locomotives special collecting devices are employed, in addition to the usual trolley pole, which is also provided on these electric locomotives.

The electric locomotives used for freight hauling on the Inland Empire System is shown in an accompanying illustration, two being used in pairs for long and heavy trains. Each of these electric freight locomotives weighs 50 tons and develops 600 horsepower. It is maintained that on the Cœur d'Alene and Spokane electric railway one of these units hauls 1,080 tons with ease up a one per cent. grade, utilizing direct current. On the Spokane



Spokane Passenger Terminal and "Shoshone Flyer."
Electric Locomotives Coupled Together for Heavy Work.
Freight Terminal at Spokane.
Frequency-changing Station at Spokane, Showing Booster Sets and Motor-driven Exciters.
INLAND EMPIRE ELECTRIC-RAILWAY SYSTEM IN THE STATE OF WASHINGTON.

and Inland division, with alternating current, it is stated that one unit will handle 315 tons on a two per cent. grade.

There are six of these high-power electric locomotives for use on the Spokane and Inland Railway. This portion of the Inland Empire System extends in a southerly direction from Spokane to Spring Valley Junction, where the road branches, the western division extending into Rosalia and Colfax, and the eastern division to Oakesdale, Garfield and Palouse. The road, when completed, will have a total mileage of 113 miles, the eastern division being extended from Palouse to Moscow, Idaho.

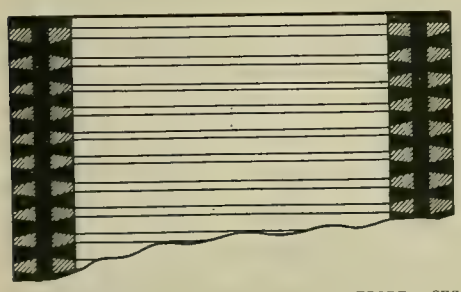
At Spokane the freight terminal used by the Inland Empire System includes a building 300 feet long and 40 feet wide, the terminal yard being 300 feet wide and 2,000 feet long and connected by transfer tracks with the Great Northern yards on the north and the Northern Pacific yards on the south.

Every morning the "Shoshone Flyer" carries its passengers from Spokane to Cœur d'Alene, a distance of 34 miles, in less than one hour. The "Red Collar" steamer leaves from this point for Harrison, where many make connections for the Cœur d'Alene mining country. The "Shoshone Flyer" is shown in the picture of the Spokane passenger terminal, which is located at Lincoln Street and Main Avenue, and is used by all of the lines of the Inland System. The building cost $110,000 and is 160 feet long and 50 feet wide, finished in golden oak, with native marble trimmings. The executive offices of the Inland Empire System are located in this building.

Spokane has a population of 85,000, with real estate worth $15,000,000 transferred in one year and $13,000,000 expended in buildings in the last six years. Great opportunities for these electric lines are claimed.

Storage Battery with Cylindrical Electrode.

A new storage battery, invented in France, presents some points of difference from the usual



STORAGE BATTERY WITH CYLINDRICAL ELECTRODE—SECTIONAL VIEW.

types of accumulator. Instead of a flat plate, Mr. Mouterde, the inventor, uses a cylindrical form of electrode, which, after some experimenting, he succeeded in making on a practical scale. The cell is made up of a series of concentric cylinders, and this construction, it is said, prevents the buckling of the plates, and gives a much more solid construction, while the battery is less liable to get out of order, and the efficiency of the cell is said to be higher. Owing to the fact that the electrodes do not change in form, they can be brought much closer together than usual, thus lessening the internal resistance of the cell.

As shown in the sectional view, the electrode is formed of a cylinder of lead of some thickness and any desired diameter and length, within reasonable limits. Grooves are cut in the cylinder on a lathe, so that its surface presents a series of grooves along its entire length. The annular grooves are spaced the proper distance apart, and one of the essential points lies in the fact that they have a dovetailed section, in order to keep the active matter well in place. The grooves can be made in one side or both sides of a given cylinder, according to the position it occupies in the cell. When the cylinder has been cut on the lathe, the paste of active matter is applied and is well pressed into the grooves, so as to fill them completely, and then the surface is evened off. As the paste hardens it is firmly held by the metal, and cannot fall out. In the drawing the thickness of the lead and also the angle of the dovetail is exaggerated for the sake of clearness, but in reality the active surface of the peroxide is greater than is shown here, as the dovetails are cut just sufficient to hold the matter in place. The internal web of the lead cylinder is much thinner in proportion to the total thickness.

It is said that a cylinder made in this way, even when of light form, is much more solid and less liable to buckling than an ordinary plate. In practice the cell is made up of a certain number of cylinders like the above, which are placed concentric, so as to occupy but little room, and thus form a round cell. Three concentric cylinders are used to form the negative series of the cell.

A like arrangement is used for the positive set of cylinders. There are two of these, corresponding to the spaces between the negative set; and the positive cylinders are attached in concentric fashion to a three-arm spider, which acts as a support for them and allows them to hang down in the cell, giving but a small space between positive and negative matter, and thus gaining in efficiency. Many variations can be used in the manner of mounting a cell of this kind, and the number of electrode cylinders, their length and diameter, etc., depend upon circumstances. A hole in the bottom part of the cell enables it to be washed out without dismounting the elements.

End of the Chicago Electrical Show.

The second annual Electrical Show in Chicago came to an end on Saturday night, January 26th. The scene was one of great enthusiasm, for while the band played "The Star Spangled Banner" and "Auld Lang Syne," the thousands who were present joined in singing the words, while the blowing of horns and the ringing of bells added to the volume of sound. Confetti and torn-to-bits "electrical literature" was showered on the heads of the throng. The closing took the form of a good-natured carnival of merriment, but there was no objectionable disorder.

It is estimated that 105,000 people actually attended the show, the largest day's attendance being on Edison Day, when 12,000 visitors were present.

"The show was a gigantic success," said Manager Homer E. Niesz, "not only by reason of the large receipts but because of the results obtained by the exhibitors, all of whom have reported large business." Mr. Niesz states that already one-half of the space has been contracted for next year's show, which is scheduled to open on January 13th and close on January 25, 1908. Furthermore, applications have been received from several companies for two and three times the amount of space occupied by them this year, which fact goes to prove the value of the show as a business builder.

A new departure in connection with next year's show has been determined upon in the matter of providing and installing all booth and electrical work for exhibitors by the Exposition company, thereby saving exhibitors a great deal of time, trouble and expense. The Electrical Trades Exposition Company proposes to include in the price for space all of the following items: Booth railing, floor covering, sign, furniture, wiring for one light for each 20 square feet of floor space, connection to mains, inspection fees, lamps, electricity for lights, janitor service and labor for placing exhibits on space and unpacking them. Any railings, decorations or signs owned by exhibitors will be erected by the Exposition company free, if in accordance with the rules and regulations of the company. Any additional wiring for electric signs or other electrical apparatus or devices will be done by the Exposition company at actual first cost.

The price of space has been fixed at $1.50 per square foot, including the various accessories referred to above.

The show which has ended has been the means of promoting good fellowship among electrical men besides being a benefit along educational and business lines.

Following is an additional list of names of electrical men who called at the booth of the Western Electrician during the last days of the show:

Chicago—Forée Bain; W. S. Houston, Chicago Brass Co.; Charles E. Coleman, Eugene Munsel & Co.; S. A. Dinsmore, Dinsmore & Lawton; Richard L. Kimble, Central Electric Co.; C. F. Kowalski; Charles Schretter; G. W. Kauser, L. V. Capek, Gray National Telautograph Co.; Rudolph Basse, electrical contractor; Charles A. Griswold, Blickensderfer Co.; Frank T. Heffron, Corwin Telephone Manufacturing Co.; J. C. Bennema; W. W. Berger, electrical contractor; Arthur J. Drebing; Fred M. Ludwig; Sam Du Vries; O. R. Erwin, Erwin & Co.; Ellis V. Gustavson; B. L. Akins; Clarke H. Methot; H. B. Radford; Frank J. Lewis, Indiana Car and Equipment Co.; J. H. Hazzard; A. B. McCollum; J. M. Daniels, Adams & Westlake Co.; George H. Zimmerman, Chicago Telephone Co.; B. D. Thompson; A. S. McKee, Tipless Lamp Co.; Neil C. McLean, Western Electric Co.; Nels C. Benson, Western Electric Co.; C. Faris, Rock Island Railroad; Edward V. Stark, electrical contractor.

Colorado—Paul F. Krier, Pueblo and Suburban Traction and Light Co.

Connecticut—Charles N. Thorpe, Franklin Electric Manufacturing Co., Hartford.

Illinois—J. R. Staley, Electric Light and Power Co., Joliet; A. B. Gichenour, Chicago Insulated Wire Co., Sycamore; William J. Cathn, electric light and waterworks, Glen Ellyn; H. R. Means, Saybrook Telephone Exchange, Saybrook; A. J. Lundberg, electrical contractor, Riverside; Anthony O. Pihl, electrical supplies, Evanston; Carl A. Latham, C. & A. Ry., Bloomington; J. J. Flynn, Bloomington; A. D. Kelley, Wheaton; W. J. Savidge, Macomb; T. H. Cassidy, West Pullman; S. N. Burch, Clyde; A. F. Palmer, Rock Falls; F. Pavlik, Jr., Winnetka; Kenith C. Holman, La Grange; Ren. Kingsley, Blue Island; G. W. Colman, Harvey, Owen Fallows, Plainfield; Fred P. Story, Joliet; William Barron, Plainfield; N. M. Snyder, Kankakee; J. T. McIntosh, Savanna; Vincent J. Kraft, Oak Park; George W. Fischer, Bloomington; James Hyman, Jr., Harvard.

Indiana—E. T. Hollingsworth, Marion Light and Heating Co., Marion; Evan Shelby, Sterling Electric Co., Lafayette; L. M. Gillespie, E. E., Marion; A. M. King, electrician, Indianapolis; Fred Eich, electrical contractor, Plymouth; Alpha H. Kling, manufacturers' sales agent, Peru; J. D. Sinnott, E. E., Notre Dame; M. H. Moss, Logansport.

Iowa—Gus Scherling, Iowa State College, Ames; H. A. Zinn, Ansonia Electric Light and Power Co., Ansonia; W. E. Nims, electrical supplies, Cedar Falls; J. C. Miller, Rudolph Meyer, Bryan and Roosevelt Telephone Co., Littleport; H. G. Prickett, Tama; Charles F. Luce, Logan; Harry B. Acott, Iowa Telephone Co., Clinton; Gus Lundgren, Cherokee Electric Co., Cherokee; L. I. Hicks, Ames; A. T. Pentzel, Davenport; Rolland S. Wallis, Ames; Fred L. White, Traer; E. C. Hunt, Belle Plaine Electric Co., Belle Plaine; J. A. Innes, Citizens Light, Heat and Power Co., Eagle Grove.

Michigan—Chris J. Litscher, Illinois Electric Co., Grand Rapids; A. J. Dunn, Citizens Light Co., Battle Creek; C. R. France, Sterling Electric Co., Escanaba; H. C. Clark, electric light plant, Hillsdale.

Minnesota—H. B. Kline, electrical contractor, Winona.

Missouri—William A. Koeneman, Guarantee Electrical Co., St. Louis; J. P. Casey, Commercial Electrical Supply Co., St. Louis; H. S. Janes, Bluff City Telephone Co., Hannibal.

Nebraska—James Carr, Wolf-Lovett Electrical Co., Omaha; G. W. Johnston, Western Electrical Co., Omaha; D. McNeil, Chadron.

New York—Albert M. Kinsley, Oneida Community, Ltd., Oneida.

Ohio—E. G. Garber, Theo. L. Garber & Son, Belleville; Arthur C. Pletz, National Machine Tool Co., Cincinnati; Ray H. Manson, Dean Electric Co., Elyria.

Wisconsin—R. H. Kreutzer, Milwaukee Electric Construction Co., Milwaukee; A. D. Alt, Mondovi Electric Light Plant, Mondovi; Fred Hollister, Delavan Light and Power Co., Delavan; G. H. Kordendt, electrician, Grand Rapids; Charles Arnesen, Milwaukee; T. B. Cook, Milwaukee; La Rue H. Stark, Delavan; Walter A. Matteson, Delavan Light and Power Co., Delavan.

FIG. 1. NEW POWER HOUSE OF PEOPLE'S LIGHT, HEAT AND POWER COMPANY, SPRINGFIELD, OHIO.

Notes.

One of the busiest men at the electrical show was Henry F. Frosch, assistant to Managing Director Homer E. Niesz. The exhibitors united in praising the manner in which Mr. Frosch fulfilled his duties. Mr. Frosch looked after the wants of thousands of people and came out with flying colors.

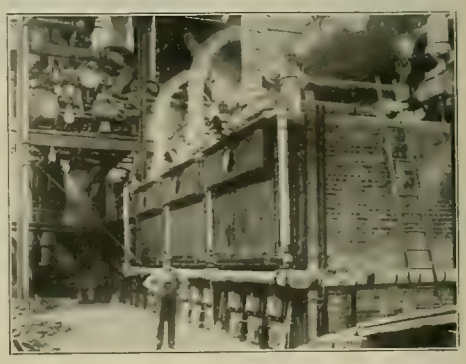


FIG. 2. BOILER ROOM IN SPRINGFIELD POWER HOUSE.

Charles R. Macloon, the press representative of the Electrical Show, also received many congratulations for the able manner in which he handled his work.

The winners in the guessing contest of the total number of paid admissions to the Electrical Show, from January 21st to January 25th, inclusive, which was held at the booth of the Simplex Electric Heating Company, were announced by Mr. Homer E. Niesz at nine o'clock on Saturday evening, January 26th. The actual number of persons who paid admissions during that period was 46,163. Eight thousand guesses were received, Miss Anna

M. Kollertz winning first prize on her guess of 46,107. The winners and prizes were as follows: First prize, Miss Anna M. Kollertz, one five-pound iron; second, Mrs. H. S. Ballinger, heating pad; third, M. Buxhaum, water heater; fourth, Mrs. Rose H. Cunat, curling-iron heater. Much interest was manifested by all who took part in the contest.

A favored few were given copies of The Jovian Bulletin, published now and then in the interest of the Order of Rejuvenated Sons of Jove. Some of the bulletins contained interesting accounts of rejuvenations held recently in various cities. Wednesday, January 16th, was Jovian Day at the Chicago Electrical Show.

The Daily Electric City was printed daily in the space occupied by the Chicago Edison Company on a new Miehle press, which was continually surrounded by interested spectators. The press was electrically driven. The daily, edited by Herbert Alden Seymour, was bright and clever, with Ralph Wilder's cartoons and many instructive squibs about exhibits and exhibitors.

New Power Station of the People's Light, Heat and Power Company, Springfield, Ohio.

By Norman G. Meade.

The rapid progress made within the last few years in the design and construction of light and power stations is aptly illustrated by the new power house of the People's Light, Heat and Power Company at Springfield, Ohio. The building is of fireproof construction and exceedingly well lighted and ventilated. The exterior is illustrated in Fig. 1, which shows the front facing on West Jefferson Street. A spur from the Pittsburg, Cincinnati, Chicago and St. Louis Railroad enters the building, providing a means for delivering coal on cars directly in the boiler room, which is illustrated in Fig. 2.

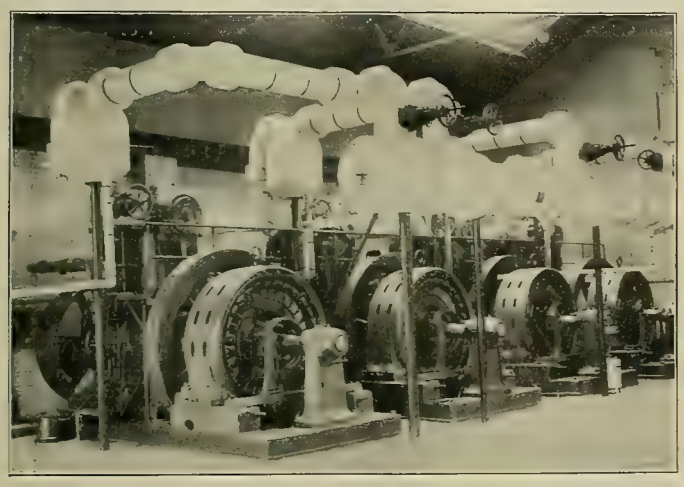


Fig. 3. Engines, Generators and Piping.

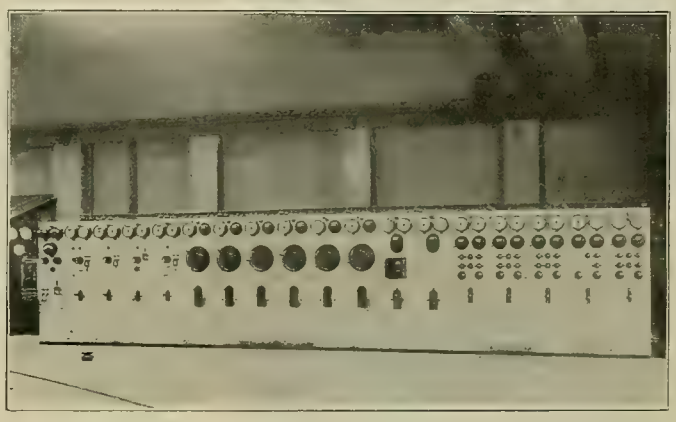


Fig. 4. Switchboard.

VIEWS IN POWER HOUSE OF PEOPLE'S COMPANY, SPRINGFIELD, OHIO.

Four Heine safety boilers of 450 horsepower each furnish steam at 150 pounds pressure to four Westinghouse automatic compound non-condensing engines of 400 horsepower each with cylinders 16 by 27 inches and 16-inch stroke, turning at 257 revolutions per minute—which operate four Westinghouse 250-kilowatt engine-type revolving-field two-phase 60-cycle 2,200-volt generators, shown in Fig. 3. Excitation is furnished by two 25-kilowatt 125-volt direct-current Westinghouse generators direct connected to two Westinghouse Junior automatic engines of 32 horsepower each, with eight by seven-inch cylinders.

The switchboard, shown in Fig. 4, which was furnished by the Westinghouse Electric and Manufacturing Company, is constructed of white Italian marble and consists of 18 panels, as follows: One double exciter panel, on which are mounted one voltmeter, two ammeters, two field rheostats, two double-pole knife switches and a voltmeter plug; four generator panels, provided with two ammeters, field switch, rheostat, type D oil switch and voltmeter receptacle; six feeder panels, on which are mounted an ammeter, single-phase integrating wattmeter, Stillwell regulator and type J oil circuit-breaker; two power panels, each provided with two ammeters, a polyphase integrating wattmeter and type F oil switch; four standard constant-current regulating transformer panels. A swinging bracket is provided on which are mounted two voltmeters and one synchroscope. This, with a Tirrell regulator, completes the switchboard equipment.

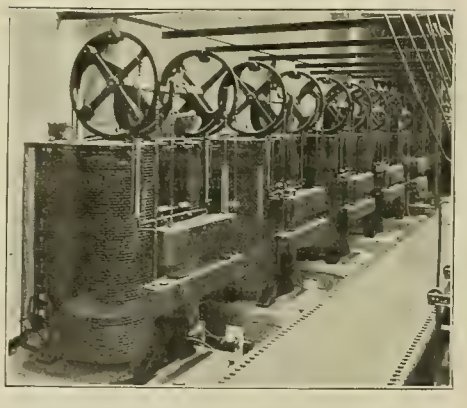


FIG. 5. FIVE REGULATING TRANSFORMERS IN SPRINGFIELD POWER HOUSE FOR ARC LIGHTING.

Immediately behind the switchboard are placed five Westinghouse 100-light two-circuit air-cooled constant-current regulating transformers (Fig. 5), 2,200 volts primary, which furnish current for 378 Westinghouse seies alternating-current arc lamps for street lighting, the People's Light, Heat and Power Company having the contract for lighting the streets of the city.

The Westinghouse lamp is of new design throughout and contains many excellent features that materially affect its regulation, durability and convenience in handling. It has a differential control, the arrangement of the series and shunt windings and cores giving close regulation from the beginning, with full length of carbons to the cutting out of the lamp with carbons exhausted. The binding posts, switch, cut-out, gas check and adjustments have all received careful attention.

Fig. 6 is a reproduction of a photograph at a street corner in the residential part of Springfield, showing method of lamp suspension.

Aside from the city lighting, the People's company does a large commercial business, furnishing current for Nernst, incandescent and multiple arc lamps and motors. It is the successor of the Springfield Light and Power Company and is capitalized at $2,000,000. The officers are: President, John L. Zimmerman; vice-president, L. M. Ferguson; secretary, John K. Henry; treasurer, W. W. Keifer; manager, Charles S. Kay; superintendent and chief engineer, B. H. Clingerman. The rate for all-night street arc lighting is $73 for each lamp per year.

FIG. 6. LAMP SUSPENSION IN SPRINGFIELD, OHIO.

The entire equipment of the power house is striking in its uniformity, which is a great contrast to older stations, where many different types of machines are generally found, each performing its particular work.

Electrical Salesmen's Association.

The second annual convention of the Electrical Salesmen's Association was held on January 24th at the Grand Pacific Hotel, Chicago, about 50 members attending.

The afternoon was devoted entirely to business matters. At six o'clock dinner was served, after which many interesting papers were read and a general discussion on "Which Is the More Important, the Salesman or the House?" was taken up.

The following are the names of the officers elected for the ensuing year:

President—C. A. S. Howlett, Chicago.
Vice-president—J. Robert Crouse, Cleveland.
Secretary—Francis Raymond, Chicago.
Treasurer—Arthur Jones, Chicago.

Chairmen for the various committees were appointed as follows: Executive, C. A. S. Howlett; membership, J. S. Corby; co-operative, J. R. Crouse; general advancement, E. W. Kearnes; financial, Vincent Gray; auditing, E. W. Kearnes.

J. Robert Crouse read an instructive paper on the relations of salesmen to the Co-operative Electrical Development Association. Thomas G. Grier spoke in an interesting manner on the duties of salesmen, forcibly outlining the importance of integrity. Others who made speeches were C. A. S. Howlett, Francis Raymond, N. C. Cotabish, George H. Erich and Mr. Evans of the Moneyweight Scale Company.

A meeting will be held at the same place on February 23d for the purpose of submitting to the committee a new set of by-laws, which, it is expected, will be ready for distribution in five weeks' time. Dinner will be served, after which a number of papers will be read and matters of general interest discussed. It is important that all members be present. Further information can be had by addressing the secretary, Francis Raymond, Old Colony Building, Chicago.

Students from Ames, Iowa, on Tour.

Headed by Profs. F. A. Fish and Adolph Shane, a party of students of the Iowa State College of Ames, Iowa, consisting of 15 seniors of the electrical engineering course, has just completed a tour of the principal electrical plants and factories manufacturing electrical apparatus in Chicago and Milwaukee. The trip was timed to enable the students to visit the Electrical Show at Chicago. In this city the plants visited included those of the Commonwealth Electric Company, the Western Electric Company, the Kellogg Switchboard and Supply Company, the Automatic Electric Company and the Metropolitan West Side Elevated Railway Company. In Milwaukee the students were also given an insight into up-to-date methods of manufacturing electrical apparatus, spending the better part of a day in the plants of the Allis-Chalmers Company and the Cutler-Hammer Manufacturing Company. In addition to the professors named, the party consisted of F. A. Skelley, H. L. Walters, J. A. Moorehead, Paul Whallon, G. T. Grove, E. A. Cameron, L. J. Hicks, L. E. Trotter, H. G. Semmons, R. S. Wallis, F. L. Tunis, W. A. Suaveley, C. J. Stahl and H. H. Henningson.

An Electrostatic Machine Proposed for Industrial Use.

The characteristic feature of all electrostatic machines is that the electricity they produce is at high tension but of low current strength. If the output of a static machine could be made to equal that of any kind of small voltaic cell, it would obviously become a useful agent. Suppose, for instance, a machine could supply electricity under a pressure of 200,000 volts with a current of two amperes; its output would represent a power of 400 kilowatts or 536 horsepower.

The powerful machine invented by Armstrong, which consists of a veritable steam boiler resting on insulated supports, will no doubt be recalled by readers of the Western Electrician. In this machine the steam, after traversing some cotton, causing it to assume a globular form, issues through narrow orifices. Owing to the friction against the walls of the tubing the steam is electrified, its charge being deposited on the collecting combs on which the steam globules are condensed. Such a machine will give sparks of an enormous length. But owing to the smoke and steam which it gives out, and which eventually interfere with the operation of the machine, it has never been of practical service.

The Wimshurst machine on the other hand is free from these drawbacks, and provided it be fitted with metallic sectors will be charged automatically after two or three turns of the crank, even in moist or hot weather. This machine, as is well known, mainly consists of two plates placed in front of each other and rotating in opposite directions. These plates are generally made of glass or ebonite. On both sides of the horizontal axis are placed two collectors, while a rod carrying two brushes is arranged obliquely before the front plate and another similar brush-holder placed at right angles to the former behind the other plate. The initial charge is yielded in the case of machines without sectors by the friction of the finger against the plate, and with sector machines merely by the friction of the brushes. The strength of the discharges is increased by Leyden jars suspended from the collectors.

The working of these machines is fitly illustrated by the following method suggested by Dr. A. Breydel in a French contemporary.

Suppose the perimeters of the plates to be developed in two parallel lines (A) (B) and (C) (D), Fig. 1. (A) (B) will represent the two brushes of the front holder and (C) (D) those of the other brushholder, while the two collectors are denoted by (P) and (N).

Respective charges are indicated by the conventional signs, as is the direction of motion of the plates. The working principle of this influence machine will be understood by simple inspection of the figure.

The power of this machine, i. e., the product of its electromotive force by the current, is found

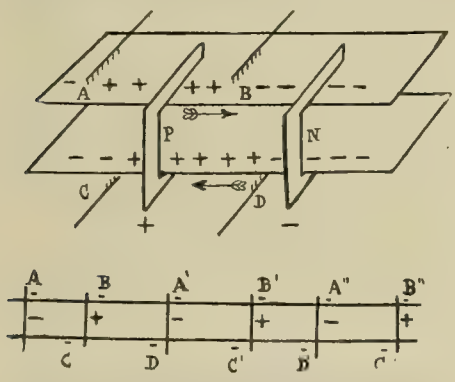


FIG. 1. DIAGRAM OF ARRANGEMENT OF STATIC MACHINE PROPOSED FOR INDUSTRIAL USE.

to be constant up to a maximum speed, which is about one turn of the crank per second. The question is how to augment the current strength and to reduce, if necessary, the electromotive force. This problem has been apparently solved in a simple manner by Dr. Breydel, thus making the electrostatic machine fit for industrial use by multiplying the number of brush-holders and collectors and by connecting the latter up in series.

In the machine constructed by Dr. Breydel the plates are made of a metallic framework lined with thin glass plates, thus allowing of its being given high dimensions and great solidity.

Tests have shown the electromotive force actually to remain constant for a given distance of the brushes, while the intensity is proportional to the number of collectors assembled in series. If the same distance were to be left between the brushes the diameter would obviously be augmented proportionately to the number of additional brush-holders. If, on the contrary, the dimensions of the plates were not to be augmented, the distance between the ends of two subsequent brush-holders should be diminished.

Experiment goes to show that the current is proportional to the number of collectors assembled in series, while the electromotive force is divided at the same ratio, without necessitating any alteration in the dimensions or in the amount of work required to maintain the proper tension.

The arrangement of the front plate is shown in Fig. 2. As the voltage of this machine is proportional to the distance between the brushes, and the current to the number of collectors, this machine may be utilized whenever a moderate current in connection with an electromotive force of, say, 10,000 volts is required. An ordinary machine of the Wimshurst type will, for instance, give 200,000 volts with two brush-holders and only 10,000 volts with 20 brush-holders, while on the other hand the current yielded will be multiplied at the same ratio. Provided the diameter of the plates be augmented—for example, to two meters—it is said a really commercial machine will be obtained.

If now a greater number of plates, say 20 plates, be combined in a single machine, the output will be increased in proportion.

The inventor seems to feel confident that his machine may take the place, in some cases, of

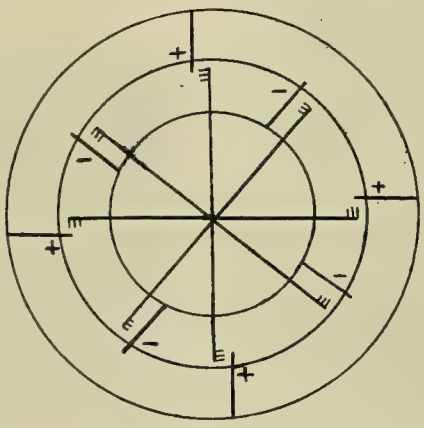


FIG. 2. ARRANGEMENT OF FRONT PLATE OF STATIC MACHINE.

dynamos, in which a given electromotive force cannot be exceeded. The machines can be readily operated by hand or by quite a small motor. They can also be made to work as motors; in fact, by connecting the two poles of a Wimshurst machine to the terminals of another machine of the same type the charges that are given off by the former will cause the latter to turn around as soon as the first machine is rotated.

Considering other possible applications, the inventor suggests that when utilizing the machine as a motor it may be actuated by means of either underground or atmospheric electricity. Thus, he says, that if at a given point at the surface of the earth (T) Fig. 3 be connected to a cable kept at a given altitude, a continuous succession of electrical emanations will be obtained at the end (T), even in the calmest weather. Any given layer of atmosphere will in clear weather be at a potential which is the higher as the altitude is greater. It is said that observations have shown the existence of potential differences as high as 50 to 200 volts for each meter of level difference. Kites or captive balloons cannot, it is true, be always resorted to to keep the end of the cable at the required height.

Underground electricity may, however, be used, it is thought, by employing carefully insulated cables which are immersed in a deep pit. A similar distribution of electricity will be observed in the underground strata of the earth, the potential decreasing proportionally to the depth. The emanations observed at the point (T') will, however, be different from those formerly noted at (T), in that the latter are due to positive electricity and the former to a charge of negative electricity. When connecting either (T) or (T') to a static machine, the rotation of the latter, theoretically at least, may be continually utilized.

A possible use of the apparatus as a source of electricity is in the production of ozone. Dr. Breydel has even designed a novel type of ozonizer for use especially in connection with this apparatus.

Another machine based on the same principle consists of two cylinders rotating in opposite directions. The current output of this apparatus is proportional to the length of the cylinder generator and to the number of brush-holders and

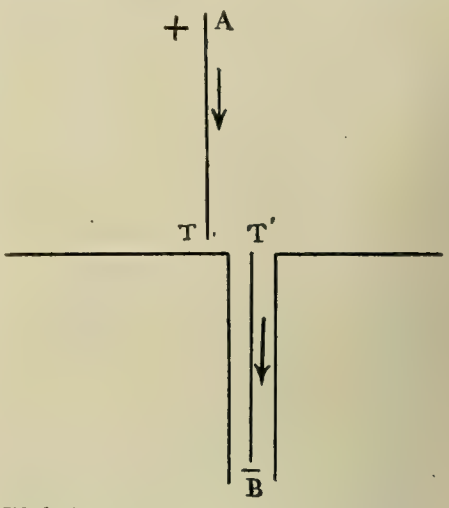


FIG. 3. DIAGRAM OF CONDUCTORS FOR OVERHEAD AND UNDERGROUND ELECTRICITY FOR STATIC MACHINE.

collectors, while the voltage is proportional to the distance between the ends of two brush-holders. The power of this machine is obviously proportional to the diameter and length of the cylinders.

G.

Electricity and Moving-picture Machines.

Insurance companies are paying some attention of late to the hazards of moving-picture machines, on account of fires that have occurred from this source. Those devices operated electrically are considered the safest. The arc is maintained by means of carbon pencils as in an ordinary arc lamp. Both direct and alternating currents are used for this purpose. The following suggestions are offered by the underwriters for the installation of the machines operated by electricity:

Appliances.—The knife switch, fuses and resistance coils should be substantially and securely mounted as far from the film-magazine as practicable, so that in the event of an arc occurring at switch-blade contacts, or should the enclosed fuse—which is the only type allowable in connection with this outfit—inadvertently burst through the cartridge and throwing out melted metal, or again should heat of undue intensity be produced by the regulating coils connected in circuit with the arc lamp, there will be no danger of either the film taking fire or of excessive heat having any effect upon the contents of magazines. The bases of the knife switches should be mounted on slate or marble, and have at least four supporting screws. Measuring on surface of the base, there should be at least one-half inch space between head of the screw or washer and nearest contact. The current-carrying wires should be soldered to switch terminals, whether the switch is furnished with lugs or otherwise, as this method gives a safer and more satisfactory contact. The construction details of knife switches are set forth in the National Electrical Code and must be closely followed.

Switches must be so arranged that the opening of the switches will cause all wires attached to them to become disconnected from main service, and furthermore, must be installed in an easily accessible place. Single-pole knife switches used for this purpose will not be tolerated by insurance inspection departments.

Cut-out Blocks must be so designed that it will be impossible to place any fuse of a given class into one which is intended for a current or voltage lower than that of the class to which the fuse is standardized.

Fuses must conform in every respect to the measurements given in the table of dimensions appearing in the National Electrical Code Details of Fittings. If cartridge fuse block is set within a metal enclosure, the surrounding atmosphere must note rise to a greater temperature than 125° Fahrenheit without melting the enclosed fuse. It is well to remember that the rated capacity of fuses so installed must not exceed the attainable carrying capacity of rubber-covered wire.

Resistance Coils, where necessary, should invariably be stationary and isolated from inflammable material. They must be treated as sources of heat, and as such will often require the placing of a suitable heat-resisting material between the device and its surroundings. This may be accomplished when installed within metal box if the coils are rigidly suspended from top of booth at rear. and further

THE ELECTRIC STEAM COLOR SCINTILLATOR.—FIVE PLUMES.

protected by securing several plates of tin or sheet-iron around coils with an air space between, taking care that this protection is insulated from the framework, for which purpose the entire resistance box and air plates should be mounted on a slate or marble tablet before being secured to booth. In other words, the attachment of the separating material to its support and to the device must be independent of each other, and this separating material must be continuous between the device and the support; that is, the use of porcelain knobs will not be acceptable. Therefore, the arc-lamp outfit must only be furnished with such regulators as are enclosed in properly ventilated non-combustible material. As a reminder, it may be well to add that incandescent lamps must not be utilized to this end.

All wire employed within booth, for whatever purpose, must have an approved slow-burning insulation and secured in place entirely on insulating supports; that is to say, no portable cord will be permitted within booth unless it is pertinent to a proper connection to the lantern itself.

None other than a competent electrician should be allowed to make an attempt to install the equipment above described, as a majority of fires in the past have occurred from approved devices and material being installed by inferior workmen.

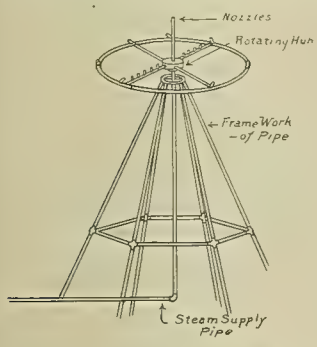
There is much prejudice against both magazines and film boxes, the latter employing an open mechanism with sprockets, and reel hangers attached to winding crank, the film passing into a large metal receiving box, for the reason that the film, while being rolled on the take-up reels, will often generate static electricity and cause sparks to ignite film. Hitherto it has been assumed that this frictional disturbance was encountered only in cold weather, but the late experience of several operators has tended to show that some recent fires, which would not formerly have been attributed to static electricity, have been caused by a static spark during the hot season within a poorly ventilated enclosure. To prevent trouble from this source, an electric neutralizer could be installed in connection with the outfit at minimum cost. The device is simple, can be attached to wall outside of booth and wired from there to the inductor-bars which can be arranged near the film-reel. The principle, well known to electricians, is that of a possible static charge selecting from a pre-arranged neighboring current the small but exact quantity of electricity to neutralize itself.

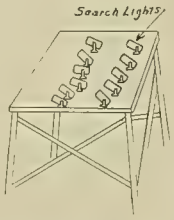
The Electric Steam Color Scintillator.

By L. I. Harris.

One of the most striking of recent inventions in the field of electric display illumination is the "electric steam color scintillator," the work of Mr. W. D'A. Ryan, the well-known illuminating engineer of Lynn, Mass., which is considered by persons acquainted with it to be quite in a class by itself.

This device consists of a bank of powerful naval electric-light projectors or searchlights, arranged in such a manner that the rays of light can be projected in any desired direction, on jets of steam, which are emitted from a series of iron pipes, located at a suitable distance and elevation from the projectors. These projectors vary in capacity and are of different sizes, varying in diameter from about 12 to 30 inches. The former are directed so as to illuminate the jets of steam, where they issue from the pipes, while the larger projectors are pointed upward and cast their light upon the great banks of rolling steam, extending like a canopy above the jets. Mounted in front of each of the projectors are large rotating gelatine screen disks of various colors.





ARRANGEMENT OF ELECTRIC STEAM COLOR SCINTILLATOR.

THE ELECTRIC STEAM COLOR SCINTILLATOR.—REVOLVING-WHEEL NOZZLE.

The steam is generated in a portable steam boiler of any desired capacity, set about 50 or 100 feet from the projector platform, this distance, however, depending upon the relative elevation of the steam nozzles to the projectors. The steam is forced through ordinary iron pipes, of sufficient strength to withstand about 50 to 75 pounds pressure per square inch, which are placed near to, or directly over, the boiler, to which they are connected in such a manner that the steam is forced through several openings or nozzles. Some of these nozzles are inserted in vertical and horizontal pipes, which are stationary, while others are placed on a circular structure of pipework, arranged to revolve by flexible attachment. All of them, however, are located on the extreme top of the structure, and above the steam boiler.

By the manipulation of the projectors and the gelatine disks above referred to there is produced a most remarkable imitation of cloud illumination, embodying all the beautiful characteristics of the natural rainbow and sunset. Sunbursts, pinwheels, waterwheels, snowstorms and various other effects can also be produced by this device, and are extremely attractive, as may be judged by reference to the accompanying illustrations, although these do not show the coloring. Objects can be made to appear or to disappear almost instantaneously, while, on the other hand, they can be made to appear as though dawning and fading, in a most ethereal manner. This can be appreciated while observing a great American flag about 50 feet square, subject to these changes. It is expected that flags of every nation will be exhibited this year at the Jamestown Exposition in this novel manner. The successful operation of this device depends largely upon the artistic taste and originality of the operator, for the way in which the colors blend with and succeed one another is due to the operator's skill.

THE ELECTRIC STEAM COLOR SCINTILLATOR.—FAN NOZZLE.

The most necessary operating condition is a clear atmosphere. From the viewpoint of outdoor illumination, this device may be regarded as entirely unique; and it will probably be the most admired of all the illuminating attractions at the Tri-centennial Exposition, at Jamestown, Va.

The beauties of these superbly lighted banks of clouds will be enhanced by the fact that the eyes of the spectator will be shielded from the glare of the arc and other lamps. All the arcs and the 200,000 incandescent lamps will be hidden from view, and the exposition will appear as if lighted from some unknown source.

THE ELECTRIC STEAM COLOR SCINTILLATOR.—SUNBURST NOZZLE.

Scarcity of Copper.

Representatives of some of the large copper producing companies deny the allegation made to Attorney-General Bonaparte by the Northwestern Metal Dealers' Association that copper is being withheld from the market by a combination of the producers. They also deny that there is any such combination, and one of them said that every pound of copper his mines could produce was sold for months ahead, and he doubted if a carload of copper could be obtained today for immediate delivery. The price of Lake copper is now about 24½ cents a pound.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

WE BEGIN in this issue Mr. Metcalfe's serial on "Elements of Electrical Engineering," which will be found to be a valuable help to all beginners in electrical work, all "practical men" who are seeking a helping hand in technical work and also to many electrical men of general knowledge who may confess a desire to "brush up" on the fundamentals of the subject. The author considers first the elements of electricity, then passes to dynamo-electric machinery, electrical measurements, station and switchboard auxiliaries, central-station design, electric lighting, electric railways, storage batteries, various industrial applications of electricity, electric welding, electric heating, etc. In fact, the whole field of electric light and power is to be surveyed in a series of "practical talks," which, we are sure, will receive a warm welcome from the large class of readers for which they are intended.

WASHINGTON, D. C., would prove an admirable convention city in many respects for this year's meeting of the National Electric Light Association, but inasmuch as last year's convention was held on the Atlantic seaboard, and indeed within 175 miles of Washington by rail, we are persuaded that many central-station and other electrical men from the West who are desirous of attending the convention will find it difficult to make so long a journey two years in succession. If the wishes of the westerners are considered, the principle of rotation between East and West will be observed this year as formerly. And it is to be remembered also that a location in the Middle West is still East to many who would wish to attend. The choice of Washington, like Boston in 1904 and Atlantic City in 1906, would seem to be in the extreme East to all those hailing from beyond the Mississippi.

STREET-LIGHTING posts placed in the center line of streets and boulevards, as advocated in certain cases by Mr. W. E. Daniels in a recent article in the Western Electrician, have not found favor in London, although there appears to be a divergence of opinion on the subject. A row of such standards is in course of erection in Oxford Street between the Marble Arch and Oxford Circus. This has caused the secretary of the Roads Improvement Association to point out that the practice has been condemned by the Royal Commission on London Traffic and that the Borough of St. Pancras has recently, at considerable expense, taken down the central electric standards which were in the street between Portland Road Station and Tottenham Court Road. Thus the highways authorities in London differ among themselves in relation to the subject. It is to be noted, however, that Mr. Daniels proposed the center placing of lamps for drives, boulevards and parkways and not for the thronged streets of business centers.

THEATER WIRING has received more attention in Chicago, since the Iroquois Theater fire, than elsewhere in the United States, perhaps. Readers of the Western Electrician may recall that in the issue of this journal for July 22, 1905, the regulations of the Department of Electricity of the city of Chicago in relation to spread lamps, lens lamps, control of stage flues and theater wiring were given. But now, it appears, the Underwriters' National Electric Association is considering the advisability of promulgating a separate code for theater wiring which shall apply to the whole country. A sub-committee has the matter in charge, and it has advised the adoption of a code embodying specific rules and requirements for the construction, maintenance and operation of electric equipment installed within buildings of the theater class. J. E. Cole of Boston is chairman of this committee, and William Carroll, city electrician of Chicago, and Henry C. Harris, electrical engineer of the Ohio Inspection Bureau of Columbus, are the other members. Mr. Cole has made a special study of the hazard resulting from the improper installation of electric wiring and appurtenances within theaters, and has, since his appointment as chairman of this committee, sought for and received suggestions on this head from every available source. Mr. Carroll has closely followed the theme since the Iroquois Theater fire in Chicago, and has been instrumental in introducing many admirable requirements for the safeguarding of theaters against defective electric installations, which have been embodied in the "Rules and Regulations" of the Department of Electricity of the city of Chicago, as mentioned above. Mr. Harris has had exceptional opportunity of studying this topic, not only in this country, but abroad. Last winter was spent by him in Europe, where the subject was given a thorough investigation. All the theaters in London and many in Paris and other large cities on the Continent were visited and important notes made, which will be of value.

One thing mentioned in the specifications for arc spread lamps in Chicago theaters is that a competent man be provided for each lamp. This might well be copied elsewhere.

ONE THING about the new metallic-filament lamps that is bothering English electrical engineers is that it is not well adapted to the 200 to 250-volt circuits that so many of them consider almost essential to efficient incandescent-lamp operation. Americans, who have in the main remained faithful to the old 110-volt system, are in better position to take advantage of the new high-efficiency filaments. Mr. J. Swinburne, past-president of the Institution of Electrical Engineers, delivered a paper on "New Incandescent Lamps" before that organization in London on January 10th, and he remarked that the metallic filament could only supplant the carbon on the ground of higher efficiency. It was very difficult, he said, to make a small lamp of 200 volts, and the question was whether the higher efficiency of the metal lamp would result in the pressure being brought down to 100 volts or less, or whether the metal lamp could be made to take 200 volts or more, either by further improvement by the use of some sort of transformer, or by using larger lamps, say of 50 candles. In his opinion the ingenuity which had made metal lamps possible was quite capable of making 200-volt 16-candle lamps within a reasonable time. It had been urged that alloys should be used for lamp filaments, but alloys generally had low fusing points, although this was not an invariable rule, and it was possible that alloys might be formed which had very high melting points. Alloying had, however, the possible disadvantage in reducing the resistance temperature coefficient. There was no reason, however, to limit the possible conductors to elements. The Nernst lamp, for instance, was made of oxides.

Professor Gisbert Kapp contributed some interesting facts to the discussion. He said that he had found that the osmium and tantalum lamps had about the same consumption per candle; that is, 1.7 watts. In the case of the carbon lamps, if one raised the pressure four per cent. he increased the light by 25 per cent.; if the pressure was dropped four per cent. the light dropped 20 per cent. Comparing tantalum in that way there was a rise of 18 per cent. and a drop of 20, and in the case of osmium a rise of 22 per cent. and a drop of 18. While the Nernst lamp had its disadvantages, it possessed the great advantage of a very concentrated light and was more efficient than the carbon lamp. If the usual law with regard to the portion of light given out to energy put in were true, then the Nernst lamp ought to give more light than the carbon lamp which took equal power, but it showed a falling off from the law, and this also applied to the metallic-filament lamp. He inferred that the reason was that heat was absorbed by the heating of the spiral, and that therefore one did not obtain light in proportion to the power absorbed.

One noticeable thing about the new tungsten lamps shown at the Chicago Electrical Show was the fact that the units were large, the lamps being of 85 candlepower in the case of one exhibit and 80 candlepower in another. They were connected to circuits of 110 volts or a little less. Each lamp contained five filaments in series, and the lamps were best adapted to burning in a vertical position. The life was variously stated at 700 to 2,000 hours. The fact that this filament seems unable to withstand 110 volts in sizes suitable for 16-candlepower lamps suggests the reflection that possibly the appearance of the tungsten lamp may serve to introduce, or perhaps one should say to revive, series incandescent lighting.

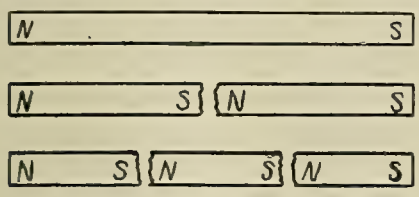
ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

I.—Elements of Electricity.

Its uses have multiplied so rapidly and extended during the last few years into so many branches of industry that electricity has become one of the most important agencies in the industrial field. In the electric-lighting and electric-railway industries alone hundreds of thousands of men are today employed, and the capital invested in these two applications of electricity is exceeded by that of but few other interests in the country.

In view of its widespread use, it behooves even the layman to acquire at least a general knowledge of the principles of electricity, and while much excellent literature on this subject is available for the trained electrical engineer, much less is available to the beginner, due to the fact that such literature is almost necessarily couched in technical language which assumes a certain familiarity with the subject on the part of the reader. In



ARRANGEMENT OF POLES OF BROKEN BAR MAGNET.

this series of articles it will be attempted to discuss and explain, in as simple language as possible, some of the important features of electrical engineering practice, together with descriptions of the construction and design of the machinery and instruments in common use.

In order that subsequent explanations may be intelligible to the beginner, it is necessary to start with the general principles of the science and advance gradually to the practical applications.

Magnetism.

It is probably the general idea that a dynamo or a motor is a highly complicated machine which requires years of study to understand, and while this is true, if we consider it in all its details, it is far from true as regards its general principles. The essential feature of every dynamo or motor is a powerful magnet, and in view of this fact it is necessary, before we can understand the dynamo, to become familiar with the magnet, which is the foundation of all dynamo-electric machinery.

The phenomena of magnetism were observed in very early times, and the name magnet is supposed to have been derived from the town of Magnesia, in Lydia, where an ore of iron was found which had the peculiar property of attracting iron. The early Greeks and Romans were also aware that the loadstone or magnetic iron ore, in addition to attracting iron bodies, also endued them with magnetic properties. No special advance was made in the science of magnetism, however, until the invention of the compass, the early history of which is very obscure. This invention has been attributed, on not very authentic authority, to the Chinese, and the earliest mention of it in English writing is about the twelfth century.

It was found that a piece of steel when rubbed by a loadstone acquired the property of magnetism to a much greater extent than the natural magnet, and that the steel magnet retained its magnetism indefinitely—for months and years. For this reason, steel magnets—or artificial magnets, as they are called, in distinction to natural magnets—are always used where permanent magnets are required.

The compass needle is an example of a permanent magnet, and it is well known that one end of the needle always points to the north, and the other to the south. These ends are called respectively the north and south poles of a magnet. If two magnets are brought together, the north pole of one will attract the south pole of the other, but if the two north or two south poles are brought together they will repel each other. From this fact we have the rule: *Unlike poles attract* each other, and *like poles repel* each other.

The action of the magnetic needle is explained by the fact that the earth is a large magnet whose poles correspond approximately to its geographical poles, and the north pole of the earth attracts one pole of the compass needle, and repels the opposite pole of the needle. That pole of the needle which seeks the north pole of the earth is called the north pole, although, as we have seen, unlike poles attract, and therefore the north pole of the needle is of opposite polarity to that of the north pole of the earth, and by some writers has been termed the south pole. All ambiguity, however, can be avoided by considering it as the north-seeking pole.

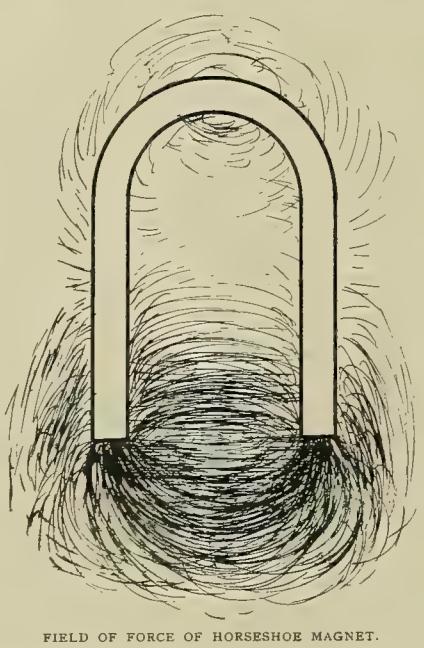
If a magnet be broken into any number of pieces each of the pieces becomes an individual magnet having two poles and the same properties as the original magnet. The direction of the axis between the poles of any piece broken from a magnet will be usually found to have a definite relation to the axis of the original magnet, from which it is concluded that the magnetic action is related to the molecular structure of the metal rather than to the mass of the magnet as a whole.

The Magnetic Field.

In order to explain the action of magnets, a conception of Faraday called the magnetic field is always used. It is well known that a magnet acts upon a magnetic needle brought into proximity to it, and all the space surrounding a magnet in which this action takes place is called the magnetic field. This field is assumed to be filled with *lines of force*, which radiate from every part of the magnet in every direction, and as the field of the magnet may be explored by the magnetic needle, the direction of the lines of force in any part of the magnetic field can be accurately platted.

There is, however, another and very simple method of determining the direction of the lines of force graphically. If a sheet of paper is laid upon a magnet and iron filings are dusted upon it, these minute particles of iron are attracted by the magnet. By tapping the paper on which they lay, the filings will arrange themselves along the lines of force in the plane of the sheet of paper.

A diagram of the lines of force made in this way from a straight bar magnet is shown herewith, from which it will be seen that these lines are more densely distributed about the poles and that they pass in curved lines from one pole to the other. Each line describes a closed curve, some part of which passes through the magnet.



FIELD OF FORCE OF HORSESHOE MAGNET.

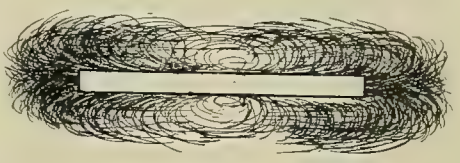
Of course, such a diagram only indicates the lines of force in a single plane, and an infinite number of planes could be taken about the magnet which would show a similar distribution of the lines of force all over the magnetic field. Those lines in the diagram which appear to vanish into space would then be found to be closed curves in some other plane.

If a magnetic needle were brought into the field of the magnet, the needle would be found to take a position coinciding with the lines of force in that part of the magnetic field where it was located. The lines of force from the north pole of the magnet would apparently enter the south pole of the magnetic needle and emerge at the north pole of the needle, finally entering the south pole of the magnet.

There are comparatively few substances which are attracted by magnets, and these are called magnetic substances. These include iron, steel, nickel and cobalt. All other substances, including air, are non-magnetic; but there is no such thing as a magnetic insulator. The attraction of a magnet for a magnetic substance cannot be cut off by interposing any other substance between them. The only way of decreasing the attraction between two magnets, or a magnet and a magnetic substance, is by separating them, and it has been found that the attraction varies inversely as the square of the distance between them.

If the straight bar magnet previously discussed be bent into the form of a horseshoe magnet, the lines of force will be found to follow quite a different path. In this case the great majority of the lines of force will pass in a short path between the two poles. If a keeper of soft iron be placed across the ends of a horseshoe magnet it will be held firmly in position by the magnetism and the lines of force will be very largely confined to the closed metallic circuit through the armature and keeper.

It has been found that blows and jars greatly



FIELD OF FORCE OF BAR MAGNET.

diminish the strength of a permanent magnet, and that its magnetism also rapidly disappears at high temperatures.

Magnetic Induction.

The action of developing magnetism in iron is called magnetic induction. Whenever a piece of soft iron comes within the field of a magnet the soft iron becomes temporarily magnetized, and it is then attracted to the magnet. A south pole will be induced in the part of the iron nearest to the north pole of the magnet, and vice versa, and this temporary magnetism in a piece of iron is capable of inducing magnetism in another piece in turn. This is shown by the experiment of picking up a small piece of iron by a magnet and attaching a second piece to the first one, and so on, adding others successively as long as the strength of the magnet will permit. Each of the pieces of iron in such a chain has a north and south pole induced in it, the north pole of one piece attracting the south pole of the next. If, however, the magnet supporting this chain is separated from the piece adjacent to it, all the other pieces will immediately lose their magnetism and the chain will fall apart.

Magnetic induction is also shown in the case of iron filings placed on a paper vertical to the end of a straight magnet. In this case the filings will stand up like bristles, radiating out from the pole. Each of these minute filings of iron is temporarily a magnet, the induction passing from one particle to the next, and the brush-like appearance of the mass is due to the repulsion between the outside free poles.

It has been explained that a piece of steel retains its magnetism indefinitely. A piece of soft iron, on the contrary, loses all, or practically all, of its magnetism as soon as it is removed beyond the influence of the magnet. Soft iron, however, can be much more strongly magnetized than steel. The harder the steel, the more permanently it retains its magnetism, but the less strongly can it be magnetized.

The strength of a magnet is measured by the number of lines of force per unit area. The best quality of soft wrought-iron is capable of carrying the greatest number of lines of force, and therefore makes the strongest induced magnet. A soft quality of steel comes next, with a value of about 80 per cent. of wrought-iron, and cast-iron third, with about 60 per cent. These three grades of metal are the ones used almost entirely in the design of dynamo-electric machinery.

[*To be continued.*]

Representative Wiley of Alabama has introduced a bill to amend the acts regulating commerce so as to provide that free passes or reduced transportation may be accorded by railroad companies to bona fide members of the Old Time Telegraphers' and Historical Association, and the Society of the United States Military Telegraph Corps whenever they may be attending the annual reunions for the transaction of the usual business or meetings incident to such reunions.

On the Substitution of the Electric Motor for the Steam Locomotive.

The meeting of the American Institute of Electrical Engineers on the evening of January 25th was noteworthy as the first to be held in the new Engineers' Building by the Institute and also as being the occasion of an important discussion of the wide subject of electric railroading.

President Samuel Sheldon was in the chair. Secretary R. W. Pope announced that at the meeting of the directors in the afternoon 104 associates had been elected. Dr. Sheldon announced that a number of members of kindred societies were invited guests at the metting. He also made graceful reference to the new building and to the beneficence of Mr. Carnegie.

The Paper of Stillwell and Putnam.

Lewis B. Stillwell and Henry St. Clair Putnam of New York were the authors of the paper of the evening, "On the Substitution of the Electric Motor for the Steam Locomotive." Mr. Stillwell gave an outline of this long and excellent paper. The purpose of the paper was fourfold: (1) To record certain facts relative to heavy electric traction which have been established by experience; (2) to present calculations of relative costs of steam and electric traction in railway service based upon these facts; (3) to point out the transcendent importance of standardizing electric-railway traction equipment as rapidly as may be consistent with progress; and (4) to raise the question whether a frequency of 25 cycles per second, or 15 cycles per second should be adopted in railway operation by alternating-current motors.

A great deal of valuable information is given in the paper which must be omitted in this brief account of the meeting. But these paragraphs, given under the heading, "General Expenses," may be quoted:

"According to our estimate, if all the railways of the United States were today operated by electricity using the single-phase alternating-current system at the potential adopted for the equipment of the New Haven Railroad, the energy required for operation being developed by power plants such as are today in extensive use and transmitted at potentials well within limits established in practical service, and if the rolling-stock equipment consisted of locomotives and multiple-unit trains fitted with motors and control apparatus no better than the best which now exist, the aggregate cost of operation, which in 1905 amounted in round numbers to $1,400,000,000, would be reduced by about $250,000,000. To accomplish this result, power plants delivering about 12,500,000,000 kilowatt-hours per annum would be required. Assuming the radius of transmission from power houses to be 150 miles, the load factor in railway service should be not less than 0.75, and, taking this figure, it appears that power plants capable of delivering a maximum output of about 2,800,000 kilowatts will be sufficient to operate the entire railway service of the United States as existing in the year 1905. The average output required is about 10 kilowatts per mile of line and seven kilowatts per mile of track."

"While our estimates have led us to the conclusion that, under average existing conditions of railway operation in the United States, improved financial results would be attained by the substitution of the electric motor for the steam locomotive, the immediate and general adoption of the new motive power by our railroad companies is neither possible nor desirable. It requires no argument to demonstrate the wisdom of making haste with deliberation in a matter involving interests of such magnitude as those which are tied up with the transportation systems of the United States. Recognizing the magnitude of these interests, and having in mind the fact that the art of electric traction as applied upon a large scale to heavy train units is yet young, the point which we desire here to emphasize is the necessity of conservative and carefully considered action upon the part of all members of this Institute who may be called upon to advise in respect to the electrification of railways now operated by steam."

Relating to standardizing, the authors thus summarize their conclusions:

"The necessity of proper standardization is obvious. Specifically, it would seem feasible and eminently wise to agree upon standards of practice in respect to the following:

"a. Location of third rail.

"b. Location of overhead conductor used with single-phase alternating-current system.

"c. Frequency of alternating-current traction systems.

"It is equally desirable, but probably less easy, to agree upon a standard system of multiple-unit control for train operation."

As to frequency, the authors say, among other things:

"If it be assumed that one electric locomotive will do the work of two steam locomotives, about 24,000 electric locomotives would be required to take care of the present railway business of the country. Assuming the cost of the average electric locomotive to be $25,000, the aggregate cost of locomotives required would be $600,000,000. Allowing for the increased cost of the 15-cycle transformers, it would seem that the difference in cost of the average locomotive should be not less than $1,000 in favor of the lower frequency, or for 24,000 locomotives $24,000,000. This is more than twice the estimated difference in cost of power-house and sub-station equipment.

"It seems entirely safe to say, therefore, that the aggregate first cost of electric equipment and of steam turbine will be decreased by a change from 25 cycles to 15 cycles. The operating cost will obviously be decreased very materially. At least three-fourths of the above estimated cost of electric locomotives, say, $450,000,000, represents cost of electric equipment. It will be seen, therefore, that of the apparatus which our electrical manufacturing companies may be called upon to furnish, more than 85 per cent. is rolling stock. Obviously, any argument in favor of 25-cycle equipment which may rest upon existence of drawings and patterns and convenience in manufacturing should have comparatively little weight.

"The use of 15 cycles instead of 25 cycles also secures considerable advantage in respect to the overhead-trolley conductor and track return. With a given limit of voltage drop, this advantage may be utilized by reducing size and, consequently, the cost of the overhead copper and the copper used to reinforce the track return.

"Under the plans which we have assumed as a basis of our calculations, the amount of copper required for feeder circuits, trolleys and reinforced track return, estimated at 20 cents per pound, would cost approximately $750,000,000 were the entire railway system of the country as existing in 1905 to be equipped for electric operation."

Discussion (in Abstract).

Frank J. Sprague, New York: I have ventured a few prophesies; these prophesies are now history. The authors ask where, 10 years from now, will be the 600-volt, 1,200-volt or 1,500-volt systems—and I see my initials under all of them—where will they be? Right here; just where the 500 and 600-volt operation of the past 19 years have been, right here. I do not believe you quite appreciate the modest work which is being done today by those who are actively developing the higher tension direct-current work. I do not find it necessary, to come to any conclusions on the electric-railway business, to generalize all the railroads of the United States. I prefer to deal with the living, immediate question. There are now three great trunk-line railroads in New York city which in the near future will be electrified. One of them is developing electrification along certain lines, and the others on somewhat different lines. There has been considerable discussion as to the wisdom of both. I have been guilty of some of the development on one, and I am not ashamed of it. I have criticized some of the development on the other, and I do not know that I am ashamed of that. But, leaving these two out of consideration, where do we need to look for a more typical trunk-line division than the third road, the Pennsylvania, from here to Philadelphia—an engine run, and none other, a more typical trunk-line division in the world. I am going to venture, not a prophecy, but a statement. If that line were called upon to be electrified today, it would not be, in my judgment, overhead single-phase alternating-current equipment, whether 25, 15 or one cycle. It would be a half cycle, and the cycle would be the length of time between two runs. I am going to make a prophecy—that, on a large number of the lines which can by any stretch of imagination be considered as subject to a reasonable prospect of electrification, 1,200 or 1,500 volts will, on any present development known, give better results in every way than alternating current, 15 or 25 cycles, overhead system.

I hope, in the comparatively near future, I may present to this Institute, of which I have had the honor to be president, a few comparative statements on the subject of direct-current and alternating-current operation. I will reserve until that time most of what I have to say.

B. G. Lamme, Pittsburg: As the time is limited, I will confine myself to the question of frequency alone. It seems to me that, considering the total amount involved in the electrification of the railroads of this country, about $1,500,000,000, the problem is big enough to call for a frequency which is best suited for the work. The question is whether that should be 25 cycles or something lower. For instance, with a first-class motor, built for 25 cycles, the operation may be above question, the machine may be considered perfect in its way, but take that same machine and operate it on 15 cycles, you can raise the induction from 25 to 40 per cent., which means that 25 to 40 per cent. higher voltage can be applied at the same speed; you get 25 to 40 per cent. greater output from the same motor, or 25 to 40 per cent. greater tractive effort can be developed. That in itself is a controlling feature in the question. We have verified that by actual test. It may be questioned if 15 cycles is better than 25 cycles, why is not still lower frequency recommended? The answer is that at 15 cycles we can practically saturate the machine, and we gain in efficiency and power factor, but lose in other things, such as the speed of turbo-generators and weight of transformers, so there is some point at which a compromise can be best made, and my opinion has been for a long time that that compromise is below 25 cycles, and should be about 15 cycles. This increased output you can get from a motor at lower frequencies is of advantage, principally in getting a smaller number of motors under a locomotive or car, which cheapens the cost, or you secure a bigger output for a given weight of locomotive.

There is one point Mr. Stillwell has not touched on, and that is the fact that the single-phase series motor can operate on both frequencies, 15 and 25; for instance, a 25-cycle motor will operate beautifully at 15 cycles and at practically the same speed, because the speed has nothing to do with the frequency, and a 15-cycle motor, if well designed, will operate on 25 cycles fairly well, at the nominal capacity, but at slightly reduced capacity will operate very well, so that if a locomotive should be equipped with transformer suitable for operating at 15 cycles, for instance, it could operate on both 25 or 15 cycles very well. By taking 25-cycle equipment, nominally designed for 25 cycles, and putting 15-cycle transformers on it, the equipment is adapted for very good operation on both 25 and 15 cycles. That is important in connection with the fact that 25 cycles will have to be used in a certain number of cases, but in other cases where the generating conditions can be made suitable, 15 cycles will work to advantage.

We have been making tests at East Pittsburg on some electric locomotives at both 15 and 25 cycles, and it is very difficult to determine any difference in the ratio of tractive effort to the weight on the drivers. In some cases the tests are possibly in favor of the 15 and in others in favor of the 25, and the difference is probably no more than would be found in making two consecutive tests at any one frequency.

I will call attention to the fact that quite a number of the European companies have adopted 15 cycles for railway work. The Valtellina plant, put in by the Gans company, with three-phase motors, is at 15 cycles, and I feel safe in saying that a great deal of the success and good operation of that plant is due to the choice of that frequency. I think they could have made the apparatus a success with 25 cycles, but it would have required much heavier equipment, and with poorer efficiency and power factor, especially at low speeds. The Oerlikon Company of Switzerland is going into the single-phase work extensively and has adopted 15 cycles as its standard. The Siemens-Schuckert Company of Germany is also manufacturing series motors and adopted 15 cycles. The Allgemeine Company of Berlin is the principal company which is adhering to 25 cycles, and that is largely due to its type of motor. They have a so-called series repulsion motor in which the characteristic of the motor shows to better advantage if the frequency is not too low. It is not due to the high frequency that they get better results, but due to the fact that the motor should preferably run below the nominal synchronous speed, and that is obtained to better advantage by keeping the frequency up.

Bion J. Arnold, Chicago: About three years ago, when I came to New York from Pittsburg, where I had been examining Mr. Lamme's new single-phase motor and complimenting him on its work, I received a telegram when I got to this city to the effect that the single-phase system which I had been developing for the last two or three years, and which was at that time ready to make its trial run, had been destroyed by fire. I rebuilt the machine and operated it some six months later. That experiment cost me about $50,000, but I believe I was instrumental in advancing the state of the art to such an extent that today two or three of our large railroads are being equipped with the single-phase system—invented by others, to be sure—but I believe forwarded by my efforts some four or five years ago.

It makes no great difference to me personally which system wins so long as we get a system of electric railroading in this country that we can put on our steam railroads and so operate them for less money than we can operate them with steam. That was the principal idea I had in mind in starting out on the single-phase experiment, because in 1898 I was engaged in building the Chicago and Milwaukee electric railway, which, I believe, is considered the pioneer rotary-converter sub-station road in the country, possibly in the world, to be driven by a steam station. I took the risk of putting into practice such a system, took the responsibilities, engineering and financially, of making it go, and it "went." When engaged in that work I felt that was not the complete solution of the electric-railway problem, because the introduction of the rotary-converter sub-station necessitated men in the sub-stations and necessitated more investment than I thought the railroad systems of the country would stand, if they were to be attracted to electrical operation. That started me on the single-phase idea, and, as many of you will recollect, we had various discussions on it, and it was stated it could not be done. I maintained

it could be done and had to be done, and it cost me money to find that out. It has been done since by at least two companies in this country and two or three abroad, and seems to be coming quite rapidly into practice for steam-railroad work.

I do not know that I agree entirely with the author of the paper that we should standardize at once and thereby shut out the utilization of the talent of men who are members of this body and other bodies in this country and other countries, or the prospect of developing something that may prove better than anything we have now. I am willing to concede, if we are going to use alternating-current railway systems, that it is probable that we should adopt a standard frequency, and so far as my investigation has gone, in conjunction with work with Mr. Stillwell—the Erie Railroad work—my own conclusion is to lean toward the 15-cycle frequency, although I do not want definitely to stand on that now. It seems to me it is the frequency we will come to on account of the fact that to get the requisite amount of capacity between the wheels of railway machines, the gauge being limited, it is necessary to get as much motor in there as possible, and we can do that with the alternating current by adopting 15 cycles and get more than we can with 25 cycles. It makes the weight of the machine practically the same as 25 cycles, as it increases the size of the transformer but reduces the size of the motor, and the net weight is the same, but it gets additional power on the machine, and that is what we must get, and we do not get as much power on the wheels with the alternating current as with the direct current. However, I personally believe that some form of high-potential overhead conductor is going to be the final solution of the railway question. I believe in the third rail where it is applicable, but I do not believe there are many places where it is applicable; in other words, I think the legislation of this country will come to a point where they will not permit the use of third rail, at any rate in exposed places, and that being the case I think it is up to the electric-railway men of this country to begin to get ready to take care of the problem when that sort of legislation comes.

W. B. Potter, Schenectady, N. Y.: I most heartily endorse the recommendation of the authors of the paper for a more perfect standardization of the systems and apparatus for railway work. One thing, however, I think we must appreciate, and that is that standards are ordinarily secured where it does not cost anything to bring them about.

There is no question that the motor, limited as it is by the space between the wheels, the car body on the clearance over the track, is the device to which all of the rest of the equipment must be subordinated in order to get the best results. A great deal would be involved in the substitution of 15 cycles for 25. It means considerable increase in cost for the generating apparatus, it means a frequency that would not be suitable for lighting the cars, even, and a frequency which for every other use than the single-phase motor itself, and incidentally the conductor system from the generating station to the motor, would possess no advantage. I do not think, however, that we can look for the ultimate development of the single-phase motor on 25 cycles. We can build, it is true, a motor that has good commutation, but it has a relatively small output for its size, weighing something like 25 per cent. more than the direct-current motor having corresponding capacity. With 15 cycles, with the same degree of commutation, the motor would probably weigh from 10 to 15 per cent. more only. The efficiency and power factor would both be very much the same.

Mr. Stillwell made some mention of the maximum available tractive effort as between 25 and 15 cycles. Mr. Lamme also spoke of some tests they made in the same connection. The tests which we have made indicate that, assuming the tractive effort to be 100 per cent. for direct current, on 25 cycles it varies from 80 to 90 per cent., and on 15 cycles from 70 to 80 per cent. There is in this connection, however, a fact of interest—that when the motor with direct current slips, the torque is maintained uniformly, the wheel rotates rapidly and the torque falls off immediately to something like 20 or 30 per cent. of the maximum. In alternating current, whether on 25 or 15 cycles, although the wheel slips at a lower point, it only falls off something like 10 or 15 per cent., due to the fact that the slip is a series of progressions or jerks which allows the wheel to grip the rail, so that after the wheel has once slipped it may take hold of the rail and have a higher maximum pull than before it first slipped by reason of having cleaned the rail off, which is a condition you do not get with direct current. The average drawbar pull after slipping with alternating current is perhaps 70 per cent. greater than it is with direct current. Furthermore, except for freight work, where the motor is geared so as to have a high torque per ampere, there is little probability that an alternating-current single-phase locomotive can be built sufficiently light so that anyone need have no fear as to a lack of adhesion on the rails.

The question of 15 cycles is one which, I think, will have to be considered with respect to some given problem, but it does not seem to me that 15 cycles alternating current or 25 cycles alternating current, or 1,200 volts direct current or 600 volts direct current should be required by anybody, any particular one of them, as suitable to meeting every case. Some reference has been made to the high-voltage direct current. We have always looked upon the commutator of the direct-current motor a good deal as the buzzsaw in a sawmill. By the addition of the commutating pole to the ordinary direct-current motor—that is, building the ordinary direct-current motor magnetically of the same character as the single-phase motor—sparking at the commutator may be said to be eliminated. For instance, a 600-volt motor, designed for 600 volts, can be run—I would not say it should be operated, because the insulation is not provided for that—but it can be run at 1,000 or 1,200 volts without showing any sign of arcing over or sparking. A 1,200-volt motor would have reasonably the same margin, so that, so far as commutation is concerned, there has been an improvement made in the direct-current motor that is comparable to the advance made when the carbon brush was substituted in place of the copper brush. That certainly will have more or less bearing upon the continuation of the use of direct current.

W. S. Murray, New Haven, Conn.: I have here accurate figures on the cost of locomotive repairs for steam locomotives extending over a period of exactly one year. It seems that on a freight basis the steam locomotives average 6.68 cents per locomotive-mile. On the passenger basis the cost per locomotive-mile total is 5.6 cents. I thought these figures would give you an idea of what the saving will be under the electric method of train compulsion. The gentleman who spoke just before me gave me as the corresponding figure for the No. 6,000 electric locomotive 1.25 cents when operating, I think, 50,000 miles on the test track, which were very severe conditions.

O. S. Lyford, New York: One of the oldest railroads in the country has proved itself the most progressive and has during this present week put into commercial service an electric traction system which embodies most of the features which the authors have assumed as probable characteristics of the standard of the future. On January 22d the Erie Railroad ran its first electric train into Rochester, N. Y. This consisted of a motor car equipped with single-phase motors and multiple-unit control for operation from an 11,000-volt trolley wire. A pantagraph trolley is used in making contact with a wire supported with steel catenary construction at a height of 22 feet above the track. The 34-mile line is fed from one sub-station, which in turn receives current at 60,000 volts from a power station 90 miles away. The conditions are in many ways almost identical with the assumptions made by the authors. Power is transmitted about 90 miles at 60,000 volts. One sub-station supplies 34 miles of track; 11,000-volt catenary trolley construction is used; there is the single-phase motor, with multiple-unit control. I may say that the operation of the entire equipment was perfect and fully demonstrated the sufficiency and general practicability of the system. On the return trip the vice-president's private car was hauled as a trailer, resulting in a total weight of train 22 per cent. heavier than that for which the motors were designed. This was on an icy, slippery rail. The impression given by the overhead catenary construction is that it is the adequate thing for heavy railroading. An 11,000-volt trolley wire so supported is a safe proposition. The 11,000-volt wires on the car are so short and so well guarded that they are not a source of increased danger and all the other wires, housed in the usual way, and operated at only one-half the usual voltage, are unusually safe. The system is necessarily operated at 25 cycles, as the power comes from one of the Niagara Falls plants, which are all built for 25 cycles. The advantage of the lower frequency is apparent, however. Trucks of unusual size are entirely filled with 100-horsepower motors. At 15 cycles motors of 150-horsepower capacity could be used on the same trucks. The engineering and construction were done by Westinghouse, Church, Kerr & Co., and all apparatus is of Westinghouse make. Mr. Stillwell and Mr. B. J. Arnold are on the electric-traction commission that recommended the adoption of the system.

It seems to me that we as engineers ought not to go into too much discussion of the detail, but to place emphasis on that one great fact, that almost every specific case that can be presented bears out the conclusion of this paper, which is based on the problem of the United States as a whole, namely, that electric traction can be adopted with great advantage by the railroads.

C. L. du Muralt, New York: I have, I believe, some interesting data on the subject of comparing the power and speed characteristics of the different types of locomotives. I have had occasion to make a rather detailed investigation into that subject, and in the course of making diagrams showing the performance of the various locomotives these diagrams seem to show so plainly the superiority of the electric locomotive over the steam locomotive, and more particularly of the three-phase alternating-current locomotive over anything else extant that I really think it may interest you to see what the results were. I believe the great advantage of the electric locomotive lies principally in the fact that it is able to stand great overloads for a great length of time. The curve of the steam locomotive represents practically the maximum output, because the boiler of the steam locomotive cannot for any length of time be forced above its normal rating. An electric locomotive will be able to give for any reasonable length of time, say for one hour, 25 or 50 per cent. overload, or for short times 100 per cent. or more, because it has the great power house back of it and can practically develop unlimited power. The three-phase locomotive can also give this great overload capacity without trouble, and it can give it without any drop in speed.

The greatly increased traffic which the railroads have to handle is forcing us to use as high train weights and high speeds as possible. It is therefore quite natural that that locomotive which combines the greatest speed qualities and at the same time the greatest power in the smallest weight is the one which we want to choose for hauling our future traffic. The electric locomotive is quite surely superior to the steam locomotive in this respect, and therefore should be chosen, no matter whether electric service may cost more than steam service. The three-phase alternating-current locomotive is superior to any other electric motor in this respect, and I believe it should deserve more attention than it has thus far found in America.

A. H. Armstrong, Schenectady, N. Y.: We have outgrown the days of a piece of apparatus having an indicated horsepower capacity under 2,000, having a maintenance charge of 8 or 10 cents per locomotive-mile under the best level-track operation, and double that when the conditions are adverse, and we now have a piece of apparatus that under an endurance test of 50,000 miles has had a maintenance charge of less than 1.5 cents, has a concentrated horsepower of 2,200 and is capable of giving 50 per cent. increase for unlimited periods with forced ventilation. I believe that with the asset we have in the electric locomotive we have reached the day when we can approach big problems in railroading with supreme confidence of winning out over the steam locomotive. In 10 years from now we will still be disputing over the question of frequency—alternating-current or direct-current operation. Looking back on the history of the steam locomotive, we have no standard. You can talk to the representatives of the different roads, the master mechanics and different engineers, and they have their own ideas about various matters in connection with their locomotives, and unless I am mistaken the meetings of our steam-railroad engineering clubs carry the same lack of agreement that we have seen here tonight.

N. W. Storer, Pittsburg: The single-phase locomotive seems to offer the greatest possibilities. In speed characteristics the single-phase locomotive, I am bound to say, pleases me much better than the three-phase for application to electric railways.

The question of frequency is to my mind the most important. Every time the single-phase locomotive comes up for heavy work it very quickly brings up the question of frequency, and it always, or nearly always, works down to 15 cycles, or so it has been the last few months. It is just this: You can get larger motors within the limited space which you have and you can get at least 30 per cent. greater output from your motors with 15 cycles than with 25 cycles. The 15-cycle motor approximates very closely the efficiency reached by the direct-current motor. In power factor it comes very close to the direct-current motor. The question of lighting the cars has come up, and I want to say here, as no one else has, I believe, that you can get very satisfactory lighting with 15 cycles by going to the low-voltage lamp having a heavy filament; a lamp designed for 15 volts will give just as good light and as perfect illumination as the ordinary incandescent lamp on 25 cycles. You can scarcely detect a flicker at all, and there will be no question about the lighting of cars.

William McClellan, New York: I believe firmly that the solution of the railroad problem is going to be by means of the high-voltage overhead-trolley alternating-current single-phase motor, particularly if we can bring the engineers to think that 15 cycles are better than 25.

I see no reason why the train-line should not be standardized and why it would not be possible to have one kind of train line for both systems. Certain things would have to be yielded, but very few. That would solve a great many problems in itself, particularly if the train line could contain the heater and light circuits, making thereby one jumper between the cars to be put in in addition to the air-brake holes. That would solve one large factor in the necessary standardization, and I believe the only standardization that is possible or ought to be allowed at present because anything else would stifle proper advance in the art.

W. I. Slichter, Schenectady: As we go toward heavy railroad work there will be more demand for the lower frequency. A great deal depends on the design of the generating station. The generator itself may increase in cost from 15 to 50 per cent. This is due to the fact that the speed of 15 cycles is going to be somewhat of a

problem in connection with turbine work, whereas with slow-speed engine-driven units it is not so much of a problem. It can increase the transformers by 20 per cent. and bring about a decrease in the distributing system of 10 per cent. There is one point that has not been discussed this evening: Although the output of the motor has been increased 35 per cent—that is the output during acceleration—the continuous output of the motor is not correspondingly increased and for passenger service with long runs and lesser acceleration, not so much is to be obtained by the lower frequency.

Prof. J. B. Whitehead, Jr., of Johns Hopkins University, Baltimore, and Mr. Stillwell closed the discussion.

Strength of Elm, Oak and Locust Insulator Pins.

At the request of certain consumers the Forest Service of the United States Department of Agriculture recently made tests on 53 insulator pins of rock elm, live oak and black locust. The tests were made at the timber-testing station of the Forest Service at Purdue University, Lafayette, Ind. The results indicate the relative strength of the pins tested. They depend upon too small a number of tests, however, to show in an authoritative way the relative value of these woods.

The pins were of standard size, 1¼ inches by 8 inches. The oak pins were from one-eighth to one-quarter inch shorter than the others, and of slightly smaller diameter at the shoulder. Their lever arm was also about one-half inch shorter than in the cases of the other two species.

In testing the pins an iron block was clamped to the fixed upper head of a small screw-testing machine. The pins were inserted to a tight fit in a hole in this iron block, and projected horizontally over the pulling head of the machine. The glass insulator was unable to bear the strain of the wire, so an iron model of the ordinary glass insulator was screwed on the pin and connected by means of a heavy wire to the pulling head of the machine. When a strain was put on this wire the pin acted as a beam fixed at one end and loaded at the other, which is practically the condition met with in practice. The breaking moment (maximum load times lever arm) is taken as a measure of the strength of the pins. The iron block mentioned was used in preference to a wooden cross-arm for supporting the pins for the reason that this iron block forced the pins to break under the test. Furthermore, it furnished uniform conditions for all pins. Thus, the results of the tests do not show the strength of a combination of pins and cross-arm, but they show the bending strength of the pin itself.

The following table gives the results of the tests:

Species	No. of Tests.		Weight of Pin in Grams.	Rings Per Radial Inch.	Breaking Moment (Maximum Load Lever Arm) in Inch-pounds.
Black locust from Boston, Mass.	23	Avg.	106.3	12	3,070
		Max.	119.3	25	5,380
		Min.	86.6	3	2,520
Black locust from Nashville, Tenn.	7	Avg.	125.9	8	4,087
		Max.	147.1	11	4,930
		Min.	111.8	4	3,010
Rock elm from Nashville, Tenn.	8	Avg.	93.8	42	2,512
		Max.	108.7	48	3,150
		Min.	77.5	33	1,450
Live oak from Houston, Texas	12	Avg.	127.1	Not distinguishable.	3,025
		Max.	141.0		4,590
		Min.	110.4		1,990

From the table it appears that the breaking strength of the two shipments of black-locust pins was practically the same, and may be taken as 4,000 pounds. Live-oak pins came next in order of strength, with a breaking moment of about 3,000 pounds. Rock-elm pins were the weakest, having a breaking strength of 2,500 pounds.

The oak pins were the heaviest, the locust next, and the elm the lightest.

The locust and elm pins failed mostly by splitting from the threads to the shoulder, or by tension at the shoulder. Occasionally the portion of the pin inserted in the block failed by shearing horizontally. The oak pins nearly all failed by tension at the shoulder.

In addition to the installation of a 2,000-kilowatt Westinghouse-Parsons turbine in its Beach Park power house, the Lake Shore Electric Railway of Cleveland, Ohio, is planning to rebuild two 400-kilowatt units in this station, substituting alternating-current generators for the direct-current generators now in service. This will eliminate the last of the direct-current type of generators on this company's system.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER VII. (*Continued*).

Syntonic Wireless Telegraphy and Directed Waves.

Alessandro Artom of Italy a short time ago carried on experiments having for their object the limiting of direction of transmitted electric waves. Artom employed aerial wires arranged symmetrically in regard to the predetermined direction of transmission so that they form a downwardly open angle with each other of 90 degrees, each of them being inclined 45 degrees to the horizontal. Screening wires are placed behind each aerial, and Artom asserts that this arrangement permits of the radiation of circular and elliptically polarized waves. Fig. 60 shows a diagram of the Artom arrangement for producing circularly and elliptically polarized electromagnetic oscillations.

Fig. 61 is a diagram of the connections of the aerial system for sending out a compact cone of electromagnetic waves in a predetermined direction.

In Fig. 60 (R) is an induction coil, the primary circuit of which is provided with an interrupter (I). The secondary terminals are connected with the regulation discharge balls (M) (P). A third spark-gap sphere (N) is connected through a suitable inductance or small capacity condenser (C), which is connected with one side of the secondary circuit. These three discharge balls are disposed as the vertices of a right isosceles triangle. By

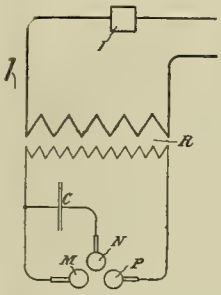


FIG. 60. ARTOM ARRANGEMENT FOR DIRECTING HERTZ WAVES.

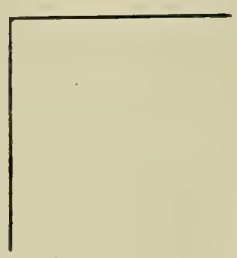


FIG. 63. THEORETICAL PLAN OF MARCONI'S BENT AERIAL.

this arrangement of the spheres circular or elliptical polarization of the electromagnetic waves set up is effected, but in order to transmit these waves into space it is of course necessary to use aerial conductors in connection therewith.

In Fig. 61 four aerial wires are electrically coupled in pairs and these are disposed at right angles to each other. The aerial (14) (15) is connected with the discharge ball (M), and the other and opposite aerial (16) (17) is connected with the ball (P), while the third spark-ball is connected to earth at (E). These aerial conductors are arranged in or near to a vertical plane. The novelty of the Artom arrangement is in the plurality of discharge gaps so disposed that the balls are at the vertices of a triangle. Such arrangement of spark-gaps provides that a "bundle" or cone of electric rays will be transmitted in a direction normal to the plane of the spark balls and to the plane of the aerial employed.

Still another method which has recently been heralded as solving the problem is that of Dr. Ferdinand Braun of Germany. Dr. Braun employs three aerial conductors, as shown in Fig. 62. The radiating antennæ are tuned to the same pitch, but vibrate slightly out of phase. By this means an amplification of the radiation in one direction is obtained and radiation in the direction opposite to that desired is almost completely prevented.

The subsidiary apparatus employed makes it possible to set the wires on poles (1) and (2) into synchronous vibration and to set up a vibration of the wire on pole (3) of the same pitch, but which lags or leads in phase the vibrations of the other two. If we assume the vibration of wire (3) to slightly lag, interference between wire (3) and wires (1) and (2) would take place in the direction from (3) at right angles to the plane containing poles (1) and (2), which in effect is the same as throwing an electrical shadow in that direction.

Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radiotelegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

Suppose, however, the vibrations of wire (3) should lead those of (1) and (2) by a mathematically determined amount, an amplified wave would be sent out in the same direction and a shadow thrown in the reverse direction back of wire (3), and an interference would at the same time be developed on both sides. Provision must be made for accurate timing of the vibration rate of the three aerial wires. Dr. Braun finds it practicable to adjust the time difference within a one-hundred-millionth of a second.

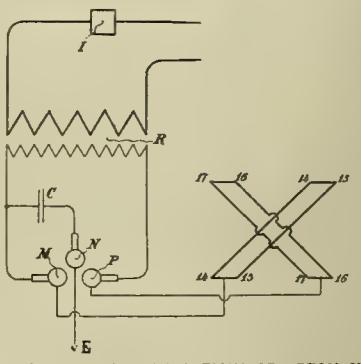


FIG. 61. DIAGRAM OF CONNECTIONS OF ARTOM SYSTEM.

It is evident that the direction of radiation may be altered; for instance, in the reverse direction by reversing the phase relations, or by altering the function of aerial (3) in regard to that of wires (1) and (2), transmission in six different directions is possible, and this could be accomplished without any tearing down or building up of aerial connections, simply by making use in the operating room of the well-known mechanical arrangement known as a commutating switch. Braun's method makes it possible to direct radiation through an angle corresponding to the disposition of the triple aerial, and it would seem feasible to reduce this angle to narrow limits by the addition of more aerial wires connected with the system.

Mr. Marconi's latest efforts in this direction have brought to light a great many new facts concerning the radiation of waves in the ether. A design of aerial conductor recently adopted by Marconi is shown in Fig. 63.

As before stated, maximum radiation is obtained when the maximum amount of the forces concerned operate at right angles. By using the inverted L aerial there is very little diminution of the forces working at right angles to each other, for, as is well known, the upper portion of any aerial contributes very little to the magnetic forces. It has also been observed that the horizontal portion of this type of aerial may be given a slight inclination downward without decrease in effect. In discussing the operation of the bent aerial, Fleming

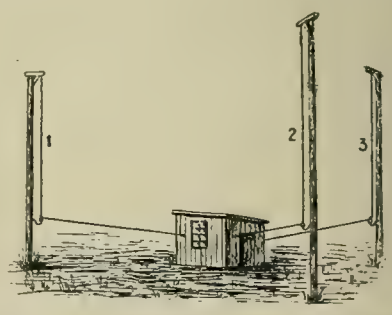


FIG. 62. BRAUN'S ARRANGEMENT FOR DIRECTING WAVES.

of London points out that the unsymmetrical radiation in the equatorial plane depends not upon absolute wave length, but upon the ratio of wave length to the distance of the receiving point and upon the proportion between the length of the vertical and of the horizontal portions of the oscillator.

The bent aerial employed by Marconi calls to mind the design of radiator invented by Professor Fessenden early in the year 1904, and which is shown in Fig. 64.

Fessenden found it desirable to employ a highly conducting surface from the point of generation of the waves along the path of their propagation, the conducting surface to extend a quarter wave length from the point of origin and in the direction of the receiving station. In Fig. 64 (1) is the

sending wire and (2) (2) (2) the grounded wire extending over adjacent buildings or other obstacles to a quarter wave length beyond such obstructions and where the terminals are earthed, as shown. The guys supporting the mast have an oscillation differing from that of the antenna proper, and this, with the wave-chute conductor, eliminates interference from all extraneous sources. The aerial conductor employed has a large capacity and low inductance, the capacity being regulated by altering the area of the conductor and the inductance by increasing the turns of wire between the aerial and the oscillator.

Another method of obtaining secrecy of operation is simply to have each office supplied with a call number or letter, and with an apparatus which will work or switch in automatically when such prearranged signal is received. Quite a number of patents have been taken out covering arrangements of this kind, and while most of these have little practical value, there is one improvement of this kind which gives promise of being worthy of a place in practical operation, especially is it applicable to naval signaling. I refer to the invention of Andres Bull of Christiania, Norway.

Instead of using simple wave impulses in transmitting signals, a series consisting of a fixed number of wave impulses, succeeding each other at prearranged short intervals of time, is used, and thus it is possible to give the signal from each separate transmitter a distinctive feature of its own. For instance, suppose that each series consists of five impulses, the intervals of time between them being a, b, c and d. Then by giving these intervals different values it is a simple matter to produce a great variety of series. If a dot in the Morse code is to be transferred from a station A to a station B, a series of, say, five impulses at intervals of a′, b′, c′ and d′ is dispatched. The receiver at B, tuned for these intervals, collects the five impulses and registers them as a dot on the tape of the Morse register. In transmitting a dash a sequence of series is dispatched from A and the receiver at B will register a row of dots (a dash) on the tape.

Now suppose the station A wishes to communicate with a third station C, a second series is used,

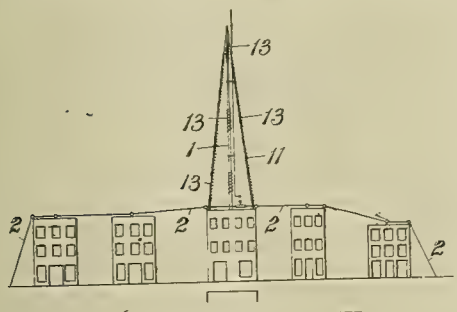


FIG. 64. FESSENDEN WAVE CHUTE.

the intervals being a″, b″, c″ and d″. This series will not be picked up by the receiver at B, as the intervals do not correspond with the adjustment of the latter. The receiver C will, however, receive and record the signal.

In this way, by using series of different forms, selective signaling is possible among any number of stations. The conversion of the Morse signals into series at the transmitting station as well as the reconversion of the series into dots at the receiving station is accomplished automatically by two instruments, the disperser and collector, respectively. Sending the signals is accomplished in the usual manner by the depression of a telegraph key for long or short intervals as may be required to form the letters of the Morse code.

Fig. 65 shows diagrammatically the connections at the sending station. By pressing the key (1) a current is allowed to flow from the battery (2) through the coils of the electromagnet (3), the armature of which is fitted with a hook (4) to grasp the stop (5) on the disk (6). The latter is loose on the pivot (7), which rotates with a velocity of about five revolutions per second, the friction being sufficient, however, to give the disk a tendency to rotate with the pivot. When the armature is attracted the disk (6) is released and starts rotating; the stop (5), in passing the contact springs (8), will close a circuit, including the battery (9), and the electromagnet (10) mounted on the frame of the disperser. If the circuit be closed for a short time (to make a dot) the hook, having released the disk, resumes its normal position and the disk is stopped after one revolution. Only one impulse is then sent through the windings of the magnet (10). If, however, the key is pressed long enough to allow the disk to make several revolutions, a number of impulses at regular intervals of one-fifth of a second are sent around the magnet.

The disperser consists of a disk (11), to which is fixed a large number of concentrically arranged vertical steel springs (12). The upper ends of the springs are free and are passed through radial slots in a second disk (13). Their ends are thus allowed freedom of action in a radial direction only. The two disks are mounted on the same spindle and

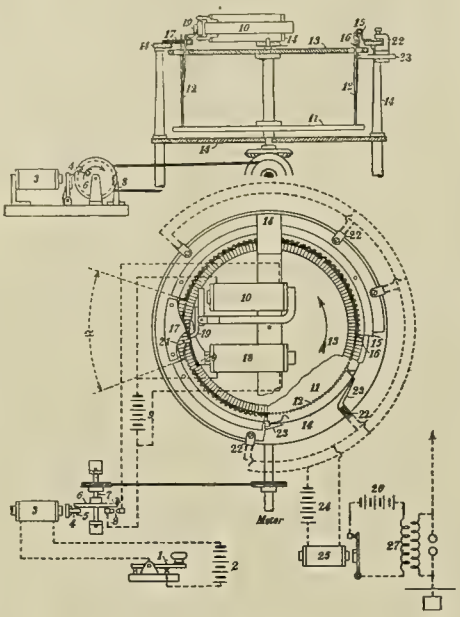


FIG. 65. CONNECTIONS FOR BULL'S SECRET WIRELESS SYSTEM. (SENDING END.)

revolve within the frame (14), to which is fixed a ring (15), serving as a guide to the points, so that during a revolution they are caused to glide either within the ring or in the U-shaped groove (16), formed by the latter.

A piece of the ring corresponding to the angle (a) on the left of the diagram is cut off, and in its place is fitted a piece of bronze (17), which bends the ends of the springs toward the end of the magnets (18). This magnet is constantly excited by current from the battery (9) and the steel springs are attracted by it, their elasticity being overcome by the strength of the magnet and the bronze finger (19) being in its normal position, the springs will slide along the pole of the magnet (18), and will not be released until they have reached the edge (20). On further revolving they will glide within the ring (15).

If, on the contrary, the magnet (10) is excited, the finger (19) fixed to the armature will be pushed over the pole of the magnet (18) and protrude slightly in front of it. Then when the springs pass by this finger they will be forced from the pole of the magnet (18), and on account of their elasticity will resume their vertical position. They will, therefore, enter the U-shaped groove at (21) and remain in the latter for one complete revolution.

Around the circumference of the disperser a number of contact devices (22) are fitted, consisting of two contact springs (23) insulated from each other; by the aid of screws these devices may be fastened around the frame at any desired angular intervals. The contact springs are arranged in such a way as to allow the steel springs moving within the ring (15) to just clear them, while the steel springs (16) protrude, and, therefore, in passing, will establish contact.

When the disperser is working, provided the magnet (10) has not been excited, all the steel springs will glide within the ring (15), and consequently all the contact devices (22) will be open, but if a short-current impulse is sent through the windings of the magnet (10), a steel spring is brought into the groove (16) and establishes contact successively at every one of the contact devices.

The contact springs are electrically connected, as shown in the diagram, and accordingly each time a contact is made, current from the battery (24) will excite the interrupter magnet (25), the armature of which will be attracted, causing a current from the battery (26) to flow through the induction coil (27). On the subsequent opening of the circuit a spark discharge takes place between the secondary terminals of the coil, and a wave impulse emanates from the transmitter. Consequently for each current impulse that is sent through the windings of the disperser magnets a number of wave impulses corresponding to the number of the contact devices (22) are dispatched. The disks revolving at approximately constant speed, the time intervals between the impulses of such a series will be proportional to the angular distances between the contact devices, and by putting these in different positions around the frame of the disperser it is an easy matter to vary the form of the dispatched impulses at will.

Fig. 66 shows a diagram of the selective receiving arrangements. The arriving wave impulses strike the aerial wire (28), lowering the resistance of the coherer (29) and allows the relay circuit to close. The relay (30) in turn closes the circuit containing the decoherer. At the same time a current impulse is sent through the windings of the collector magnet (32), which is in shunt with the decoherer. As the collector is constructed in the same manner as the disperser, a steel spring for each arriving wave impulse is brought into the groove of the ring (33). The disk to which the steel springs are fastened, like that of the disperser, revolves at approximately isochronous speed, and consequently the regular distances between the springs brought into the groove will be proportional to the intervals of time between the impulses which have impinged upon the aerial. A series of, say, five impulses will, therefore, cause five springs to be brought into the groove at angular intervals corresponding to the intervals of time between the impulses.

Around the frame of the collector are fitted the same number of contact devices (34) as are on the disperser, and similarly only the springs moving in the groove will be able to establish contact. The contact devices of the collector are connected in series so that a current cannot flow through the Morse instruments (35) until such time as contact is established simultaneously at all points. If now these points are adjusted to the same mutual angular distances as the steel springs, which on the arrival of a prearranged series of impulses are brought into the groove, then such a group of steel springs will, during the revolution of the disk, cause a momentary simultaneous contact at all the points. A current impulse then flows through the Morse instruments and is registered as a dot on the register tape. Consequently a continuous succession of series sent out by the distant transmitter is rendered a continuous row of dots (a dash). Any other series than that for which the collector is adjusted cannot possibly cause a simultaneous contact of the devices (34),

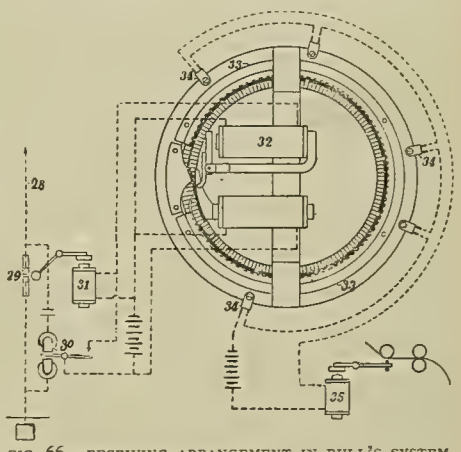


FIG. 66. RECEIVING ARRANGEMENT IN BULL'S SYSTEM.

and therefore any other series or combination will not be registered by the Morse instruments.

In actual operation the collector and disperser are mounted together. The apparatus is geared to a small motor, the disk carrying the steel springs being rotated at a speed of one revolution per second. The number of the springs is 400. The Morse relay used is a very sensitive one and will give satisfactory indications with 0.1 milliampere of current. It might be supposed, on account of the large amount of gearing and mechanism in connection with these devices, that the speed of signaling would be slow as compared with what would be good practice, but such is not necessarily the case, as a speed of 20 words a minute was attained with the experimental apparatus.

From the descriptions given the reader can,

if he have patience, figure out the circuits and thereby gather sufficient information regarding the principles involved to enable him to understand the operation of most of the inventions of this kind, which have for their object selective signaling. And while this method is not as attractive scientifically as the syntonic wave scheme, nevertheless it is one way in which multiplex wireless telegraphy is practicable.

The reason for giving considerable space to the description of the Bull method of selective signaling is not that the invention offers a solution of the problem which will be final, but because the ingenious mechanical arrangement of the apparatus employed by Bull is well worth study. The Bull method was given favorable mention by the members of the International Wireless Telegraph Conference held at Berlin, and Professor Fleming of London, who is associated with Mr. Marconi, has stated that the Bull system is quite practicable.

[*To be continued.*]

The Pennsylvania Terminal Work in New York City.

At the Brooklyn Art Gallery on the evening of January 17th, George Blinn Francis, A. M., chief engineer for Westinghouse, Church, Kerr & Co., delivered an interesting and instructive address to the department of engineering of the Brooklyn Institute. The subject was "The Pennsylvania Terminal Work in Manhattan." Mr. Francis used the lantern to illustrate his remarks, and his hearers were much interested in the story of the work in which he is engaged.

The work includes the construction of a double-track line from a point near Harrison, N. J., just east of Newark, to Weehawken. This line across the Hackensack meadows is to be elevated, owing to the crossing of other railroads near the surface of the meadows, and will consist of an embankment of rock and earth, using available soil from the Bergen Hill tunnels.

Other engineering feats in connection with the project are: (1) The driving of separate tunnels (each tube containing one track) through Bergen Hill and under the Hudson River and Manhattan Island to a point near the east line of Tenth Avenue; (2) the building of a terminal station and yards occupying four city blocks, comprising 1,200,000 square feet, located about 50 feet below the street level, and the erection of an immense passenger station, covering about eight acres and superimposed over the track area; (4) a connection with the Long Island Railroad system in Long Island, by four tracks, carried in double-track tunnels under New York city, and by four single-track tunnels under the East River; (5) a connection with Port Morris branch of the New York, New Haven and Hartford Railroad by means of a new line to be built from Woodside and carried over the East River and Ward's and Randall's islands by a high-level bridge; (6) the erection and equipment of two large power plants, one in Long Island City and one in New Jersey; (7) the construction of a service plant at the terminal site to furnish light, heat, refrigeration and power for the station requirements; (8) the operation of railway trains through the tunnels by means of electric-locomotive power; (9) the establishment of interchange and terminal-service yards at both Long Island and New Jersey, where change from electric to steam-locomotive power and vice versa will be made; (10) the electrification of a portion of the Long Island Railroad, the control of which was secured by the Pennsylvania Railroad some time ago.

About 100 miles (single track) of the western lines of the Long Island system have been equipped for operation by electric traction, and the entire installation was designed and executed a year ago by Westinghouse, Church, Kerr & Co.

General Electric Engineers in Session.

The local-office engineers of the General Electric Company from the principal cities in the United States gathered in annual session at the company's main office in Schenectady, N. Y., last week, January 21st to 26th, inclusive. The synopsis of the discussions covered in detail the work during the year. On Friday afternoon about 40 of the engineers left the city in a special car for New York, where they attended the first regular monthly meeting of the American Institute of Electrical Engineers in the new engineering building. On Friday night the party continued on its way to Lynn, Mass., where the Lynn plant was inspected. Among the local-office engineers in the New York-Lynn party were C. T. Mossman of Boston, J. H. Lighthipe of San Francisco, James Lyman of Chicago, L. F. Demming of Philadelphia, William H. Hand of St. Louis, H. V. D. Allen of Atlanta, W. S. Culver of Cincinnati, W. G. Whitmore of New York, and L. Wilson of Denver.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Outline Lighting.[1]

By Homer Honeywell.

The Lincoln (Neb.) Gas and Electric Light Company organized a new-business department, with a competent manager at its head, about the first of February, 1904, and started out with well-defined ideas as to the desirable classes of business and the effects on the station load. It was the aim to take on a steady load that would run from dusk until midnight each and every night during the year, and to that end a flat rate was figured out, based on the Doherty rate of $1.80 per year for each connected 16-candlepower lamp, or its equivalent, $12 per year for a customer charge and six cents per kilowatt-hour for current used, all subject to a discount of 10 per cent. for prompt payment, and on the actual number of burning-hours as applied to Lincoln.

No flat rates are taken on inside lighting. We have free renewals, and do it whenever our men see a lamp out.

The outlining is installed free when two-year contracts are taken, and the cost of installation figures about 38 cents per four-candlepower lamp installed, the lamps being placed 18 inches apart. By this method a number of small stores were induced to light up. The small merchant with a strip of 17 four-candlepower lamps over his sign, burning each and every night from dusk until midnight, turned on and off by us, pays $5.30 net per month. At the present time there are in use the equivalent of 10,000 four-candlepower lamps for sign, outlining and window lighting, and used by barbers, shoemakers, livery stables, undertakers, second-hand stores, bootblack stands, butcher shops, lunch cars and popcorn stands; in fact, all kinds of business. No business is too peculiar or small to be a prospect. We have one customer, a clothing store, whose sign, outlining and window lighting amounts to 960 four-candlepower lamps. This was the first customer to get into the game, and we have used him as a pacemaker.

It is claimed that the display lighting is one of the most valuable assets of Lincoln, and it certainly has a far-reaching effect—people promenade the streets, and can inspect the goods displayed at their leisure. All of the large-size show windows have light-colored stucco ceilings and are lighted by trough reflectors. Artistic, well-dressed, frequently changed windows are the rule in Lincoln. Progressive merchants, aided by the Doherty rate, are responsible for the handsome appearance of our streets at night. Had we attempted to install display or advertising lighting on a flat meter rate, even though the rate was lower than the present rate, it is more than doubtful if we could have gotten the merchants interested. An appeal to the merchants' civic pride, and a showing of the very small cost for a big lot of good advertising works wonders.

Six-o'clock closing is the rule in Lincoln every night except Saturday, and it would seem that the smaller towns where the stores keep open every night or two nights a week, and the people have few places to go, would offer a fine field for display lighting. Well-lighted windows and outlining displays will bring the people to the streets at night and cause the merchant to put better goods in his window and display them to better advantage.

In soliciting we are always careful to impress on the prospect's mind that the outside and window display is an advertising, and not a lighting, expense. Solicitors are paid a small salary and a percentage of the increase in gross revenue over the corresponding month for the previous year.

Each solicitor's commission depends on the number of points he has in proportion to the total number turned in, and points are given for each dollar of estimated revenue. Industrial business is worth 10 points; additional inside consumption, 10 points; new contracts, five points; outlining or signs until 12 o'clock, 10 points; outlining or signs less than 12 o'clock, five points; outlining or signs on meter, three points. If business is taken from the competition, the points are doubled. Each man is responsible for his own territory, and is keen to hold business, as well as to get new business.

Personal solicitation, newspapers, mail advertising and personal letters are used, and the cost of getting business to the company for the last three years has been 43 cents for each one dollar of increased revenue procured.

Of the advertising done at the start, I believe the mail advertising was the most valuable. It was done on a fairly large scale and in a way that was new to a great many people. The first week one letter or card was sent out, the next week two, and so on, until the prospect received a letter or card every day. The mail advertising helped put the prospect in a receptive mood, and the solicitor was able to close quickly. The combination of mail advertising and personal solicitation is a strong combination.

The effect on the station has been gratifying. The increase in peak load has been 23 per cent., while the sales have increased 60 per cent.

The sale of signs was not pushed particularly until we had made considerable headway in the other forms of lighting. At the present time we have 48 lamp-lettered signs in use, all of them bought outright from the local sign builder. The reason for installing free outlining on two-year contracts and not installing free signs is apparent. The outlining can be taken down, be repainted and put up again anywhere at a very small cost, while a sign to be used again would have to be remodeled at a considerable expense. Then, too, the first investment for a sign is considerable, and if the merchant is not required to carry the investment he feels more free to discontinue the use of the light. During the last three years we have not had over five or six outlining contracts discontinued, where the merchant remained in business, but, on the other hand, have increased the display of most of them.

There are in use 8,500 four-candlepower lamps for sign, outlining and sidewalk showcases. All these are on a flat rate. For window lighting 900 16-candlepower lamps are used.

Outlined roof signs also seem to be a popular and cheap method of advertising. So far all the outlining has been done along straight lines, but we are now attempting to relieve the plainness by getting into curves and circles.

Our sales for the last year have been 689 kilowatt-hours for each kilowatt connected. The Sunday output runs about 63 per cent. of the average weekly output and is largely due to flat-rate lighting.

There is a municipal street-lighting plant here and the traction company supplies some commercial light and power, but the generous display lighting is not due to competition, because our so-called competitor has but three outlining customers and two customers using signs of respectable proportions.

Discussion.

C. A. Parker, Detroit: There seems to be quite a tendency to revert to the flat rate in such business as outline and sign lighting, especially in the case of small business. It seems as though the attitude is that the small man wants to know how much it is going to cost him, particularly in such classes of business as druggists, barber shops, etc. I would be very much interested personally to hear what some members have to say on that particular subject.

F. W. Insull, Chicago: We have made a certain number of flat-rate contracts, based on the number of hours use of current and number of lights installed, and we install a light on a two-year contract. The scheme works well. A good many customers are a little bit afraid of meter rates, and you go and talk window lighting to them, and they will ask you how much it will cost. You can give them a rate per kilowatt-hour and figure out how much it will cost, and yet they are a little afraid; but the moment you make a flat-rate proposition to them you interest them. We turn these lights on and off ourselves. We have tried switches, and these work all right sometimes, and sometimes they do not. Moreover, the switches are very expensive. We have many small towns where it is not a difficult problem to get the window lighting, and, in fact, the window lighting is very good business, and we have a lot of it.

President Almert, Chicago: In a majority of the very small towns the business district is confined to just two or three blocks, generally all on one street, and I have seen but very few of the towns where the company has been warranted in sending an inspector or someone to turn these lights on and off. My experience is that the time-switch business has not been very satisfactory. I have, however, within the last 90 days, spoken with three or four central-station men, some of them large ones, who report very satisfactory results from the time switches; and it has been my idea to put into use soon, in one town, a time switch on each side of the street in the business district, and endeavor to get outline lighting such as is referred to in this paper; also window lighting, and endeavor to get and keep these lights on a flat-rate basis from dusk until two o'clock. At present in these small towns at certain seasons of the year the stores close at six o'clock and at other seasons at nine o'clock, and everything seems to be off at nine o'clock. The line of letter advertising will show results in larger cities where the store windows are lighted, even though they are closed. It will be my endeavor to convince the merchant that lighting can be profitably used for window display; and that in the small towns, if you light the windows people will come down after dinner in the evening to see the shop-window display,

1. Paper read at the convention of the Northwestern Electrical Association in Chicago on January 17th. Mr. Honeywell is manager of the Lincoln Gas and Electric Light Company, Lincoln, Neb.

and the desire to purchase is thus created; and the next day, or soon after, the result in sales is obtained. While I have not had the experience yet, I hope I will have a better experience with time switches than I have had heretofore, and from the construction of the last ones I have seen I think they will be satisfactory.

J. S. Allen, Lake Geneva, Wis.: I have found that in our case we could for a very small amount of money hire the night policeman to turn off the light, and we have made contracts in such a way that the consumer turned on his own lights, and we found very few instances where that privilege was abused. But that must be confined to outside sign or window lighting. We paid the night policeman a very small amount of money (I believe $4 a month). We thus created exceptionally good feeling with the customers.

As to the question of rates, I made a statement in a paper a year ago before this convention that we originally started in the lighting business with the flat rate, and we very shortly found that that was radically wrong; that there were very serious difficulties with it; and when we found that it was wrong we went to the other extreme. We made a very broad general statement that flat rates were disastrous to our business and unsatisfactory to the consumer. We accepted that as one of the fundamental principles of the success of our business, that everything must be on a meter basis. We all know when that idea was prevalent. It is only a very few years since almost all of us believed that everything must be on a meter basis. It is only within the last few years that we have come to realize that a combination of the two is advisable. We are now taking a middle ground, which, it seems to me, is the rational ground to take, so far as we can at present determine. Of course we have had during that time a great many different rates advocated, rates that were very beneficial, such as the Doherty rate and many others that we know about; but it seems to me that the combination of the flat rate and the meter rate is the most enlightened mode of selling current to the public at the present time.

And this question of a combination of flat and meter rates gives us an opportunity to get closer to the customer. It gives him an insight into our way of doing business that convinces him of our fairness; and that conviction is so pronounced that it has worked great benefit to the central station.

President Almert: You hold that the flat rate is desirable for stores where the consumer probably turns on the light, or where the central station turns on the light, but in all cases it is turned off, and then meters for the rest of the store?

Mr. Allen: Yes; we recommend a flat rate where the flat rate belongs and a meter rate where the meter rate belongs. You cannot make an ironclad rule. They must be combined in an intelligent way.

President Almert: But in no case is there a flat rate back in the store.

Mr. Allen: No; that cannot be tolerated. It is as unsatisfactory for the consumer as it is for the central station.

Irving P. Lord, Waupaca, Wis.: You establish your flat rate on a meter rate basis, don't you?

Mr. Allen: Certainly; directly as outlined by Mr. Honeywell.

Mr. Insull: The customer cannot economize on the flat rate for window lights. He gets into the habit of display and he continues the display, and if you start out with the best customers in town that naturally creates a desire for the other fellow to display his goods at night. Most stores nowadays close at 6 or 7 o'clock, and if you once get the merchant started on window display, it is bound to keep up. The same thing applies to sign lighting. Some mention was made in the paper about the excessive cost of the sign. Now, you can buy a sign in which you need only change the panels, and the panels do not cost very much. Sign lighting is much the same way; you start one druggist in town with a sign, and the next man wants one, and the thing spreads; one customer means another customer, and so on, and there is no chance to economize by shutting off the sign, as your customer pays a flat rate for the two years.

W. B. Johnson, Madison, Wis.: I think the paper seems to prefer the outline advertising to signs. That is something on which I would like to hear an expression of opinion. It seems to me if you can get the merchant to invest a certain amount of money in a sign he will take pride in it, and he is less liable to discontinue the lighting of that sign than he is an outline, after his contract has expired. When the company pays for the installation, at the end of the two years he is more liable to discontinue it than if he has a sign that he has paid anywhere from $40 to $100 for. He has a certain pride in the sign. It gets to be a sort of a landmark for his business, that is, if you can design a sign for him that is a little different from those of his competitors. I do not think much of signs that are alike. It is a good thing in a way from the station standpoint, but at the same time if you can furnish the various merchants each something unique in the sign line the variety gives a more enticing effect.

In regard to window lighting, I think one of the best arguments you can give a merchant—in fact, it is the argument that I have used a number of times and won out with it every time—is to get a merchant who is not favorably inclined to lighting up his window to come down to his place of business and sit in the back part of the store and watch the number of people that stop to look at the goods in the windows. I have had merchants try that two or three times, and every time they have come to window lighting on a flat rate. At Madison we make a flat rate on all signs both for outlining and window lighting, turning them off at midnight. We have only the one rate—the midnight lighting rate. The difference between 10 or 11 and 12 o'clock lighting is too small to be considered. We have not had as good success with the outlining as we have with the sign lighting. At present I think we have only 4,000 or 5,000 candlepower in outlining, while we have between 14,000 and 15,000 candlepower in sign lighting. We have a total equivalent of about 8,000 candlepower in lamps used in signs, outline and window lighting.

Mr. Lord: The question of window and sign lighting is somewhat different in the larger than in the smaller cities, like Waupaca, where I live, a city of 3,000 inhabitants. It would be useless for me to go to one of our prospective customers and try to get him to light up his windows till 11 or 12 o'clock at night. Most of our people are in bed at 10 o'clock, though sometimes I am not. We could get them perhaps to light up to, say, 10 o'clock, but most of them would prefer to light up till nine o'clock—no later than that. Now nine-tenths of our stores at present close at six o'clock, summer and winter, except two nights out of the week, when they stay open until nine o'clock. This follows throughout the year, except the two weeks preceding Christmas. This made a great difference with our load, which prior to their adopting this plan of early closing used to be at its peak at about eight o'clock in the evening. At this time of the year our peak load is at about 5:30 p. m., because at six o'clock the stores are closed.

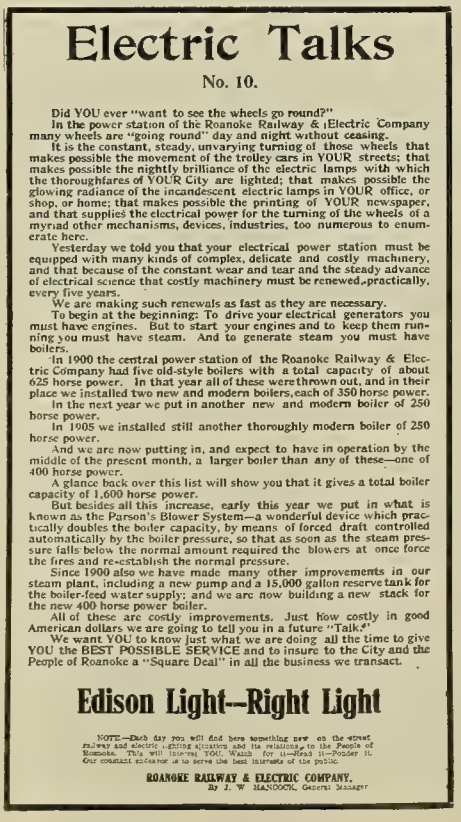
I would say, in regard to our lighting, that everything we have is on the meter system, but this early closing business is a problem that will affect the small station men more materially than it will the large station men, because in the large cities they operate these schedules until 11 or 12 o'clock at night, and we cannot do it.

C. A. Parker, Detroit, Mich.: There is an advantage to the small-station man if a flat rate is made extending throughout the year, as his revenue during the summer months does not fall off as it does when he runs on a meter rate, and the revenue falls down very materially during the summer months.

"Electrical Talks."

The Roanoke Railway and Electric Company of Roanoke, Va., a member of the National Electric Light Association, has been running a series of "Electrical Talks" in the daily papers, which are found to be profitable. That others may gain an idea of the plan one of the "talks" is reproduced here. The cut is a reduction from a three-column space running half the length of the page. One of these "talks" is published daily in three of the papers.

In this space the company tells the people what it is doing to serve their interests and presents facts concerning the advantages to be gained from the use of electricity. The company also tells the people something about the intricacies and working of electrical machinery and explains how current is distributed, thus giving something of an educational nature which is attractive to all.



Electric Talks

No. 10.

Did YOU ever "want to see the wheels go round?"

In the power station of the Roanoke Railway & Electric Company many wheels are "going round" day and night without ceasing.

It is the constant, steady, unvarying turning of those wheels that makes possible the movement of the trolley cars in YOUR streets; that makes possible the nightly brilliance of the electric lamps with which the thoroughfares of YOUR City are lighted; that makes possible the glowing radiance of the incandescent electric lamps in YOUR office, or shop, or home; that makes possible the printing of YOUR newspaper, and that supplies the electrical power for the turning of the wheels of a myriad other mechanisms, devices, industries, too numerous to enumerate here.

Yesterday we told you that your electrical power station must be equipped with many kinds of complex, delicate and costly machinery, and that because of the constant wear and tear and the steady advance of electrical science that costly machinery must be renewed practically, every five years.

We are making such renewals as fast as they are necessary.

To begin at the beginning: To drive your electrical generators you must have engines. But to start your engines and to keep them running you must have steam. And to generate steam you must have boilers.

In 1900 the central power station of the Roanoke Railway & Electric Company had five old-style boilers with a total capacity of about 625 horse power. In that year all of these were thrown out, and in their place we installed two new and modern boilers, each of 350 horse power.

In the next year we put in another new and modern boiler of 250 horse power.

In 1905 we installed still another thoroughly modern boiler of 250 horse power.

And we are now putting in, and expect to have in operation by the middle of the present month, a larger boiler than any of these—one of 400 horse power.

A glance back over this list will show you that it gives a total boiler capacity of 1,600 horse power.

But besides all this increase, early this year we put in what is known as the Parson's Blower System—a wonderful device which practically doubles the boiler capacity, by means of forced draft controlled automatically by the boiler pressure, so that as soon as the steam pressure falls below the normal amount required the blowers at once force the fires and re-establish the normal pressure.

Since 1900 also we have made many other improvements in our steam plant, including a new pump and a 15,000 gallon reserve tank for the boiler-feed water supply; and we are now building a new stack for the new 400 horse power boiler.

All of these are costly improvements. Just how costly in good American dollars we are going to tell you in a future "Talk."

We want YOU to know just what we are doing all the time to give YOU the BEST POSSIBLE SERVICE and to insure to the City and the People of Roanoke a "Square Deal" in all the business we transact.

Edison Light—Right Light

NOTE—Each day you will find here something new on the street railway and electric lighting situation and its relations to the People of Roanoke. This will interest YOU. Watch for it—Read it—Ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY.
By J. W. MANDOCK, General Manager

NEWSPAPER AD FROM ROANOKE, VA.

Low Rate for Electric Cooking at Sault Ste. Marie.

A notable departure in the way of a special cooking and heating service is to be inaugurated by the Edison Sault Electric Company of Sault Ste. Marie, Mich., immediately upon the occupancy of its new power house at the Rapids. A rate of 2½ cents a kilowatt-hour for current for cooking and heating service is to be established. William Chandler, vice-president, says that the company will make this business a new division of its service, separating it from the regular lighting business by the running of special service wires and installing separate meters.

The company is also preparing to maintain an electrical show room, where every cooking, heating, lighting and power device known to the business will be on exhibition. The inspection of this room will be interesting and instructive as well to every householder in this city. At 2½ cents per kilowatt-hour for cooking and heating the cost of using electricity in the home and elsewhere will be so low that nearly everybody can afford it.

The manifest superiority of electricity over any other form for lighting, cooking, heating and power in safety, convenience, hygiene and its many other features, is pointed out by the company.

Residents of Sault Ste. Marie may congratulate themselves upon being able to secure this special cooking and heating rate, which is said to be the lowest rate of the kind that has been made by any central-station company.

New-business Notes.

The number of central stations availing themselves of the benefits to be derived from the co-operative effort inaugurated by the Co-operative Electrical Development Association is rapidly increasing. During 1906 the solicitors added numbered 373, and reports are still coming in.

Calmly appropriating the name originated by the Western Electrician for this department, the C. W. Lee Company has started a magazine with the name "Selling Electricity." This title first appeared in the Western Electrician of October 28, 1905, and it has appeared once a month or oftener ever since. The new magazine will not arouse confidence either in its originality or its honesty of purpose by this convenient way of bedecking itself with a striking name long used elsewhere.

Western Electric Employes Dine.

An informal dinner given to directors and department managers of the Western Electric Company was enjoyed by three hundred employes of the company at the Grand Pacific Hotel, Chicago, on the evening of January 28th. A minstrel show which followed the dinner proved a very enjoyable feature to all who listened to the many local jokes which were given.

President E. M. Barton delivered an interesting speech in which he reviewed the history of the company which he said had grown from a small and comparatively insignificant organization to its present mammoth proportions.

Secretary C. G. DuBois in his remarks referred to the present status of the concern in the business world. His speech abounded in suggestions valuable to all interested in the system of conducting the business of a large corporation.

Montana Waterpower Dam Completed.

The gates of the Hauser Lake dam near Helena, Mont., were closed last week. This is said to be the largest dam of its kind in the world and is to supply the waterpower to develop electricity for running the Washoe Reduction Works, the Anaconda railway, light cities and operate many of the Butte mines. It will be three weeks before the power is turned on, as it will take this time for the lake to fill. The water will back up 18 miles in the river and through the Prickly Pear Canyon, six miles in the valley below Helena.

The dam is 640 feet long and 70 feet wide and is made of steel throughout. Fifteen thousand horsepower will be generated, and this, with the Canyon Ferry plant, will make Helena one of the largest producers of electricity in the country.

Adaptability of Wireless Clusters for Burning Two Lights in Series.

The Benjamin Electric Manufacturing Company of Chicago has placed upon the market a new line of devices in an adaptation of its wireless clusters to burning two lights in series. Recent changes in the incandescent-lamp situation, brought about by the use of metal filaments, have well-nigh established as standard, voltages of 120 and 125. In

Fig. 1. No. 22½ Body.

Fig. 2 No. 19½ Body.

Fig. 3. No. 92½ Receptacle.

Fig. 4. No. 412½ Twin Socket. Fig. 5. No. 15½ Body.

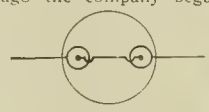


Fig. 6.

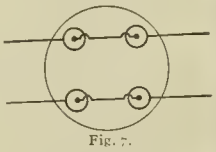


Fig. 7.

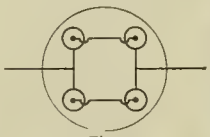


Fig. 8.

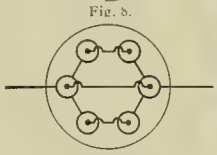


Fig. 9.

WIRELESS CLUSTERS ADAPTED TO BURNING TWO LIGHTS IN SERIES.

many cases where the wiring installation includes 220-volt circuits there is an increased demand for devices in which two lamps may be burned in series.

The body designated as No. 22½ (Fig. 1) serves the general purpose of a two-light device for ordinary cluster purposes. No. 19½, wall bracket (Fig. 2), is intended for the lighting of side walls in groups of two lamps in series. No. 92½, receptacle plug (Fig. 3), is furnished for 220-volt circuits wired in multiple, where it is desirable to use 110-volt lamps.

No. 412½, twin socket (Fig. 4), has heretofore been furnished for multiple work only. This can now likewise be used to burn two lamps in series. The device is largely used for show-window lighting. Lamps may be placed parallel to the surface to which the socket is attached. The socket can also be used for fixture work with lamps placed either in a vertical position or in a horizontal position surmounted by half shades.

The diagram shown in Fig. 6 applies to all of the aforementioned two-light series devices. For clusters ranging from four to six lamps, No. 15½ body (Fig. 5) may be used, as shown in the three diagrams 7, 8 and 9, permitting, first, the use of four lamps on two different circuits (Fig. 7), two lamps in series on each; second, the use of four lamps on one circuit, two in series (Fig. 8), or again, third, with six lamps in a series-parallel grouping, consisting of three sets of two lamps in series, as in Fig. 9.

Ambitious Drainage Canal Projects.

A dispatch to the Chicago Record-Herald, dated at Springfield, Ill., January 23d, is, in part, as follows: "Completion of the Chicago Drainage Canal system is provided for in a bill introduced in the Senate today. The bill, which was drafted by the sanitary board and presented by Senator Clark, paves the way for the construction of the Evanston and Calumet branches to the north and south respectively. It removes the $20,000,000 bond limitation and permits the borrowing of money and the issuing of bonds not to exceed five per cent. of the taxable property in the Sanitary District.

"A 40-mile fringe of factories along the canal and the development of the wastes on each side the great ditch from Chicago to Joliet is one of the possibilities slumbering in the bill. Not only that, but the measure contains visions of rental rolls of a size large enough to build a deep-sea way that will float ships from the Lakes to the Gulf, and thus provide transportation facilities that will attract mill owners and foundry magnates from all parts of the country to the banks of the great sewer.

"Waterpower is to be the magnet. The bill provides that the trustees shall be empowered to lease lands and property, and in case it goes through it means throwing open a 40-odd-mile course, every foot of which is provided with the water force that comes from a flow of from 10,000 to 14,000 cubic feet per second.

"The lands along the ditch at present are practically unused, and the current is going to waste, but the new reform board has discovered that it has a potential gold mine in its possession."

New Factory of the Wesco Supply Company.

The Wesco Supply Company, St. Louis, Mo., and Fort Worth, Tex., which has always occupied a prominent position among the electrical supply jobbers and dealers, has in recent years been venturing upon the manufacturing field. A few years ago the company began assembling its own telephones in order to insure perfect uniformity in the telephone instruments and has since added the latest machinery, tools and dies for the manufacture of its own specially designed parts, until within the last year it has been manufacturing practically the complete instruments in its own factory.

NEW FACTORY OF THE WESCO SUPPLY COMPANY.

On account of the rapid growth in the demand for the company's product it has become necessary to provide larger quarters and better facilities to meet this demand. A large five-story brick building at the corner of Eighth Street and Clark Avenue, St. Louis, was therefore recently secured and has been equipped throughout with the very best and latest machinery for the manufacture of a complete line of telephone instruments and telephone accessories and is now in full operation. A picture of the building is shown.

Among the articles of recognized merit manufactured especially for this company and which have found a ready and extensive sale are the Wesco desk and ceiling fans, Wesco tape, Wesco soldering specialties, the Red Shield and Wesco dry batteries and Hercules pliers. In addition a portion of the factory is being equipped for the manufacture of knife switches, panel boards, cut-out cabinets and switchboards. Other electrical specialties will be brought out from time to time. The company announces that everything produced in its factory will bear the stamp of quality.

Massachusetts "Tech" Alumni Dinner.

About 250 alumni of the Massachusetts Institute of Technology attended the annual dinner at the Hotel Brunswick in Boston on the evening of January 18th. Everett Morse, president of the alumni association, was toastmaster. Owing to sickness President Pritchett of the Institute was unable to be present, but he sent a telegram of hearty wishes and regrets. Lieutenant-governor Draper, a member of the corporation, made a speech in which he said that there is no other institution that gives to its graduates such a working capital to start with as the Massachusetts Institute of Technology. Dean Sabine of the Lawrence Scientific School; Frederick P. Fish, president of the American Telephone and Telegraph Company, and Prof. Dugald C. Jackson, the new head of the electrical engineering department, also spoke. B.

Steam Roads Said to Have Come to Terms.

A Rock Island, Ill., paper is authority for the statement that the steam railroads in the territory of the Central Passenger Association have decided to discontinue their boycott against their electric competitors, and that as a result of a conference with D. C. Edwards, vice-president of the Consolidated Electric Railways of Indiana and Ohio, the passenger officials of the steam roads have decided to abrogate their agreement not to interchange traffic with electric lines. The electric lines were prepared to notify the Interstate Commerce Commission of the boycott declared against them by the steam roads.

Central Electric Railway Association.

The first annual meeting of the Central Electric Railway Association was held in the assembly room of the Claypool Hotel, Indianapolis, on January 24th. Two hundred members of the association were present. The meeting was called to order by E. C. Spring, president. Secretary Milholland reported the association in most excellent condition, and that the work of the year had been fruitful in results. A good balance was reported in the treasury and a score of new members had been received.

President Spring delivered his annual address, saying that he reviewed the work of the last year with pleasure and satisfaction. State lines have been blotted out, and the association is putting forth every effort to strengthen and develop the best interests of the electric-railway work in the Middle West. The establishment of permanent headquarters was an innovation among similar associations, but the experiment has proven the wisdom of the plan.

G. H. Kelsay, superintendent of power of the Indiana Union Traction Company, read a paper on "Developing a Demand for Renting Power—Does It Pay?" Mr. Kelsay went into the details of the cost of power, the cost of a plant, per cent. of interest and depreciation, and figured out what such service would cost a company in attempting to furnish light and power to towns and farmers along the line. Estimate of the cost of power and lighting at points on a railway system involves some very nice calculations, and deals with somewhat uncertain factors unless proper recording and indicating instruments are at hand for making some determinations. Mr. Kelsay thought the most practicable way to determine such cost on any point on a railway circuit is to take the cost of power at the bus-bars of the plant as a basis for calculation.

The development of a demand for the rental of electric power depends on the service that the company can give and the adaptability of such power to the consumer. The hours required are usually during the whole day and half of the night—the same hours the line is carrying the heaviest load. The speaker explained how a very successful alternating-current motor service could be furnished where there is a transmission circuit and where the load will warrant the investment of the necessary step-down transformer apparatus. Mr. Kelsay concluded by saying that when railway companies can deliver power to the direct-current bus-bars of any sub-station at a net cost ranging from two to three cents, paying all costs for the generation and transmission of such power, and a fair rate of depreciation and interest, or deliver alternating-current power from the high-tension lines directly to the small towns along their lines for a price ranging from 1½ to two cents or 2½ cents per kilowatt-hour, paying all the costs chargeable to the furnishing of the power, they should, by adding a reasonable per cent. to such cost, handle all the lighting business along their lines at a profit to themselves and at the same time give the customer the advantages of enjoying the privilege of electric light and power.

It would be inferred from those participating in the discussion of Mr. Kelsay's paper, that the roads now engaged in furnishing light and power do not regard the business profitable. The subject, however, is to be taken up again.

"Handling of Accidents and Claims" was the sub-

ject of an interesting paper by E. C. Carpenter, claim adjuster for the Indiana Union Traction Company of Anderson. Mr. Carpenter said: "The best way to handle accidents is to prevent them, and it is wise economy to employ the best and most intelligent men for this service, since accidents will happen with the best of roads."

"The Model Car for Long Travel" was the subject of a comprehensive paper read by W. H. Evans of Indianapolis. Mr. Evans illustrated his paper with diagrams and drawings showing the great improvements made.

R. C. Taylor of Anderson read a paper on "Car Lighting." Satisfactory car lighting has proven a hard problem for the interurban roads. Mr. Taylor said the modern car should have its lighting arrangements so designed as to provide sufficient light at all times to enable passengers to read with comfort. The mechanism of the headlight should be strong and simple and reliable, and carbons arranged to burn at least six days without renewal. Screens should be provided for use while passing through cities. The fact that out of nine lines running into Indianapolis the interior-lighting arrangement varies from 20 to 65 lights per car seems to indicate that there is still room for discussion on the best method of electric-car lighting and room to advocate some improvement in their arrangements. Mr. Taylor outlined the improvements and additional equipment necessary in his judgment and experience to bring about the desired result.

An interesting discussion was had on the advisability of making contracts with existing express companies along similar lines to the contracts that express companies have with steam lines. The speakers generally advised against haste in the matter, asserting that there would probably be some legislation soon that would enable them to make better contracts than now. It was pointed out that the companies were now doing a fine and profitable local express business, and they could afford to wait a while before entering upon the larger business. However, the question was deemed of so much importance as to call for the appointment of a committee to investigate the matter and report at the next meeting.

The following-named officers were elected: President, H. A. Nicholl, Anderson, Ind.; first vice-president, F. D. Carpenter, Lima, Ohio; second vice-president, I. R. Todd, Indianapolis; treasurer, W. F. Milholland, Indianapolis; executive board, Ohio—H. P. Klegg, Dayton; F. J. Sloatt, Hamilton; L. C. Bradley, Columbus; C. N. Wilcoxsin, E. C. Spring, Cleveland; Indiana—Charles Murdock, Terre Haute; A. A. Anderson, Columbus; F. D. Norveil, Indianapolis; C. D. Emmons, Fort Wayne; C. C. Reynolds, Crawfordsville.

The annual banquet of the association was held at the Claypool Hotel, with about 150 guests present. Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, presided as toastmaster. The retiring president of the association, E. C. Spring, delivered his annual address. He spoke briefly of the consolidation of the two state organizations of Ohio and Indiana, and of the growth of traffic. He predicted that there would be a much greater growth in the traction business within the next few years.

A feature of the convention that the general public could enjoy was the display of electric interurban cars in Kentucky Avenue and in West Maryland Street. In the first square of Kentucky Avenue were a number of service cars, representative of the best used in Indiana, Ohio and Michigan, and four private cars that were the height of luxury. One of the private cars was the Martha of the Indiana Union Traction Company. Another was the Stillwater of the Dayton, Piqua and Covington Traction Company, which came to the city from Ohio, bearing E. C. Spring, general superintendent of the road and president of the Central Association, with a party of traction men and friends from Dayton and Columbus. Another car was the Josephine, of the Lake Shore electric road, bearing F. J. Stout, general manager of the road, and a party of traction men from various parts of the state. The fourth was the Lawton, of the Fort Wayne and Wabash Valley, with C. D. Emmons, general manager of the road, and others.

S. S.

Large Escalators for New York.

The New York and Long Island Railway Company, known as the Belmont or old Steinway Tunnel System, has just awarded a contract to the Otis Elevator Company for the two largest escalators ever built, to be installed in the Manhattan terminal of that system at Forty-second Street, between Lexington and Third avenues. Trolley cars, instead of trains, are to be operated in this tunnel. It is estimated that the escalator equipment above referred to is equal in point of capacity to that of the entire stairway equipment of the Manhattan end of the Brooklyn Bridge. Furthermore, not only will the escalators be sufficient to handle any number of people up to the capacity of the trolley cars of the tunnel, but they will also serve to marshal the crowds into streams of people moving uninterruptedly and not coming into conflict with one another.

The escalators will provide service between levels something over 55 feet apart and will be arranged side by side. Most of the time one will be operated ascending and the other descending, but during the morning rush hour both will be operated ascending.

New Direct-current Motors for Individual Drive.

The growing demand for direct-current electric motors that can be applied to the individual drive of machinery of various kinds has led to a number of important changes in both the mechanical and electrical design of the motors heretofore used. To meet the requirements of this service the construction should not only be compact, but also permit of mounting the motor in any position, while the windings and commutator must be either

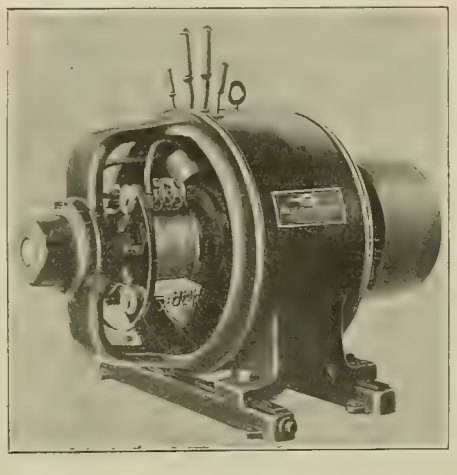


FIG. 1. ALLIS-CHALMERS TYPE "K" MOTOR.

partially or wholly protected from external injury. Geared and direct-coupled methods of driving are rapidly displacing belts, and this, together with the fact that sudden and excessive overloads are of common occurrence, requires larger bearings and shafts of greater stiffness than were formerly used in motors of the same class. The demand for a wide variation in speed by shunt-field control, with occasional heavy overloads at any speed, has also called for material improvement in commutating qualities.

Allis-Chalmers Company of Milwaukee announces a new line of direct-current motors, designated as type K, which have beeen especially designed to meet these mechanical and electrical requirements. These motors are equally well adapted to belt drive at constant speed and continuous service, or geared drive, variable speed and intermittent service. Their external appearance (Fig. 1) is similar to the well-known types N and B motors heretofore manufactured by that company, but the construction differs

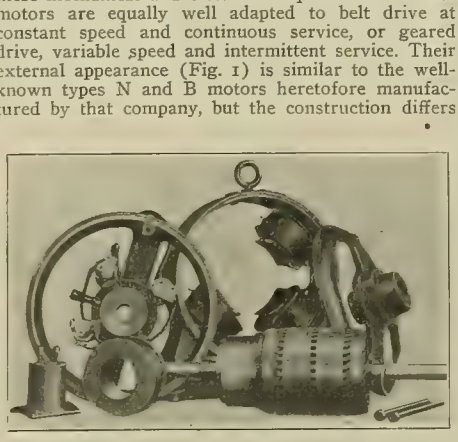


FIG. 2. ALLIS-CHALMERS TYPE "K" MOTOR DISMANTLED.

in many important details, and, in fact, represents a new design throughout.

The cylindrical field-magnet yoke is of open-hearth steel and machined on each end to receive the housings that carry the bearings. The housings are held in place by through bolts, and, on four-pole machines, can be rotated 90 degrees or 180 degrees to allow side-wall or ceiling mounting; bipolar machines can be arranged for floor or ceiling mounting. The yoke is machined on the inside cylindrical surface and the poles are fastened to it by countersunk fillister-head cap screws. The pole cores are of open-hearth steel and are circular in cross-section; these cores are machined on one end to fit the inner surface of the cylindrical yoke and on the other to receive the pole shoes. The latter are built up of annealed steel punchings riveted together and fastened to the poles by flat-head machine screws. The pole face has been carefully shaped to give suitable distribution of the field flux, thus securing good commutation and preventing humming due to the armature teeth. The field cores are wound on metal spools, except for the smaller sizes, and are covered with sufficient insulation, coated with varnish, to protect them from external injury or moisture. Fig. 2 shows a five-horsepower motor dismantled.

Armature cores are built up of sheet-steel punchings, insulated from each other, to reduce the core loss and consequent heating. The laminations are keyed to the shaft, and in building up the core they are separated at intervals, so as to form radial ventilating ducts. In punching the armature laminations, openings are made in the disks, so that when the latter are assembled, ventilating passages are formed parallel to the shaft and connecting with the radial ducts. There is thus a free passage for circulation of air through the core, and all parts of the core and windings are thoroughly ventilated.

The armature coils are form-wound and interchangeable; they are heavily insulated with stay binding, and the whole armature is thoroughly impregnated with insulating varnish after it has been completely wound. The commutator is of large diameter and ample wearing depth, having bars of hard-drawn copper, insulated from each other and from the shell by the best quality of mica; the mica between bars is selected so as to give even wear.

These motors are manufactured in 13 different frame sizes, and for each size there are a number of ratings, the output of a given frame being proportional to the speed. Type K motors are suitable for all classes of work where either a constant or variable-speed direct-current motor is required. For general driving of machinery or for variable-speed work, shunt-wound machines are used. For cases where a large starting torque, combined with the constant-speed characteristics of the shunt motor is required, compound-wound motors can be furnished. For crane and hoisting service series-wound motors are supplied.

Type K machines operate also as generators which are compound wound, and will deliver any current from zero to their full rated output without sparking and without shifting the brushes.

Telephone News from the Northwest.

The estate of Jeffery J. Donahue has brought suit in St. Paul against the Twin City Telephone Company, to recover $5,000 damages for the death of Donahue. The telephone company was constructing a line through Washington County in 1905, which crossed beneath the wires of the St. Croix Power Company. The complaint states that Donahue was directed to measure the distance from the ground to the power wires, and for that purpose a hook attached to the end of a tape line was placed over the wire. The tape line is said to have contained small metal wires, and Donahue was instantly killed when taking hold of it.

A bill has been introduced in the Legislature of Minnesota to make telephone companies common carriers and subjected to the supervision of the State Railroad and Warehouse Commission. It also applies to telegraph companies.

The Iowa Bell Telephone Company will double the capacity of its system at Muscatine, Iowa.

The eleventh annual convention of the Iowa Independent Telephone Association will be held in Sioux City, March 12th-14th.

A meeting of the Southwestern Iowa Independent Telephone Association for the purpose of forming a closer organization and arranging for the general betterment of the toll service of the Independent companies in that part of the state was called at Council Bluffs, January 26th. H. A. Kinney of that city is president and J. F. Glenn of Denison secretary.

The Home Telephone Company is enlarging its exchange and offices at Oskaloosa, Iowa. R.

Indiana Telephone Items.

The Moores Hill Telephone Company of Moores Hill will receive bids for the installation of a new exchange. The company has arranged to exchange free service with several new exchanges in the county.

During the last week the Home Telephone Company of Spurgeon and the Independent Telephone Company of Oakland City were connected; likewise the Monticello Telephone Company and the Idaville Co-operative Company.

J. E. Emrich of Shelbyville, who contracted to put in all the telephone connections for the Indianapolis and Cincinnati Traction Company between Indianapolis and Greensburg, has completed his work. The telephones were tested and found to be in perfect order.

The bill to prevent linemen from cutting or mutilating shade trees along public highways and private property has been passed by the Legislature. The penalty is a fine of from $5 to $50 and imprisonment.

A. L. Tetu, manager of the Indianapolis Telephone Company, appeared before the Commercial Club and told briefly what had been done already and what is yet to be done to better the service. There has been complaint of the service, and Mr. Tetu asks the patrons to be patient until the new exchange building is completed and installed and other improvements depending on them. S.

CORRESPONDENCE.

Continental Europe.

Paris, January 12.—The city of Grenoble, France, is now receiving a large amount of current from the hydraulic plant of Livet, erected on the Romanche River, one of the mountain streams of the Alpine region which flows into the Isère stream. From this source a head of water of about 200 feet is secured. One of the interesting features of the Livet plant is the use of an armed cement circular conduit leading from the dam to the feed reservoir. This conduit has an inside diameter of about 10 feet and is 1.2 miles long. An independent set of penstocks leads to two separate turbine houses. One of these, which is the larger, is used for electrochemical work and it contains six turbine-alternator sets of 1,250 horsepower each. As to the second station, it supplies the overhead line going as far as Grenoble, and is equipped with three groups of 2,500 horsepower each. The Bouvier firm of Grenoble supplied the turbines, which are of the Francis type. Direct-coupled to the turbine in each case is a Brown-Boveri alternator, which supplies three-phase current at 3,500 volts and 50 cycles. A bank of water-cooled transformers raises the voltage to 32,000 volts for the overhead line. In the city of Grenoble there is a large sub-station which receives the line (the distance is about 23 miles) and transforms the current to low tension.

For transporting melted metal the German firm, Stuckenholz Gesellschaft, is constructing a type of electric motor-propelled car, and one of these is now in use at the blast-furnace plant of the Aachener Mine Company. The car, which holds about 20 tons of melted iron, is taken along the track by two 75-horsepower motors and runs from the converter to the foundry building. To pour out the melted metal there is provided a 15-horsepower motor. It is said that the new system works very successfully and is an improvement upon the former method.

The Heroult electric furnace is now working at La Praz in Savoy and also in Sweden, in the Kortfors plant, for the manufacture of ferro-silicon. What is characteristic of the Heroult process is the use of two large carbon electrodes suspended above the furnace hearth and plunging into the melted metal. These electrodes are made of retort carbon and are water cooled at the upper part. An electric motor serves to move the electrodes and adjust them to the proper height and distance apart. The current passes in the form of an arc from an electrode to the melted slag forming the upper layer and thence to the melted metal, reaching the second immersed electrode. A part of the current passes directly by the slag. About 4,000 amperes at 110 volts is the current generally employed in the furnace. The electrodes are six feet in length. An advantage of the Heroult furnace is that of making steels which have a low carbon value.

Of interest in this connection is the new electric steel plant which is in construction in France at Mnieux. The current will be given by a Dujardin engine of 1,500 horsepower and a Westinghouse alternator. Some 20,000 amperes can be delivered from this group, and the current is to be utilized in an electric furnace of the Keller type. Current is also to be used in the works for the deoxidizing, refining and reheating of the metal, as the electric furnace is employed at the end of the process. Steel coming from a Siemens-Martin furnace is run into the electric furnace immediately after the fusion. The electric furnace will give flows of eight or nine tons, and three or four of these in 24 hours. The weight of the new furnace is 55 tons, and it can be inclined as is desired by means of an iron casing which holds it. The steel which is produced from the electric refining furnace is designed to be used specially for the manufacture of cannon and projectiles. A. de C.

Great Britain.

London, January 16.—The inevitable dissatisfied shareholder was much in evidence at the meeting of the British Westinghouse Electric and Manufacturing Company this week. The history of the company has been unfortunate, for when Mr. Westinghouse conceived the idea of floating the concern seven years ago he certainly did dogmatize somewhat upon the shortcomings of the English race as electrical engineers and commercial men. However, after an existence of seven years the latest balance sheet shows a deficit of over $500,000. During the last year a new executive has been appointed, and it will only be fair, as was pointed out at the meeting, to give it an opportunity of justifying itself. One result of the new management is that there has been a complete change in the personnel of the organization, and it has been remarked that all the Americans have been replaced by Britishers. There is to be a rearrangement of the territory between the American and British companies. In return for trading in South America the British company agrees to allow the American company to sell in all British possessions except Great Britain.

The city of Edinburgh stands alone in Great Britain as possessing an example of cable tramway, and a very excellent one, too. At present the lines are worked by a company, but sooner or later they will fall into the hands of the corporation, which will undoubtedly work them electrically. Consequently a deputation of councilors, accompanied by Sir Alexander Kennedy, who initially advised the London County Council, has been making a tour of various places in England. They inspected trolleys and conduits in London and also in Bournemouth; surface contact at Lincoln and Wolverhampton. Anyone knowing Edinburgh and its councilors will not be surprised to hear that the conduit system appeals to them most, but the large capital expenditure causes them to pause. But the inventors of the contact systems have made the suggestion that the existing track with its cableways can be reconstructed for a comparatively small cost, and this is a point which will receive careful consideration.

A most interesting paper on metallic filament lamps is now under discussion at the Institution of Electrical Engineers in London. Its author is Mr. James Swinburne, F. R. S., and those interested in the subject on the other side should not fail to read the paper and discussion thereon. The paper discusses the advantages and otherwise of every possible metal filament. Mr. Swinburne points out that the so-called osmium lamps contain little if any osmium, but are made of tungsten. He makes a strong plea for much higher candlepower than those which at present are used. Such lamps could be made, probably, which would use no greater energy than the existing candlepower.

It only needs a gale or a snowstorm to stir up an agitation in favor of increased underground telegraphic communication. The recent snowstorm has had the inevitable effect and a conference is being summoned of Scotch authorities. For many years the underground system went no farther than Birmingham. After repeated applications to the postmaster-general at the instance of various chambers of commerce, extensions were put in hand, and gradually Warrington, Carlisle and Glasgow were joined up. The laying of underground cables between Glasgow and Edinburgh is now being carried out, but the Scotch authorities are dissatisfied with the determination of the postmaster-general not to proceed further north for the present in consequence of the expense involved. Hence the action mentioned above.

An interesting street-lighting experiment is being carried out in Exeter, where osram lamps have been put into service.

The only new tube railway that will be promoted in Parliament this session will be one running from Euston to Watford at the instance of the London and North Western Railway Company, a steam undertaking wishing to relieve its lines of an increasing suburban traffic. The idea is to run the line under the existing track. The total cost is put at $7,500,000. The terminals will be twin, 13 feet 6 inches in diameter. It is intended to have three classes and not two, as on other tube railways. Luggage will also be carried. A power house will be built for the railway by the company. G.

Dominion of Canada.

Ottawa, January 26.—Owing to the break in the cable between Prince Edward Island and the mainland, and which cannot be repaired until the ice moves out of the strait in the spring, wireless messages are now passing between the government ships in Pictou, Harbor, Nova Scotia, and the island. The government has decided to establish a Marconi station on the mainland.

The Toronto Electric Company has decided to apply to the Ontario Legislature at its present session for permission to increase its capital stock from $3,000,000 to $4,000,000. The last increase in the company's capital was consented to by the Legislature in March, 1903, when the capital was increased from $2,000,000 to $3,000,000. This increase was all paid up last year, and the present increase is needed to pay the necessary improvements in view.

The gas and electric-light plants, owned and operated by the town of Brockville, Ont., on the business for 1906 show total receipts of $45,523, of which over one-third was from the sale of electric energy. Since the works were taken over by the town, six years ago, the consumers of gas and electricity have paid into the department $37,000 more than it has taken to operate the plants.

It is stated that the Canadian Pacific Steamship Company will equip all its vessels with wireless-telegraph apparatus. The Empresses of the Atlantic service have already been so furnished, but it is now the intention of the company to install apparatus, not only in the Pacific Empresses, but also in its coasting vessels. It is also said that the Pacific Coast company will likewise fit its steamers with the wireless appliances.

Owing to the remarkable electrical development in Canada, the Canadian General Electric Company has found it necessary to erect still another large machine shop, which will mean that between three and four acres of floor space will be occupied by this department. W.

Winnipeg, Man., January 26.—The Kaministiquia Power Company, Fort William, Ont., has decided to enlarge the Kakabeka Falls power plant by installing an additional 10,000 horsepower, thus doubling the capacity of the plant. For this purpose a single pipe line will be laid in the spring between the falls and the power plant. W. A. Black is managing director.

The Grain Growers' Association of Regina has decided to call upon the Saskatchewan Legislature to construct at once a government-owned telephone system, it being agreed the present service is both inadequate and unsatisfactory. W. J. Stevens, Indian Head, Sask., heads the movement.

A great scarcity of poles suitable for telephone purposes is reported from all over the Canadian Northwest, and it is expected this will seriously delay the large amount of telephone construction planned for the coming summer.

The Winnipeg Civic Power Commission has decided to call for tenders at once for the construction of an electric railroad to run between Lac du Bonnet and Point du Bois, a distance of 24 miles. This line is required to haul supplies to the site of the $3,500,000 power plant to be erected by Winnipeg.

Willis Chipman, C. E., Toronto, has prepared an estimate of the cost of the construction of an electric-light and waterworks system for Estevan, Sask., and finds the required work will total $67,000. H. Yardley is mayor.

The Lorimer automatic Telephone system being installed by the city of Edmonton, Alberta, will be completed by August 1st.

Tenders will shortly be called by the Manitoba government for all materials necessary for the construction of 1,000 miles of government-owned telephone lines. Estimates of cost are now being prepared in the Manitoba Department of Public Works, Winnipeg. Hon. Robert Rogers is minister of public works.

The Winnipeg Civic Power Commission will shortly call for tenders for a quantity of electrical material necessary for the construction of the power plant now being constructed. Alderman Pulford is chairman. R. F. R.

New York.

New York City, January 26.—Under a decision recently rendered by the Appellate Division of the Supreme Court the Long Acre Light and Power Company, which was organized in 1903 to generate and sell electricity for lighting, heating and power purposes, can compel the Consolidated Telegraph and Electric Subway Company to permit the Long Acre company to lay its wires and conductors in the latter's conduits. It is believed that this decision will be upheld, and in that event the New York Edison Company may have to face serious competition. The Long Acre Light and Power Company was incorporated by some theatrical men, who acquired a franchise granted 20 years ago by the Board of Aldermen to the American Electrical Manufacturing Company, long since defunct. Under this charter the Long Acre company is authorized to erect a plant and lay the necessary wires and other conductors in the district bounded by Fifth Avenue, Thirty-third Street, the North River and Fifty-ninth Street. It is within this district that most of the theaters, dry goods houses, hotels, restaurants and other large users of electricity are located. A short time ago this company was absorbed by the Manhattan Transit Company, in which John C. Sheehan and some of his political associates are prime movers.

Edgar Van Eiten, vice-president of the New York Central Railroad, is about to be elected president. Among the directors are William J. Clark of the General Electric Company, William H. Lamprecht of Lamprecht Bros., bankers in Cleveland; G. Tracy Rogers, president of the Binghamton Railway Company, John C. Sheehan and William Harris.

Negotiations are now pending with the New York, New Haven and Hartford Railroad Company which will perhaps result in the absorption of the Manhattan Transit Company. This will be of advantage to the railroad company in connection with the new terminal which it contemplates.

Charles F. Cutler, president of the Empire Subway Company, contradicts the reported increase of $50,000,000 in the capital stock of that company. He says the increase is about $5,000,000 and is made merely to take care of the gradual growth of the company, which is about 10 years old and is a subsidiary corporation of the New York and New Jersey Telephone Company. Its purpose is to build and maintain conduits for carrying telephone and other wires.

During the recent storm the new electric locomotives used in the makeup of trains about the Grand Central yards and also to pull the Yonkers and Croton trains as far as High Bridge got their first actual snow experience. Officials on both sides of Vanderbilt Avenue say that the electric locomotives "made good" beautifully. The Port Chester local was the only exception, being 20 minutes late in

getting away. During a snowstorm the clouds of steam that settle over the yard give almost as much trouble as the snow, interfering seriously with the switchmen in the performance of their duties. With the electric system most of this is avoided.

The successful installation of a new electro-pneumatic switch and signal tower on the Brooklyn Rapid Transit elevated system at the junction of Myrtle and Hudson Avenues a few weeks ago has been followed by the inauguration of a similar 10-lever tower at the junction of Myrtle and Grand avenues. The new tower, like its predecessor, is interlocking, and the handling of the heavy switches and signals is accomplished by tapping tiny levers which control the electric and compressed-air power. The tower is of the latest type in every detail and controls the heavy movement of trains over the Ridgewood and Lexington Avenue lines.

A new union has been formed called the Inside Electrical Workers' Union of Greater New York. By the signing of an agreement with the Electrical Contractors' Association, stipulating that members of the new union shall receive $4 a day for this year and $4.50 a day next year, the status of the new association has been established. The leaders assert that within a short time all the members of the Electrical Workers' union will become members of the new organization.

The Manhattan and Hudson Railroad Company, which is the builder of the "McAdoo" tunnels under the Hudson River, designates September 1st as the time when trains will begin running from Fourteenth Street, Manhattan, to Jersey City. There are three tubes. They will be used by the Pennsylvania, Erie, Lackawanna and possibly Jersey Central railroads for the transfer of their travelers. In the planning of the cars ideas have been taken from the Boston Subway and Brooklyn Bridge cars, with original features added. The middle entrances will be operated by compressed air by guards on the platform. The guard moves a lever and both the platform and middle doors open or shut. It will be impossible for a passenger to be pinched by the double doors, as the power is applied so lightly that they can be stopped with the hand. The cars are to be of steel, trussed like a bridge. The seats are to be of metal and the floors of cement. Underneath is a Westinghouse brake. There will be no hanging straps, only a few leaning posts. Two hundred and fifty cars, designed on these lines, are being built and will be ready by September 1st, when it is expected that the tunnels will be formally opened for business.

The plant of the American-De Forest Telegraph Company at Sea Gate has been seized by the sheriff for the satisfaction of two judgments obtained against the company for $900 each by the Southern New England Telephone Company.

D. E. P.

Ohio.

Cleveland, January 25.—The presidents of the two street-car companies in Cleveland have kept themselves fairly busy the past week in conferences over the holding plan. It is said that the valuations on the physical properties will be ready within a short time. A contractor and a real estate man were called in to look over the plants and real estate and give estimates on them. As both the land and buildings have appreciated in value since they were acquired, this will aid in the negotiations.

The Bryan Insulated Fiber Company of Bryan has been organized to manufacture mouthpieces and telephone receivers and other articles into which such insulated matter goes. The capital stock is $25,000. The material is manufactured by a chemical process and is the invention of Howard J. Myers.

The city council of Youngstown has passed an ordinance prohibiting the Mahoning and Shenango Valley Railway and Light Company from operating freight cars on the street railway lines until a passenger service is furnished that will satisfy the city authorities.

It is said that the proposed line from Norwalk to Indianapolis by which it is intended to form a through route between Cleveland and Indianapolis will be operated with gasoline cars. At a meeting in Norwalk a few days ago the matter was discussed at some length and the engineer reported that the cost would be about $7,000 a mile less than an equipment of power houses, sub-stations and copper lines.

Bids will be received on February 4th by the clerk of the board of education of Youngstown for gas and electric fixtures for the Myrtle Avenue school building.

The Interurban Construction Company of Toledo has been incorporated. This company is closely allied with the Toledo, Fort Clinton and Lakeside Electric Railway Company.

The Mahoning and Shenango Valley Railway Company is competing its large power house at Youngstown. When finished it will contain three turbo-generators of large capacity. Several smaller stations will be dismantled and the power will all be furnished from the main station. Sub-stations will be maintained at Niles, Edenburg and Lowellsville.

The car house of the Interstate Traction Company at Huntington, W. Va., was destroyed by fire a few days ago, when seventeen of the twenty cars used by the company were burned. The road is temporarily out of business.

The Manhattan Electrical Supply Company has put its new factory at Ravenna into operation.

The Acme Electric Company of Cleveland has made an assignment to Charles A. Morris.

President E. W. Moore of the Lake Shore Electric, at the annual meeting of the stockholders in Toledo, read a report that shows the system to be in good shape and doing excellent business. Mr. Moore reviewed the new work that has been done the past year, including the double-tracking of the line between Cleveland and Lorain and the additions to the power plants and the interests in the Sandusky-Fremont branch, under construction. The financial reports showed good results in the operating department. The officers and directors were re-elected.

O. M. C.

Michigan.

Grand Rapids, January 26.—John Tweddle and Tony Bartak of Traverse City propose to build a dam at Leland which will furnish light and power to Sutton Bay, Northport, Omena, Leland and Provemont.

Plans are being perfected for the building of a trolley line from Adrian to Detroit, paralleling the Wabash and the Detroit, Toledo and Ironton railroads.

For its share of the street improvements for the last year the Grand Rapids Railway Company must pay the city $48,879.59. The general taxes of the company amount to $40,572.41.

The village of Vanderbilt has granted the Parks and Kelley Shingle Company a 10-year franchise to light the village with electricity and furnish current for private use. The company's plant, recently destroyed, is now rebuilding.

President Griffin of the Battle Creek and Coldwater electric line announces that the road has been financed by New York capital, and work will be began at once. The right-of-way is all secured. Contractors will offer bids next week.

The Common Council of Holland, Mich., has denied the petition of the Grand Rapids, Holland and Chicago Interurban railway for trackage privileges on Pine Street.

The Shaw Electric Crane Company of Muskegon, Mich., has received an order from the Standard Steel Car Company of Hammond, Ind., for 22 cranes. The largest is to weigh 15 tons, and the remainder 7½ tons each.

The Gale Manufacturing Company of Albion, Mich., has decided to purchase from the Commonwealth Power Company of Jackson, Mich., 300 horsepower of electric current for the next five years. Motors will replace the big Corliss engine formerly used in the plant.

The yearly report covering the improvements and additions to the lines of the Michigan United Railways shows that in the lines which center in Lansing, Jackson, Battle Creek and Kalamazoo 156 miles of city and interurban tracks is owned by the company. The 200-mile mark will be reached with the completion of the Lansing-Jackson line.

L. W. B.

Illinois.

Peoria, January 26.—The Alton, Jacksonville and Peoria Railway, which was incorporated last year, announces that it will start building as soon as the weather permits.

The Peoria Gas and Electric Company's bid for street lighting was $65 for arc lights, and $20 for 32-candlepower incandescents.

A bill has been introduced in the State Legislature giving cities of 30,000 to 100,000 population the power to sell surplus electricity for light and heating purposes, and power to regulate rates for gas, electric light and heat. The bill carries a referendum clause. The bill went to the committee on municipal corporations.

The heavy rains of the week, together with the exceedingly high water in the rivers and creeks, have caused much trouble to the various electric companies. The traction company had two subways flooded, and in several places new grading was washed out. The Central Union Telephone Company's cable across the river here was broken by the high water, necessitating the laying of a new cable.

The McKinley franchise in St. Louis is still in the hands of the council committee, but will come up for a vote next week. The McKinley syndicate is securing options on property up the river to build a road from Peoria to Bureau. President McKinley in a recent speech gave out information of several lines to be built in the near future. It is proposed to construct a large power house at Sparland. The company has secured an option on a tract of ground there and will mine its own coal there for use in the power house.

Frank P. Ide appeared before the committee of the Springfield City Council and gave costs of producing electricity. He said that light could be manufactured and distributed at a cost of three cents per kilowatt-hour. He also said that a reasonable rate would be five cents for the business section and seven cents for the residence section; also that the fixing of a rate for 10 years was rather venturesome. In figuring the profit from a $200,000 plant with a capacity of 1,000,000 kilowatts per year, he stated that with a charge of five cents for commercial light, this would mean a profit of $20,000 a year on the investment.

The committee practically decided to recommend an amendment to the Brinkerhoff ordinance making the maximum rate 10 per cent. below the present rate of the Utilities company.

The Southeastern Illinois Long-distance Telephone and Telegraph Company of Robinson has been incorporated by W. M. Long and others.

The South Wilmington and Southern Railroad Company has been incorporated to build a road from South Wilmington to Wilson, with principal office in Chicago. Incorporators include A. L. Sweet, T. A. Lemmon, Walter Farmer, C. A. Sweet and R. H. Gruschow.

V. N.

Northwestern States.

Minneapolis January 26.—The Minneapolis General Electric Company is negotiating with the Armour company to supply its proposed plant in Minneapolis with power from the new power plant at Taylors Falls, Minn. The plant will be one of the largest packing plants in the world, the site consisting of about 900 acres, and an immense amount of electrical machinery will be installed if the contract is closed.

The Ellsworth (Wis.) Heat, Light and Power Company has begun preliminary work at the site of its new dam on the Rush River, eight miles from Ellsworth. The dam will be about 180 feet long.

The Beatrice Gas and Power Company has filed articles of incorporation at Beatrice, Neb., with a capitalization of $150,000.

The new electric-light plant at Red Cloud, Neb., has been completed.

Fred Buehler and J. Jerabek will install an electric-light plant at Sterling, Neb.

An electric-light system will be established at Lohrville, Iowa, and $5,000 has been voted for the purpose.

Extensive plans for the further extension and improvement of the Milwaukee Electric Railway and Light Company and the Milwaukee Light, Heat and Traction Company are being considered.

A company may be formed at North Mankato, Minn., to construct a power plant for street lighting and power purposes.

The Waterloo (Iowa), Cedar Falls and Northern Railway Company will make extensive improvements on its lines during the year, the estimated cost being $300,000. Among the improvements will be a new power house.

The Wisconsin Electric Railway Company has been incorporated at Milwaukee by W. D. Hickman and associates with a capital of $50,000.

An electric-lighting system is to be established at Sheldon, N. D.

A bill will be introduced in the Minnesota Legislature this winter to permit street railways to carry freight and to extend their lines outside the corporate limits of cities. The object of the bill is to stimulate electric lines to build into farming communities.

There is talk of the city of Menasha, Wis., putting in an electric-light plant for furnishing commercial lights.

R.

Pacific Slope.

San Francisco, January 24.—The new City Electric Company, for which A. M. Hunt is electrical engineer, has ordered for its proposed light and power plant in San Francisco two large Westinghouse-Parsons turbo-generators. The power house will be located at North Beach, where fuel oil can be easily supplied and salt water for condensing purposes easily secured. Samuel Naphtaly, who has been chief engineer of maintenance and operation of the Pacific Gas and Electric Company, will on March 1st join the new concern and will be placed in charge of the transmission lines now operated by the owners of the City Electric Company under the names of the Truckee River General Electric Company and the American River Electric Company. These concerns supply current through mining districts in Nevada and California and in Stockton, Cal.

The San Francisco Coke and Gas Company, which has hitherto furnished only a gas-lighting service, has signed a contract to distribute locally the current from the Stanislaus Electric Power Company that is to be available in a year, and is now in the market for a 5,000-kilowatt turbo-generator for installation this fall. This will place the coke and gas company in a position to bid for the public lighting contracts, which none but the Pacific Gas and Electric Company can do at present.

The United Railroads of San Francisco will at once begin work on its proposed overhead trolley lines on Sixteenth Street from Kansas Street to Seventh. The Board of Supervisors has passed to print an ordinance granting this company a 25-

year franchise for this road, which will tap the new wholesale district near the Potrero district and relieve the pressure on other lines.

The Seattle-Tacoma Power Company's big hydro-electric transmission plant at Electra, Wash., which was out of commission some days this winter on account of floods, has been frozen up, owing to the unusually severe cold. For several days the Seattle Electric Company's system was short 140 cars from lack of sufficient power for their operation. The company applied to the city for power from the municipal electric plant.

The Starbuck Electric Light and Power Company of Starbuck, Wash., has been incorporated and capitalized at $10,000 by M. and Z. Pietrzyoki and A. C. Warren.

J. A. Whitehead of Redding, Cal., an engineer, recently secured water rights on Battle Creek on the Shasta-Tehama Pacific Power Company, which plans to install a system capable of furnishing power and light for the Sacramento Valley. J. B. Madgshon and G. T. Peacocke have provided the money for the first preliminary expenses. The total estimated cost of the installation of the proposed system is $750,000. The company will make a specialty of building and operating pumping plants for the irrigation of land.

Engineer L. J. Kohl, who was engaged by the city trustees to render an estimate for furnishing the city of Oroville, Cal., with a municipal water, electric-light and gas system, has filed his report, which was accepted by the board. The cost of the system is estimated at $95,850.

The Northern Electric Company, which is operating its electric railway lines from Chico to Marysville, Cal., has petitioned the supervisors of Butte County, Cal., for a franchise for a spur freight line around the eastern limits of Chico. A second 50-year franchise has also been asked for that covers a part of the proposed route for a passenger and freight road from Chico to Hamilton City. A route westward from the intersection of Oak and Fifth streets on the West Side of the city, 1,600 feet, is desired. This company has ordered 200 40-ton flat cars in the East suitable for construction trains and freight haulage. A.

PERSONAL.

Mr. A. G. Munro, secretary of the Nebraska Electric Company of Omaha, was one of the late visitors to the Electrical Show last week.

Mr. W. R. Goodman has resigned the position of secretary of the Chicago Fuse Wire and Manufacturing Company, to devote his full time to the interests of the Whitely Exerciser Company of New York, with which business he has also been connected for some 12 or 13 years. Mr. Goodman's departure from the electrical field will be witnessed with much regret, as he has been in it for over 18 years and has made many pleasant associations.

Albert W. Foster of Chicago, who during the last four years represented Westinghouse Electric and Manufacturing Company interests in Brazil, is now electrical and mechanical engineer with the Florida East Coast Hotel Company, commonly known as the H. M. Flagler interests, including railway and steamship lines. One of Mr. Flagler's latest undertakings is the building of an ocean railroad from Miami to Key West, Fla. The construction of this line is well advanced, and when finished the road will be one of the most interesting examples of railroad building of the present day.

Cards are out announcing the marriage of Mr. Henry Hollingshead Geary to Miss Fannie Hazel Leppard on January 23d, in Fostoria, O. The wedding took place at the home of the bride's sister, Mrs. Andrew Emerine, Jr. Mr. L. P. Sawyer of Cleveland acted as best man. Miss Leppard is a descendant of an old Southern family and is one of the most beautiful and highly esteemed young women in Fostoria. Mr. Geary, although only about 30 years of age, has had quite an extensive experience in the electrical business, chiefly in the incandescent-lamp business. He graduated in the electrical engineering course from the Pennsylvania State College, and later became connected with the Fostoria Incandescent Lamp Company, first in New York city, but later in Fostoria, where he was promoted to be sales manager and then treasurer of the company. Mr. and Mrs. Geary will spend their wedding journey of three weeks' duration in the South. Afterward they will make their residence in Fostoria, as this is now Mr. Geary's headquarters, and they will be at home to their friends after February 15th.

ELECTRIC LIGHTING.

Tama, Iowa, is about to vote $10,000 for an electric-light plant.

Fred Buehler is about to put in an electric-light plant in Sterling, Neb.

D. T. Bomar is about to install an electric-light plant in Anson, Texas.

The Ord Electric Light and Power Company of Ord, Neb., has been incorporated with a capital stock of $20,000. It will conduct a general electric light and power business. The incorporators are A. P. Jensen, C. E. Detweiler, Fred J. Bell and C. R. Smith.

D. M. Dean has been granted a franchise for an electric-light plant in Valparaiso, Neb.

The Citizens Light and Railway Company of Muscatine, Iowa, has been incorporated with a capital of $20,000.

The Houston Electric Company of Houston, Texas, proposes to spend $500,000 for improvements and extensions to its plant.

The Texico (N. M.) Water and Light Company has been incorporated with a capital stock of $10,000 by T. R. Reagan and others.

The Ralls County Electric Light and Power Company of New London, Mo., has been incorporated with a capital stock of $5,000.

An ordinance passed by the council at Sioux City, Iowa, requires electric wires within a certain district to be placed in conduits.

New Hampton, Iowa, will vote on February 5th on a proposition to issue bonds for $18,000 for an electric-light plant and waterworks.

The Wisconsin Electric Company of Milwaukee has been incorporated with a capital stock of $50,000 for the purpose of building and operating electric light, gas and water plants.

The directors of the Denison Light and Power Company of Denison, Texas, have decided to improve the plant at a cost of about $50,000. W. B. Munson is president of the company.

The electric-light plant and cotton gin owned by W. B. Worsham & Co. of Henrietta, Texas, has been destroyed by fire, with a loss of $25,000. The plant will probably be rebuilt at once.

The New State Electric Company has been chartered at Oklahoma City, Okla., with $30,000 capital. The incorporators are: C. D. Leach and H. L. Rubardt of Oklahoma City, and H. W. Dean of Gainesville, Texas.

The properties of the Electric Company of America, with headquarters in Philadelphia, have been transferred to the American Gas and Electric Company. The stockholders of the former company have subscribed to nearly $250,000 of the $1,200,000 issue of preferred stock of the American Gas and Electric Company.

The Compania Electrica e Irrigadora of Pachuca, which has been supplying the city of Pachuca, Mexico, with electrical energy for power and lighting from the company's Juando generating station, has now in process of construction a new plant. The Westinghouse Electric and Manufacturing Company will supply all of the new equipment for the Elba plant and also the necessary additions to the Juando plant, as well as at the receiving plant at Pachuca. Arrangements are also being made to double the capacity of the electrical equipment in the plant of the Compania de Cemento Portland at Pachuca.

The old question of the legality of granting permits to the North Shore Electric Company to continue the maintenance of electric-light wires and poles in Norwood Park, Jefferson, and other localities within the city limits of Chicago where operations have been carried on by virtue of a suburban grant 14 years ago, is now settled by announcement of W. G. Beale, representing the Commonwealth Electric Company, that the question has been eliminated by the purchase of the disputed lines from the North Shore company by the Commonwealth. Most of the business of the North Shore company is outside the city limits. The Commonwealth company will take over the wires and poles in dispute on February 1st. The Commonwealth company has an ordinance permitting it to do business in the localities in question, and the council committee is thus relieved of further consideration of the matter.

ELECTRIC RAILWAYS.

C. J. Jones of Oklahoma City is promoting the construction of an electric railway between Okmulgee, Okla., west to Chandler.

The San Bernardino Valley Traction Company has announced its intention of building an extension seven miles long from Colton to Riverside, Cal. Right-of-way has been obtained and survey made.

The Ithaca-Seneca Falls (N. Y.) Electric Interurban Railway has been incorporated with a capital stock of $1,000,000. Jacob Rothchild of Ithaca is president and J. M. Hammond of Seneca Falls, secretary.

Formal announcement of the project to connect Indianapolis and Chicago by an electric railroad was made in the incorporation of a new $7,500,000 company. The road will be known as the Chicago, South Bend & Northern Indiana Railway Company. It is said that the company has purchased the Northern Indiana Railroad Company's system for $4,000,000 and that these lines will be used in the extension of the present system. Work on the extension from South Bend to Michigan City will be begun at once, it is said. From Michigan City the road will be extended to Chicago.

The Transcontinental Electric Railway Company has been organized at Portland, Maine, with a capital stock of $50,000,000. The purpose is to build electric railways anywhere in the United States.

The Delaware, Lackawanna & Western Railway will electrify its lines between Morristown, N. J., and New York city on the completion of the McAdoo and Bergen Hill tunnels. It will use the third-rail system.

The Hamilton Radial Electric Railway Company of Hamilton, Ont., is making application to construct an electric railway from Hamilton to Windsor and to build and operate ferry boats between Windsor and Detroit.

The Steubenville (Ohio) Traction and Light Company recently turned over all its property to the new Steubenville-East Liverpool Traction and Light Company. The new corporation is capitalized at $3,000,000. Van Horn Ely of East Liverpool is at the head of the company.

The Payallup Valley Northern Rapid Transit Company, incorporated for $3,000,000, will build an electric road from Spokane to Puget Sound, 450 miles, to be completed in 1909. Contracts for part of the work have been awarded to the Continental Engineering-Construction Company of New York.

The Utah Light and Railway Company of Salt Lake City has appropriated money for a new steam-power plant at Jordan. This plant will be modern in every respect and will have a capacity of 25,000 horsepower, of which about 15,000 will be installed for immediate use. Final plans are being drawn.

George M. Clark, John H. Brand and R. P. Halleck of Louisville, Ky., owners of 175 shares of the common stock of the Memphis Street Railway Company, have asked the Chancery Court for a receiver for the company. The bill further asks an injunction to restrain the proposed merger of four companies into the American Cities Railway and Light Company, chartered under the laws of New Jersey.

A 70-year franchise has been granted to Carlos Schmidt and others of Rio de Janeiro for construction of an elevated railroad to serve the city of Rio de Janeiro and its suburbs. This franchise was obtained for an American company. It represents a purely American enterprise, and present plans are that all the equipment will be purchased in the United States. Charles E. Browne of New York city is president of the company. It is planned to send engineers and technical experts to Rio de Janeiro to begin preliminary work. Plans call for about 60 miles of right-of-way which is to be double-tracked throughout. The third-rail electric system will be used, motive power to be derived from its own plant or from one of the two concerns now preparing to develop waterpower in the mountains near Rio de Janeiro.

PUBLICATIONS.

The Antikamnia Chemical Company of St. Louis has issued a pleasing calendar bearing a sympathetic picture, in colors, of "The Convalescent—A Neighborly Visit."

The Electric Journal of Pittsburg has issued a Topical Index for the first three volumes of that journal. By the use of this index it is not necessary to look through a number of volumes, but any article in any volume, along with all articles on this subject, may be quickly located.

Two new circulars, Nos. 53 and 54, issued by the Garvin Machine Company, New York city, have been issued. The former circular treats of the company's vertical spindle milling machines, and the latter of the Universal and Plain machines. Both circulars are well printed in two colors.

The Wellman-Seaver-Morgan Company of Cleveland, Ohio, has just issued its circular, No. GP-1, on the Hughes continuous gas producers. The book, which is printed in two colors, on very fine enameled paper, shows a number of halftone engravings and diagrams of both the hand poked and mechanically poked gas producers.

"The Electric Railway and the Municipality," an address by Hon. Henry J. Booth of Columbus, has been issued in pamphlet form. The address was delivered before the Columbus convention of the American Street and Interurban Railway Association last October, and B. V. Swenson, 60 Wall Street, New York, secretary of the association, can give information in relation to it.

The Evans patent automatic non-reversing friction stop, manufactured by Scott F. Evans, Minneapolis, Minn., is fully explained in a circular just issued. Attention is also called to the Evans patent motor attachment for elevator leg drive. The friction stop is designed to be attached to a motor or countershaft which drives an elevator leg for the purpose of preventing the "backing" and conse-

quent "choking" when a fuse blows out or the power is shut off unexpectedly.

The Ontario Power Company of Niagara Falls, Buffalo, N. Y., has issued five excellent maps of the several Niagara power districts. The maps are contained in a convenient and servicable cloth-covered case. Map No. 1 is a general map from Syracuse, N. Y., to Hamilton, Ont.; Map No. 2 a general map of the Niagara frontier, eastern Ontario and Western New York; Map No 3, Welland Canal; Map No. 4, Niagara Falls and vicinity, and Map No. 5, Buffalo, Depew and West Seneca.

The Hubbell Electrical Catalogue of electrical specialties presents a class of goods original in design and practical in use. Some fine special finishes for fixtures are shown. Then there are illustrations and detailed descriptions of pull, wall and rosette sockets, switches, attachments, adapters, plugs of all kinds, receptacles, shade holders, reflectors, shades, guards, clusters, fittings, etc. Increased facilities will enable the closest attention to design and quality. The catalogue is issued by Harvey Hubbell, Inc., Bridgeport, Conn.

The Westinghouse Companies' Publishing Department has just issued several interesting little booklets treating of Westinghouse motor applications. These booklets are very neatly printed in two colors and are descriptive of an automatic pin-ticketing machine, Champion blacksmith blowers, Blackeslee dish washers, Singer sewing machines, sanitary air-sweeping and scrubbing apparatus, Day dough-mixing machines, Mills ice-cream freezers and coffee grinders. All these devices, as described, are driven by Westinghouse motors.

The Peirce Specialty Company, Elkhart, Ind., has just issued a catalogue of the steel construction material which it manufactures and carries in stock. The company's new plant is adequately provided with facilities for manufacturing and shipping its extensive lines of material used in line construction. It makes a specialty of catering to companies doing business in tropical countries, where climate and insects render the use of wood inadvisable. But, whether used in Illinois or in the antipodes, the company points out that "there's a reason" for every Peirce bracket, pole fixture, expansion bolt, hammer drill or other appliance.

A catalogue of unusual interest is that of the J. P. Devine Company of Buffalo, relating to vacuum drying and impregnating apparatus. The Emil Passburg system of vacuum drying apparatus is illustrated and described. Among other things described in the pamphlet is vacuum drying and impregnating apparatus in various dimensions for transformers, armatures, field and magnet coils, etc.; also cast-iron vacuum drying chambers for power and telephone cables, etc. The vacuum process of drying appears to have decided advantages over other methods using hot air, direct-fire gases, etc. The company says that it will be pleased to dry for prospective customers, free of charge, samples of material forwarded to it.

The General Electric Company has issued a handsome bulletin devoted to electric heating and cooking. It will be appreciated especially by central-station managers and lighting-company contract agents who are striving hard in the development of increased revenue from the introduction of cooking and heating devices in the home. Besides giving some very good and instructive literature on the general subject the company illustrates, describes and quotes prices on its excellent line of cooking and heating utensils and appliances. There are two valuable diagrams showing the plan of a house without a kitchen chimney and showing separate lighting and heating circuits. Several of the pictures are done in three colors and are very beautiful. The bulletin is a valuable contribution to the subject of electricity in the household and an excellent example of the printer's skill.

CALENDARS.

A calendar issued by Harvey Hubbell, Bridgeport, Conn., describes a number of Hubbell specialties. It also serves, to some extent, the purpose of a catalogue, as no less than 34 cuts are shown.

The Hazard Manufacturing Company of Wilkesbarre, Pa., manufacturer of wire rope and insulated wire, shows on its 1907 calendar a large cut of an anthracite colliery in operation.

A pretty calendar is that issued by the National Carbon Company of Cleveland, Ohio. It is a combination of a calendar and moonlight schedule, the latter being especially useful to central-station men.

"The Practical Engineer," published in Philadelphia, has not forgotten in getting up its calendar to lay special stress on the importance of advertising. It refers to it as "the motive power that drives the sales department of a business."

SOCIETIES AND SCHOOLS.

In a recent University of Illinois press bulletin attention is paid to the demands which the trustees of the university intend to make on the Legislature. They will ask for the sum of $1,600,000 for the running expenses of the university during the coming biennium, $62,000 for increase in the plant, and for an appropriation of $1,000,000 for the erection of much needed buildings upon the campus in Urbana.

The proceedings of the ninth annual meeting of the Kansas Gas, Water and Electric Association, held in Lawrence, Kan., on October 16 and 17, 1906, are now available in pamphlet form. President Sweezy's address occupies three pages, while ample space is devoted to "The problem of the country plant," "The sources and composition of natural gas," "The Kansas water survey," "Developing a day load for a small central station," etc. James D. Nicholson, Newton, Kan., is secretary of the association.

AUTOMOBILES.

The Chicago Automobile Show of 1907 will be held at the Coliseum during the week of February 2d to February 9th. Samuel A. Miles is the manager. Three hundred exhibitors and a very fine display are expected.

The International Automobile Exposition of Berlin, recently closed, was the most brilliant success ever attained by any previous exhibition of its kind in Germany. The exposition was held under the auspices of the Imperial German Automobile Club and the German Association of Motor Car Manufacturers. According to the official catalogue, there were 980 distinct exhibits, shown by 371 firms, companies and individual manufacturers. Of the exhibitors, 338 were German, 17 French, five Italian, four English, three American, two Belgian and two Swiss. This classification designates only the nationality of the direct exhibitors, and does not explain the large number of exhibits, such as machinery, automobile parts, and accessories made in other countries and exhibited by German firms and companies who are the resident agents for the sale of such products in Germany. While there was but little that was strikingly novel, great progress, however, was shown in the attention paid to the details of construction, not only in the motors, but also in the methods of transmission, in the brakes, in the coach work, and in the refinement of design.

MISCELLANEOUS.

Three hundred electric cabs—$320,000 worth, it is said—were destroyed in New York city on the night of January 28th in a fire in the building of the New York Transportation Company. Because of poor water pressure, the blaze was got under control only after two hours. The company has a general electric cab service throughout the city.

James M. Ketcham, a traveling salesman for an electrical-supply house, was one of the talesmen summoned for examination in connection with the Thaw murder trial in New York city a few days ago. On being questioned as to whether he had any conscientious scruples against capital punishment, Mr. Ketcham replied with some feeling: "I have not, but I do object to the application of electricity as a means of carrying out such a penalty." Upon further questioning the witness admitted that the fact that the New York law calls for death by electricity in capital cases would not deter him in finding a verdict of guilty if the evidence seemed to demand it. The electrical man, however, was not accepted as a juror.

TRADE NEWS.

The American Electrical Supply Company, 211 Lake Street, Chicago, suffered a small loss as the result of a fire which started at 39 Franklin Street on the night of January 24th.

The Falkenau Electrical Construction Company of Chicago has been granted incorporation papers. The capital is $20,000, and the incorporators are Victor Falkenau, W. A. Burroughs and H. A. Strauss.

Exports from the United States to Cuba in the calendar year 1906 were larger than in any other year of our trade with that island. Imports from the island fell ten million dollars below those of the high record year, 1905. The total value of exports to Cuba in 1906, as shown by figures just compiled by the Bureau of Statistics of the Department of Commerce and Labor, was $46,491,944, against $44,569,812 in 1905, $32,644,345 in 1904, and $23,504,417 in 1903, the year immediately preceding the beginning of the present reciprocity treaty with Cuba.

BUSINESS.

Promoters of the Aabt Manufacturing Company have started the erection of their factory plant in South Elgin, Ill., and during the early spring expect to have machinery installed and everything in running order for the manufacture of electrical supplies, including a patented business block telephone system. Charles Heywood of Elgin is president of the company, which is capitalized at $60,000.

The Crocker-Wheeler Company of Ampere, N. J., announces recent orders from customers named below. In many cases these are additions to the electrical equipment which is composed principally of C-W apparatus: Bridgeport Malleable Iron Company, Bridgeport, Conn., one 200-kilowatt direct-current generator, one 90-kilowatt direct-current generator; Pittsburg and Baltimore Coal Company (Edna Mine No. 2), Wendel, Pa., one 300-kilowatt direct-current generator; W. & J. Knox Net and Twine Company, Baltimore, Md., 25 25-horsepower direct-current motors; Bridgeton Electric Company, Bridgeton, Conn., one 500-kilowatt direct-current generator; Alliance Machine Company, Alliance, Ohio, 74 motors ranging from six to 100 horsepower; Bosches Troy Laundry, Austin, Texas, 14 motors ranging from one-eighth to 7½ horsepower and one 35-kilowatt generator.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 22, 1907.

841,709. Electric Brake. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed May 3, 1900.

The combination is used on an electrically operated car and consists in part of a running controller and a braking controller which is adapted to apply the brakes and to connect the running controller with the braking circuit whereby the brakes may be controlled either by the running controller or the braking controller. The braking controller is adapted to connect the motor to act as a generator for the braking circuit and also adapted to control the current in the braking circuit. A running controller for the motor is also adapted to control the current in the braking circuit by the same movements as in running.

841,710. Electric Brake. Frank C. Newell, Wilkinsburg, and Edward H. Dewson, Edgewood Park, Pa., assignors to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed April 11, 1904.

The combination, on an electric car, consists of one or more motors, a running controller and a braking controller for connecting up the motors to act as generators in a local brake circuit, the braking controller being provided with contact-points adapted in one position to supply line-current to the fields of the motor generators and in another position to close a shunt around the fields of the generators.

841,720. Electrolytic Apparatus. John H. Ryan, Portland, Ore. Application filed March 1, 1906.

An electrolytic apparatus comprising a trough adapted for conveying a stream of electrolyte has electrodes therein connected electrically in multiple, and means operating simultaneously on a number of the electrodes to adjust their positions.

841,743. Alarm Gauge. George A. Wall, Providence, R. I., and John H. Derby, Brookline, Mass., assignors to the Boston Automatic Fire Alarm Company, Boston, Mass. Application filed February 17, 1904.

A bridge conductor between the electrodes of an alarm circuit of a pressure gage is substantially circular except at portions normally opposite the electrodes, where it is recessed. Means connect the gage and conductor to operate the conductor and thereby break the alarm circuit when the recesses are opposite the electrodes and make the circuit at other times.

841,747. Telephone Trunking Circuits. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 3, 1902.

Combined with a trunk circuit adapted to be united to a calling telephone line at its outgoing end and a called telephone line at its incoming end are a number of relays at the latter end of the trunk, a signaling circuit controlled by the relays, a source of current and a signaling device in the circuit. Means are provided whereby the circuit may be void of current when no signal is displayed, a portion of the signaling circuit on one side of the source being used only for signaling purposes whereby it and the source may be common to a number of such trunk-signaling circuits.

841,765. Illuminating Apparatus. Norman D. Bishop, Los Angeles, Cal., assignor to Donald G. Bishop, Los Angeles, Cal. Application filed August 24, 1904.

An apparatus apparently for illuminating show cases consists of a tube containing illuminating devices and electrical connections to the source of electrical supply.

841,767. Signal. Edward J. Condon, Dixon, Ill. Application filed November 13, 1905.

In a railway signal system a series of signals are operated by means of fluid under pressure. An electromagnet in a normally open circuit causes the release of the semaphore arm, and a switch operated by the next succeeding semaphore arm momentarily closes the circuit through the magnet.

841,769. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 6, 1903.

The combination, with a telephone trunk circuit, is adapted to connect lines together for conversation and consists of a relay the actuation of which completes the tip strand of the trunk circuit for talking purposes, a locking circuit for the relay, a signal circuit, a second relay the actuation of which opens the signal circuit, a locking circuit for the second relay and a trunk relay

the demagnetization of which breaks each of the locking-circuits.

841,816. Electric Sparker for Gas Engines. Reuben P. Ralston, Woodsfield, Ohio. Application filed March 6, 1905.

An electric for electric sparkers comprises a cone-shaped plug having flat ends and a longitudinally-extending aperture formed therein, and a metallic contact point removably secured in the aperture and having one of its ends projecting from the larger end of the plug.

841,820. Electric Arc Lamp. Braxton L. Scott, Washington, D. C. Application filed September 6, 1905.

The frame includes upper and lower disks, the lower disk being provided with a pair of diametrically opposed notches. A pair of side bars extend through the notches and are secured to the disk, the upper ends of the bars being secured to the upper disk, the lower ends converging and forming a support for the lower carbon and globe. Other features are: A casing connecting the upper and lower disks, an insulating cross-bar arranged at a point between the upper and lower disks and connected to and supported by the bars, a steadying resistance arranged in the space between the cross-bar and the upper disk, a pair of series magnets supported by and depending from the cross-bar, and a carbon-clutch under the control of the magnets. (See cut.)

841,830. Internal-combustion Engine. Frederick Wackenhuth, Newark, N. J. Application filed April 19, 1905.

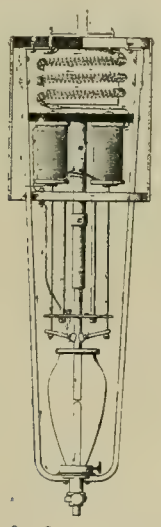
The head of the engine has a combustion chamber and an annular cavity outward from the chamber, a non-conducting material lining the chamber. A sheet metal covering holds the material in place. An ignition tube is located in the combustion chamber and sustained by the sheet-metal covering. An annular metallic case is attached to the face of the piston and adapted to contain a non-conducting material, and an annular metallic shell projects from the case and is adapted to enter the annular cavity of the cylinder head.

841,844. Key-operated Locking Switch. John Bernet, Chicago, Ill. Application filed February 10, 1905.

In an electrical switch comprising a number of sets of oppositely disposed clamping contact points is a key-operated transverse bar adapted to be clamped at its ends in the oppositely disposed contact points, also a laterally projecting plate rigidly engaged to the transverse bar, a cylindric sleeve and a centrally apertured cylindric hub therein adapted to receive the plate therethrough.

841,849. Electrothermal Protector. Frank B. Cook, Chicago, Ill. Application filed April 16, 1906.

An electrothermal protector is described comprising a heating element permanently held in circuit, means for grounding a portion of the circuit through a portion of the heating element under abnormal current conditions, and heat-susceptible insulating material normally holding the grounding means out of electrical connection with the heating element.



NO. 841,820.—ARC LAMP.

841,855. Electric Signal. William F. Dreer, Coulters, Pa. Application filed October 27, 1906.

An electric signal for railways is covered comprising track-rails, an electric trolley or conductor, electric signaling devices, pairs of contacts, one contact of each pair being electrically connected to one of the track-rails and the other contact of each pair being electrically connected with one of the signaling devices and with the trolley or conductor, a circuit-closing lever mounted to alternately engage the pairs of contacts, a lever extending longitudinally of the track and carrying trips to be engaged by the wheels of passing cars, and a connection between the longitudinal lever and the circuit-closing lever.

841,870. Hoisting Apparatus. Charles H. Hunt, New York, N. Y. Application filed July 24, 1906.

In an electric hoisting apparatus are combined a motor, a hoisting-drum, a mechanical brake, means to decrease the resistance of the mechanical brake, electrical connections for driving the motor in hoisting, and electrical connections for increasing the resistance of the motor to backward rotation during the descent of the load, the whole of the field of the motor being included in the connections for hoisting and a portion only of the field of the motor being included in the connections for increasing the resistance of the motor to backward rotation

841,874. Rotary-current Motors Connected in Cascade System. Coloman de Kandó, Budapest, Austria-Hungary, assignor to the Westinghouse Machine Company of Pennsylvania. Application filed October 14, 1903.

The claim of the patent reads: In a system of electric traction a plurality of rotary-current motors with their rotors on the same driving-axle, and a single set of collector-rings located outside the motors, to which rings the windings of both motors are connected, and connections leading through one of the motors to the collector-rings (See cut.)

841,885. Telegraph Code. Charles W. McDonald, San Francisco, Cal. Application filed July 26, 1905.

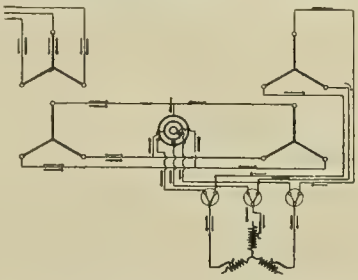
Details of a telegraphic code are covered.

841,914. Cable-holding Clip. Augustus Andrews, Gulfport, Miss., and Lawrence M. Galliher, New Orleans, La. Application filed November 3, 1906.

A clamping plate designed to embrace a cable and bent to form a shell has lugs projecting from one end of the plate and adapted to engage over the ends of the flattened portions of the plate, and means for holding the lugs in locking relation.

841,952. Telegraphic Code. Alexander M. Fisher, New York, N. Y. Application filed August 11, 1905.

A telegraphic code comprising a plurality of tables, one for each syllable of an artificial code-word, each table containing syllables each formed by a vowel and a consonant, and translation numerals and combinations of the same for determining the syllables on each table.



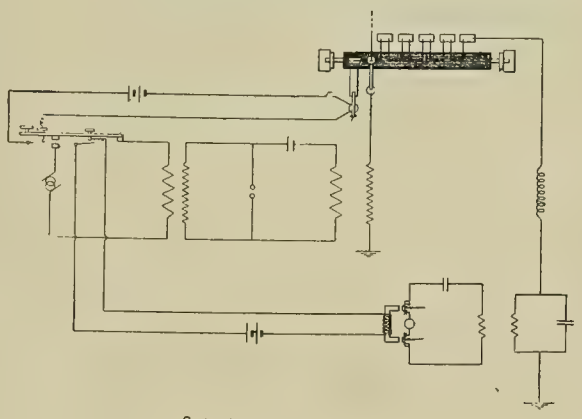
NO. 841,874.—POLYPHASE MOTORS CONNECTED IN CASCADE.

841,975. Electrically Operated Hammer. Ronald P. Irving, Quincy, Mass. Application filed May 21, 1906.

Combined are a frame consisting of a base formed of insulating material, two hollow standards of sheet metal fast thereto, two guide blocks constituting ways of sheet metal fast to the standards, a slide-block adapted to slide on the ways, a magnet, a core slidable therein constituting a hammer and fast to the slide-block, a lever in electric circuit with the magnet, a contact plate with which the lever is adapted to contact, two arms fast to the lever and insulated therefrom, and means fast to the core adapted to alternately engage the arms during the upward and downward movement thereof, respectively, whereby the lever is alternately brought out of and into contact with the plate.

841,993. Telephone Switch-hook. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed December 2, 1905.

The hook is stamped from a single integral sheet of metal and has prongs and a shank, the prongs and shank being folded along their length to make the device of double thickness. A pivotal connection is at the end.



NO. 842,134.—SPACE TELEGRAPHY.

842,020. Receptacle for Incandescent Electric Lamps. Bert E. Salisbury, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed August 16, 1905.

The receptacle combines a porcelain base having a cylindrical central portion, opposite side extensions on the back part of the receptacle and parallel grooves in the extensions on the rear. Wire terminals have their outer ends arranged in the grooves and their inner ends extending into a mouth on the front of the base, an outer lamp terminal being arranged in the mouth and secured on the inner end of one wire terminal. A single screw forms a central lamp terminal arranged in the mouth and engaging with the opposite wire terminal to secure the same in position, the base being also provided with integral, perforated securing ears.

842,082. Circuit-closer. Ernest S. Clayton, Newark, N. J. Application filed December 16, 1905.

A closed receptacle has terminals and a movable contact piece within it and flexible spring electric connections between the terminals and a source of electric energy, whereby the electric circuit is controlled by changes in position of the receptacle, permitted by the flexible spring connections.

842,092. Compass Light. Arthur C. Glover, Ipswich, and William E. Hadlock, Wenham, Mass. Application filed May 28, 1906.

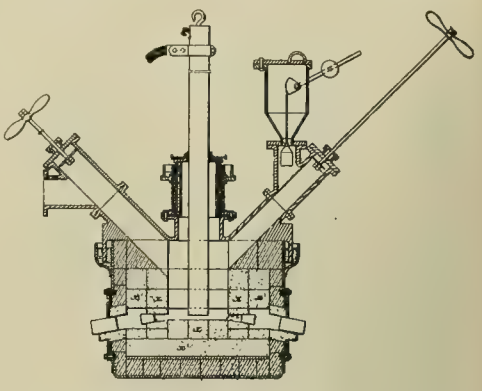
The compass is mounted upon gimbals, and a casing supported upon the compass encloses an electric lamp. An opening through the wall of the casing permits the light to fall upon the compass dial.

842,099. Electric Melting or Reducing Furnace. Gilbert C. Landis, Carlisle, Pa., assignor to the American Phosphorous Company, Camden, N. J. Application filed September 21, 1904.

The combination in an electric furnace consists essentially of a body portion having a conducting lining, an electrode extending into the furnace, a top plate, an inclined passage therein, the passage extending through the upper portion of the furnace and communicating with the reducing-chamber, the passage being so arranged that a tool may be passed through the inclined passage into the reducing-chamber to break the arch of material being treated above the bath. (See cut.)

842,106. Code or Cipher System. Charles W. McDonald, San Francisco, Cal. Application filed October 16, 1905.

A code or cipher system comprising a series of sheets or pages having distinguishing characters, each sheet or page having couplets of characters, adapted to be assembled to form pronounceable words.



NO. 842,099.—ELECTRIC REDUCING FURNACE.

842,110. Multiple-circuit Panel. Henry T. Paiste, Philadelphia, Pa. Application filed April 12, 1906.

A multiple-circuit panel is described consisting of a number of sections of insulating material, a number of metallic connections all on one face of the panel, and a number of fuse-plug sockets on the other face thereof, each socket having one terminal engaging one of the metallic connections and the other terminal formed for the attachment of a conductor, the metallic connections serving to hold together the sections of the panel.

842,123. Containing Cell for Batteries. George H. Stout, Chicago, Ill., assignor to the Automobile Parts and Equipment Company, Chicago, Ill. Application filed August 13, 1903.

The cell comprises a casing or cell proper having a series of slots or grooves on opposite sides, a series of elements received in the slots to form one electrode, and a plate arranged in the bottom of the cell to form the other electrode.

842,134. Space Telegraphy. Sewall Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed November 25, 1905.

Combined in the system are a transmitting system, a receiving system, an elevated conductor, a sending key, a high-potential switch constructed and arranged to alternately connect the elevated conductor to the transmitting and receiving systems, the switch comprising means for augmenting the gap in the circuit beyond an air-gap formed between two contacts, and means controlled by the sending key for operating the switch. (See cut.)

842,154. Telegraph Transmitter. Horace G. Martin, New York, N. Y. Application filed April 16, 1906.

The combination consists of a two-part key lever adapted to be moved as a unit in one direction, part of the key lever being adapted to be moved independently in the other direction, a vibrator carried by the key-lever and adapted to be set in vibration by the movement of the key lever as a unit, a pair of contacts constituting terminals of an electric circuit, one of the contacts being carried by the vibrator and the other being located in the path of the first, and means actuated by the independently movable part of the key lever for making and breaking the circuit independently of the vibrator.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 28, 1907:

420,070. Electric Detecting Apparatus for Coin-actuated Boxes. William J. Howey, New York, N. Y.
420,077. Incandescent-lamp Socket. H. Lemp, Hartford, Conn.
420,079 and 420,080. Electric Reciprocating Tool. H. N Marvin, Syracuse, N. Y.
420,091. Testing Apparatus for Telephone Exchange Switches. J. J. O'Connell, Chicago, Ill.
420,101. Conduit for Electric Street Railways. J. W. Reno, Boston, Mass.
420,102. Telegraphic Transmission of Index Movements. F. Richard, Paris, France.
420,109. Electric Arc Lamp. C. E. Scribner, Chicago, Ill.
420,117. Electric Motor and Regulator Therefor. E. A. Sperry, Chicago, Ill.
420,138. Regulator for Dynamos. J. J. Wood, Brooklyn, N. Y.
420,173. Electric Fire-alarm System. J. Speicher, Jersey City, N. J.
420,183. Telephone Exchange Apparatus. F. G. Beach, Chicago, Ill.
420,198. Automatic Safety Cut-out for Electric Circuits. G. M. Guebrant, New York, N. Y.
420,214. Electric Meter. W. F. Smith, Philadelphia, Pa.
420,234. Plate for Secondary Batteries. G. A. Johnson, Boston, Mass.
420,240. Printing Telegraph. J. F. McLaughlin, Philadelphia, Pa.
420,255. Electric Signal. J. D. Taylor, Piketon, Ohio.
420,314. Electric Arc Lamp. R. Schefbauer, New York, N. Y.
420,360. Draft Equalizer. J. Ryan, Pecatonica, and William A. McDonald, Leaf River, Ill.
420,370. Incandescent Lamp Socket. M. J. Wightman, Lynn, Mass.
420,384. Electrical Communicating System. A. G. Holcombe, New York, N. Y.
420,396. Electric Transformer. E. Thompson, Lynn, Mass.
420,398. Governor for Dynamos or Motors. A. G. Waterhouse, Hartford, Conn.

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Up-to-date Brick-handling Methods.

By Dr. Alfred Gradenwitz.

Hand-operated barges were almost exclusively in use on rivers and canals, especially for handling cheap goods in bulk, before hand labor was so highly priced as it is now, steam cranes being used only exceptionally for unloading. As, however, improved methods had to be designed for the propulsion of vessels, in connection with mechanical unloading processes, motors were soon substituted for sails, and electrically propelled barges of all sizes were adopted in connection with harbor plants.

But the methods used along the watersides of Berlin were, strange to say, rather antiquated until a short time ago (even now a considerable portion of the coal and sand barges is laboriously unloaded with baskets and wheelbarrows), nor was there a single hoisting device available for the many hundreds of brick barges which can be found permanently at anchor in the Urban, Humboldt and Nordhafen harbors.

A concern has just been founded with a view especially to replace these antiquated methods by more modern processes. An electric traveling crane has just been installed at Urban harbor, where the same kind of energy has been adopted for the propulsion of brick barges.

It should be remembered that some difficulties had to be overcome, no purely automatic process being available in the case of bricks, as with coal, sand or corn; furthermore, in order to avoid any superfluous handling of the bricks, the unloading operation had to be accomplished by means of trucks at the time of the arrival of the barges. On the other hand, some conditions were greatly in favor of an economical mechanical operation in the handling of bricks.

As the brick kilns supplying Greater Berlin are not too far distant, while being mostly situated on waterways, the brick barges have to traverse only relatively short distances, as compared with coal, corn and wood barges. The energy of a storage battery was thus found to be quite sufficient for the propulsion of such barges, this battery being recharged during the short stay at anchor of the vessel.

The space requirements of such a battery, including the electric motors, are relatively small, and, while mechanical propulsion greatly shortens the journey, the use of electricity in unloading will reduce the stay at anchor to a minimum. In fact, the duty performed during six hours by the barge represented in Fig. 3 just corresponds to the amount of work done by human labor in five days.

As there is only rarely any necessity for the bricks being stored, while the times of the arrival of the barges, being, under normal conditions, practically independent of the wind and weather, can be determined in advance, the consumer will be able to keep in readiness at the proper moment the proper number of trucks (each barge carrying about 40 truck-loads of 1,500 bricks each), thus eliminating any expense for storing in the harbor.

Fig. 1 illustrates clearly the method used in Berlin for unloading these barges. To the south of the isle a crane constructed by the Benrath Machine Works travels on rails alongside the quay wall, in order to be able at any point to lift the bricks from the moored vessel. The power required for moving this crane is derived from a 5¼-horsepower motor, while two other motors of 2.3 and 12.5 horsepower, respectively, the arrangement of which may be inferred from Fig. 1, are used for operating the trolley and lifting the load.

The loading by hand of the carplate taken to the barge, the lifting of the load of 114 hundredweight by means of the large motor through toothed-wheel gearing and chain drum, and its lowering down to the waiting truck placed below the crane, on an average requires only seven to eight minutes, while the whole load of 60,000 bricks, in the case of forced operation, can be discharged within three hours.

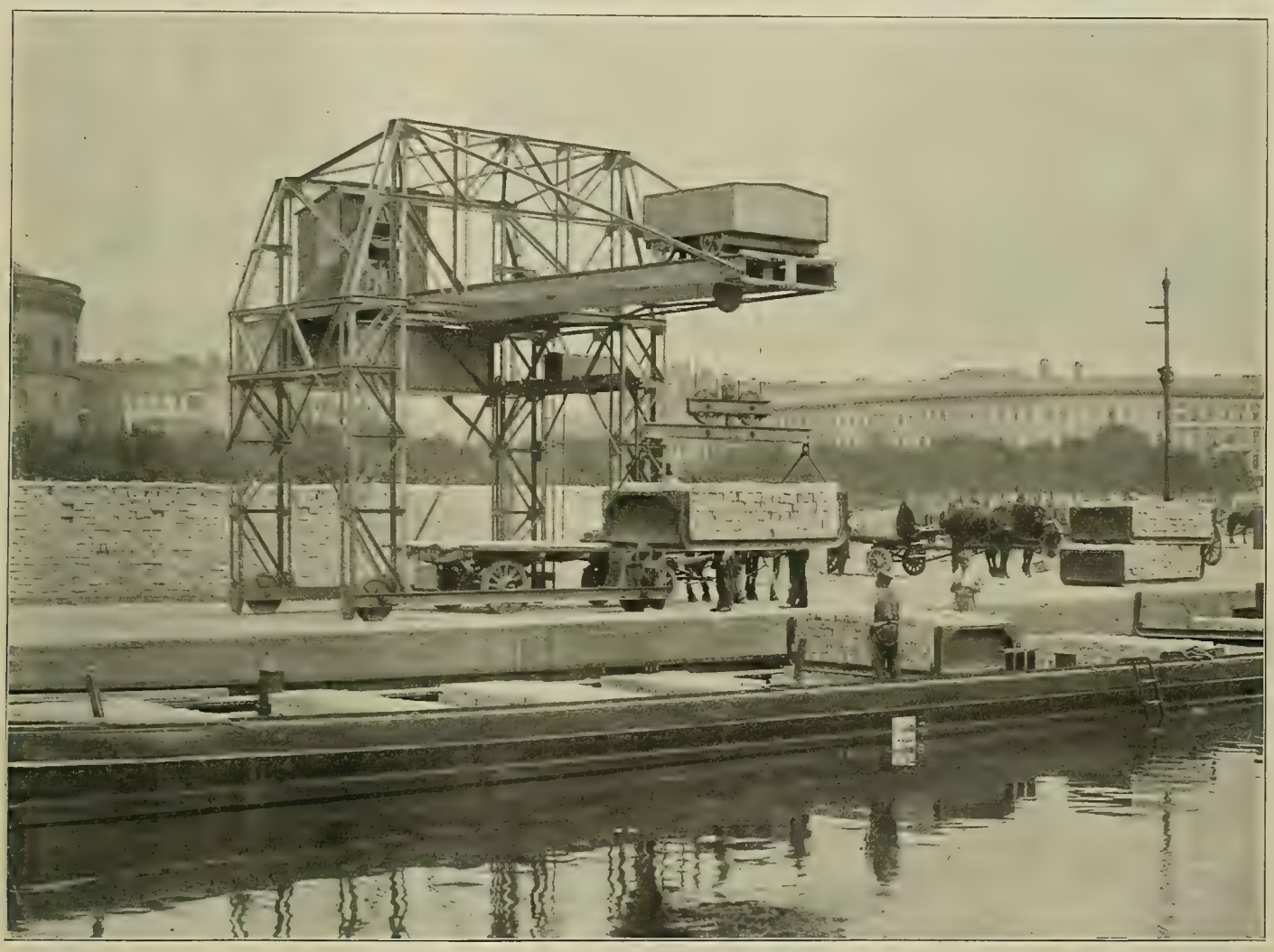

FIG. 1. UNLOADING BRICK FROM BARGE TO TRUCK IN BERLIN BY ELECTRIC POWER.

The three motors, made by the Allgemeine company, derive their current through overhead cables from the mains of the Berlin Electricity Works, and are controlled from the operator's cab, visible on the top of the crane in Fig. 1, the interior of which is shown in Fig. 5.

A reference to Fig. 2 shows the driving gear for the crane. The lifting and transverse-motion motors are clearly shown.

Fig. 4 shows the little shore station, which contains the measuring and switching apparatus for the 80-cell storage battery of the barge, the capacity of which is sufficient for a range of nearly 100 kilometers. The barge motor was supplied by the Siemens-Schuckert Works. For the return trip to Berlin the batteries are charged near the brick kilns.

The new method of using electricity, both in connection with the propulsion of the barges and the operation of the cranes, has given such satisfactory results that three other hoisting devices in connection with further electrically propelled brick barges will be installed before long.

Suggestions for Users of Electric Current.

In former years, when the electric current and its characteristics were less familiar, and inspection by the local government and fire underwriters was less efficient, a great deal of the inside or house wiring was poorly installed. This condition exists to-day in many localities.

In some of the smaller cities the central-station companies do not install the inside wiring of their customers' houses. The customers want the wiring done without trouble and delay, and as the estimated cost is often larger than they imagined, they insist on very close figures from the contractor, and sometimes get men who will put in inferior material in order to get the business.

The character of the original installation, however, is not the only feature, in many cases, that causes trouble and danger. The customer or user of the electric current is often his own worst enemy.

It is well known, now, that properly installed electric wires, if properly used, are perfectly safe and harmless, but even with the best initial installation, conditions may arise, caused by the lack of knowledge of those who have access to the wires and lights, which may introduce a fire hazard.

From conditions noted by inspectors and central-station men, a number of things that customers should not do may be compiled, and some of the more important are mentioned hereafter. It would be well if everyone could be made familiar with the liberties that he should not take with his wiring, for it is certain that both the suppliers and users of electricity would be more satisfied and receive more benefits if the user were better informed.

One of the principal faults of the user or his agent is the addition of lights to an already filled circuit. This is generally done to save the cost of additional circuits, and sometimes the customer thinks he will receive the extra light free of charge. Often it is intended as only a temporary addition. Sometimes it is done by the customer himself, who has sufficient knowledge to enable him to make the connections properly, but not enough to know the effects upon the rest of the wiring. The consequence of adding these additional lights is that the circuit wires are overloaded, and heated by the passage of more current than it was intended that they should carry. This of course may cause a fire, especially if, as is sometimes the case, the fuse protection is not properly provided.

Another common fault among customers comes from a lack of knowledge of the inherent weakness of flexible cord. Often a lamp, hung by flexible cord, is pulled to one side and fastened to a metallic support, such as a gas pipe. This is, at least, unwise and possibly dangerous. At the place of contact the wires become bent and sometimes moisture from the pipe aids in destroying the insulation. The result may be short-circuit, and often, the lamp is severed from the upper part of the cord and particles of molten copper and burning insulation fall upon whatever is below.

Sometimes, if the flexible cord is not long enough it is spliced and the joints left bare; again, if the cord is already long enough it is carried through partitions, over inflammable goods and even through doorways. All of these expedients are to be avoided.

Among the minor but not less dangerous things that are constantly being done—sometimes by those who certainly ought to know better—is the using of paper shades on incandescent electric lamps. This is often done temporarily, but the paper shade may be forgotten and allowed to remain. Some persons seem to think that because one cannot light a cigar or a match at the light bulb, there is no heat given from it. This is a mistake, for the amount of heat so radiated is considerable. Some qualities of paper are inflammable at comparatively low temperatures, and after many hours in close contact with the lamp may catch fire with serious effect.

In general it may be said that the customer should have his installation put in by a competent man in a substantial manner, and when any alterations are wanted, he should not allow the office boy to do the work, but should get a man who "knows." When sockets and fixtures become loose, they should be put in repair as soon as the defect is noticed. The present needs and the future possibilities should be studied and planned when the installation is put in, and if the demand becomes greater than the plans call for, new circuits should be run; it is cheaper. It is not as expensive to install properly in the first place as it is to meet the expensive troubles that come from a poor installation.

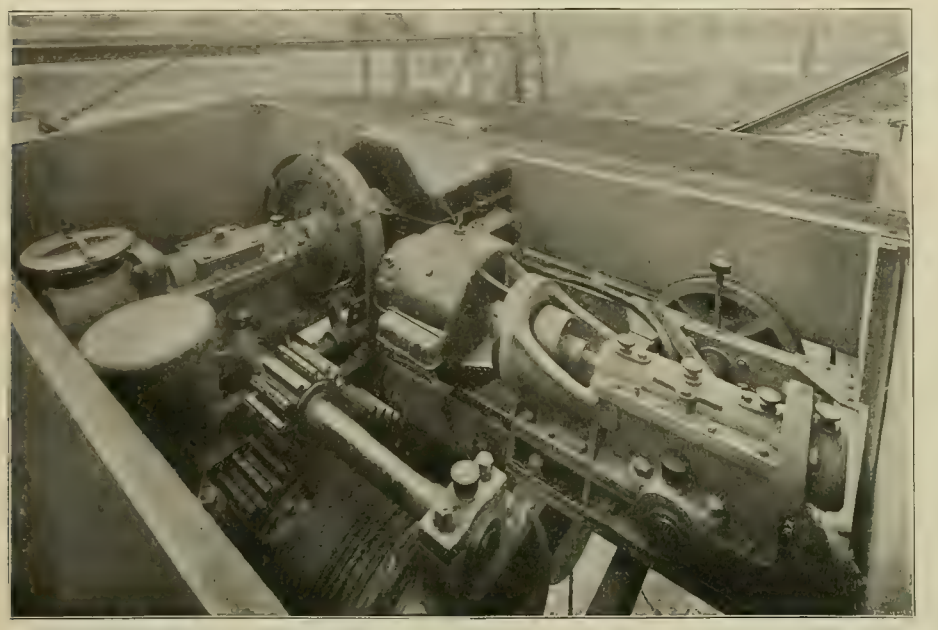

FIG. 2. DRIVING GEAR OF ELECTRIC CRANE FOR UNLOADING BRICK IN BERLIN. (SEE PRECEDING PAGE.)

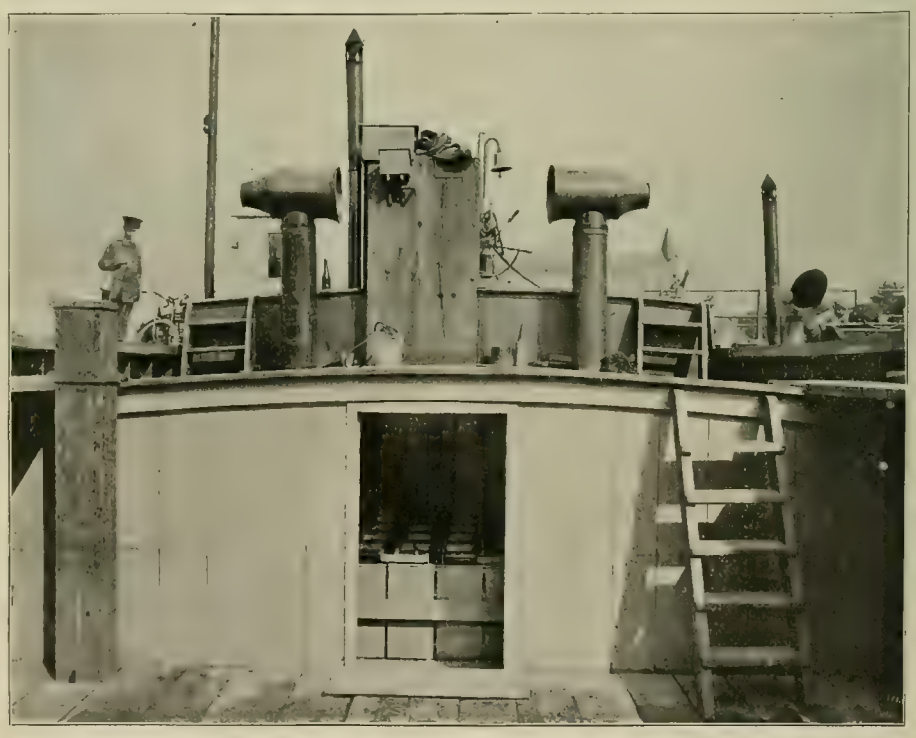

FIG 3. VIEW ON GERMAN BRICK BARGE, SHOWING STORAGE BATTERY FOR PROPULSION.

Characteristics of the Oscillograph.

A meeting of the Chicago branch of the American Institute of Electrical Engineers was held in the rooms of the Western Society of Engineers in the Monadnock Building on January 31st. Prof. P. B. Woodworth of Lewis Institute, chairman of the branch, presided.

The work of the evening was devoted to a demonstration of the oscillograph. Prof. E. H. Freeman of the Armour Institute of Technology explained by means of lantern slides the principles of the instrument, showing its several parts and its manner of construction. He also pointed out in a very interesting way the peculiar difficulties of operating the machine. He showed several curves which had been taken from telephone-magneto generators, showing the effect of impedance when placed in the circuit. Many beautiful curves were thus thrown upon the screen, and the audience was given a rare treat in this manner

Prof. C. E. Freeman, also of Armour Institute, followed with a talk upon telephone transmitter currents, showing a great many lantern slides in which the peculiarities of various transmitters were shown. He emphasized particularly the effect of vowels and diphthongs when spoken into a transmitter, and suggested that, inasmuch as there was no standard of sound, the oscillograph furnished a method of making such a standard. He explained at length the production of overtones, and showed their characteristics. Several pairs of curves were also shown, representing two transmitters operating on different circuits producing simultaneous curves as a result of the same disturbance. These several pairs of curves were the result of transmitters of different makes, as well as those of the same make.

Dr. G. W. Wilder, formerly of Armour but now a consulting engineer in Chicago, followed with an interesting talk on the practical application of the instrument. He showed several curves by means of lantern slides, which represented the result of an investigation carried on last summer in seeking stray currents about the city of Chicago. He spoke of the non-adaptability of the oscillograph for portable work, pointing out that this particular instrument was poorly adapted for such purposes, and briefly outlining the difficulties met with in producing a portable instrument. He pointed out the faults in the mechanical design, and suggested many improvements, stating that, for telephone purposes, an oscillograph should be, above all things, a portable instrument. Many interesting curves, showing the shape of trolley currents before and after leaving the trolley wire, were thrown upon the screen.

Dr. Wilder referred to the two construction methods of making telephone transmitters, and suggested that the oscillograph would do much to settle for all time the relative merits of the cornplaster type versus the carbon-electrode type. He pointed out that, in the mathematical theory of a vibrating diaphragm, it was shown that when the pressure was concentrated at the middle portion of the diaphragm, as done in the modern type of transmitter, the result of the vibration produced a fundamental tone devoid of harmonics, while, if the pressure were distributed over a considerable area, as is done in the cornplaster types, the fundamentals would be accompanied with an abundance

of overtones. A study of these facts would, perhaps, change the entire design and construction of a transmitter.

Kempster B. Miller alluded to the difficulties encountered in the old method of determining alternating-current curves. Regarding the oscillograph, he also stated that he believed there would be a radical change in the design and construction of transmitters. He predicted that great progress would be made along this line within the next few years. Attention was called to the desirability of inventing an oscillograph which would be sensitive

FIG. 4. SWITCHING CABIN ON SHORE FOR CHARGING STORAGE BATTERY OF BRICK BARGE.

enough to measure receiver currents, as the receiving end of a telephone line is really, after all, the more important end of the transmission line.

Professor Rowe of Leland Stanford University gave an interesting account of his experience in connection with long-distance power transmissions in California. He agreed with the previous speakers that the present instrument was mechanically imperfect, calling particular attention to the synchronous motor which rotated the shutter. He spoke of the great value of these instruments in enabling power engineers properly to regulate their loads.

Mr. Flint of the Kellogg Switchboard and Supply Company gave an interesting talk on the methods used in adjusting transmitters for their greatest sensitiveness.

At the conclusion of the talks the audience was treated to an exhibition of the oscillograph, which was set up in a convenient place and furnished with alternating current of various frequencies. The telephone transmitter was used in connection with the instrument, and many interesting things were shown illustrative of the points brought out by the various speakers.

The Helion Lamp Demonstrated.

An interesting demonstration of the new helion lamp filament invented by Prof. Herschel C. Parker and Walter C. Clark of New York city took place in the Columbia University laboratory in Fayerweather Hall on January 31st.

The demonstrations of most interest were of the non-vacuum non-filament lamp, which is unbreakable and is intended for use chiefly on battleships and in fortifications. The non-vacuum lamp consists of a quartz tube a little smaller than a pencil, which is lined with helion and which becomes incandescent when a current of electricity is sent through it.

The officers who witnessed the experiments were Major L. A. Abbott, retired, and his son, Lieutenant-colonel Frederick V. Abbott, assistant to the chief of the Engineering Corps at Washington; Colonel Amos Stickney, in carge of the improvements in New York Harbor; Colonel William M. Marshall, in charge of the fortifications of New York Harbor, and his assistant, Engineer Le Blanc; Lieutenant Commander William S. Crossley and Rear Admiral Clifford H. West, retired.

Professor Parker announced that both lamps had passed the experimental stage and would be put on the market this coming summer.

A tablet commemorative of Michael Faraday was recently unveiled at Barnsbury, England, in the exchange of the National Telephone Company. The ceremony was performed by Lord Kelvin.

An Electrically Operated Floating Dock.

By Frank C. Perkins.

There has recently been constructed for Rotterdam, Holland, a most interesting modern floating dock having a lifting capacity of nearly 16,000 tons. The accompanying illustration shows the general appearance of this exceptional dock. The dock was towed by several tugs at the head and at the stern to its permanent berth in the Maashaven. The illustration shows the New Amsterdam, a

FIG. 5. OPERATOR'S CAB ON ELECTRIC BRICK UNLOADING CRANE IN GERMANY.

twin-screw steamer of 17,000 tons belonging to the Holland-American line, in the dock.

It may be stated that this floating dock of modern construction is one of the largest ever constructed and belongs to the town of Rotterdam. It has side walls on both sides, and seven pontoons, the latter with gaps of six meters between them. It has a total length of 170 meters, with a width of 36 meters, and an average pontoon depth of 3.8 meters. The decks and bottom of the pontoons have a slight inclination, and the side walls are 11 meters high, with a width of 4.8 meters at the bottom and 3.5 meters at the top.

ELECTRICALLY OPERATED FLOATING DOCK AT ROTTERDAM WITH 17,000-TON SHIP.

Each of the pontoons has three longitudinal bulkheads, of which one is at the center, and by which each pontoon is divided into four compartments of almost equal capacity.

In order to pump out the water in raising this floating dock, each half of the pontoon is provided with a horizontal centrifugal pump, fixed at the lowest possible level under the side walls and close to the bottom of the pontoon. These pumps have vertical shafts and are driven by direct-coupled electric motors located on a gallery running from end to end of each side wall, at a height of about six meters from the deck level.

It is also interesting to note that all of the other machinery, including the tackle and gear, as well as the leakage pumps and capstans, are also operated by electricity. The electric current required for driving the motors on the dock is supplied from a power house on shore, which is provided with storage-battery auxiliary.

One of the valuable and important features is that all of the pumps and valves are worked from a single point. The water level in every compartment is clearly visible by pneumatic indicators, and apparently every available form of labor-saving device and modern convenience has been installed. The dock is electrically lighted, and may be operated day or night without difficulty, and the electric power has given most excellent satisfaction for this class of service.

Electric Braking System for Electric Cars.

Two patents for inventions making improvements in electric brakes for electrically propelled railway cars, granted by the United States Patent Office on January 22d last, are worthy of study. The first one, No. 841,709, is for the invention of Frank C. Newell of Wilkinsburg, Pa., to whom the patent is granted. Application was filed May 3, 1900. The other was granted to Mr. Newell and Edward H. Dewson of Edgewood Park, Pa. It bears No. 841,710, and the application was filed April 11, 1904. Both patents are assigned to the Westinghouse Air Brake Company.

The invention covered by the first-mentioned patent provides improved means, independent of the running controller of an electric car, whereby the supply of current from the line to the running controller may be cut off and the brakes may be applied and controlled, and whereby the running controller may be connected with the braking circuit to control the brakes.

With the running controller of a car and its connections a combined brake switch and controller is employed, in which, by a single movement of the handle of the brake switch and controller, the brake switch is adapted to cut off the supply of current from the main line to the controller to apply the brakes and to connect the running controller and the braking controller with the braking circuit to permit control of the brakes by the running controller and by the braking controller, whereby either may used for this purpose.

Of the succeeding drawings Fig. 1 is a diagram showing the circuits and connections on a car for running and for braking; Fig. 2, a view showing the braking switch and controller in elevation and its casing in section, the parts being in the "running" position, and Fig. 3 a similar view of the braking switch and controller with the braking switch in the "braking" position.

In Fig. 1 is shown an application of the improvement to a car equipped with two motors and a magnetic brake device and with a running controller and reversing switch at each end of the car, two braking switches and controllers being employed. The running controllers (C) (C′) and the reversing switches (D) (D′) at opposite ends of the car are shown in the open or neutral position. The braking switch (B) is shown in the running position and the braking switch (B′) in the braking position.

The device referred to as a "braking switch and controller" consists of a switch and a resistance-controlling device on the same shaft and operative by movement of the same handle, the switch forming the upper portion of the device and having the contact bars (29) to (33), inclusive, and the resistance-controlling device having the contact bars (34) to (40), inclusive. The construction of the braking device is such that although the upper portion or switch and the lower portion or resistance-controlling device are on the same shaft and operative by the same handle the switch has but a single movement from the running position to the braking position and no movement in the same direction beyond the braking position, but the lower portion or resistance-controlling device is further movable in the same direction and by the same handle independently of the switch—that is, while the switch remains stationary in the braking position.

When the car is running and the brakes are off, both of the braking switches are in the running position—that is, in the position occupied by the switch (B)—and one of the controllers (C) or (C′) should be in position to connect the motors with the main supply line by contact of the bar (13) with the terminal point of the lead (TC) and by contact of one or more of the bars (14) (16) (17) (18) (19) with the terminal points of the leads (R1) (R2) (R3) (R4) (R5).

The connections and the course of the current when running may be traced by referring to the left-hand portion of Fig. 1, in which the braking switch and controller (B) is shown in the running position, the braking switch (B′) being also supposed to be in the running position.

For running ahead, the reversing switch at the front end of the car should be moved so that the contact bars (1) (2) (3) (4) are in contact with the points (F2) (AA2 (A2) (15), etc.; and for running in the reverse direction the contact points (5) to (12) should be in contact with the points (F2) (AA2), etc.

When the car is being operated by means of the controller (C), the controller (C′) and the reversing switch (D′) should be in the open or neutral position, as shown, and both of the switches (B) and (B′) should be in the running position. If the car be supposed to be running forward with the controller (C) in position to make contact between the bars (13) (14) and the points (TC) and (R1), current will flow from the main line through the trolley (T) and lead (TC) to bars (13) (14), through lead (R1), resistance device (R), leads (R5) and (19), contact bar (4) on the reversing switch (D), lead (A1), armature (A) of No. 1 motor, lead (AA1), contact bar (3) on reversing switch leads (F1) and (F1C), contact bar (30), on the braking switch (B), lead (F1M), through field (F) of No. 1 motor, lead (E1M), contact bar (33) on the braking switch (B), lead (E1C) to contact bars (20) and (19a) on running controller (C), lead (15), contact bar (2) on reversing switch (D), lead (A2), armature (A) of No. 2 motor, lead (AA2), contact bar (1) of reversing switch (D), lead (F2C), contact bar (31) on braking switch (B), lead (F2M), through field (F) of No. 2 motor to ground.

The brakes may be applied by a single movement of the braking switch, by which it is moved from the position occupied by the switch (B) to the position occupied by the switch (B′), and after this movement has been made the brake may be controlled either by the running controller or by the braking controller.

In order to trace the connections and to understand the operation in applying and controlling the brakes, the right-hand portion of Fig. 1 may be considered, the controller (C′) being regarded for the time being as the operating controller on the front end of the car and the reversing switch (D′) being set for running ahead—that is, with the contact bars (1) (2) (3) (4) in position to make contact with the points (F2) (AA2) (A2) (15) (F1), etc. When running, both braking switches are in the position occupied by switch (B) in Fig. 1, and to apply the brakes the braking switch corresponding to the controller then in use is shifted by a single movement to the position occupied by switch (B′) in Fig. 1. The controller (C) and the reversing switch (D), being at the opposite end of the car from the operator, should be locked in the open or neutral position in which they are shown in Fig. 1. The running controller (C′) may be in any position, open or closed, when the switch (B′) is moved to the braking position without interfering with the application of the brakes, the position of the running controller affecting only the resistance in the braking circuit.

The movement of the braking switch (B′) to the position shown in Fig. 1 disconnects the controller (C′) from the main line and cuts off the supply of current and connects the motors in a local braking circuit, so that, as the car continues to run by its own momentum, the motor or motors operate as generators to supply current to the braking circuit. Current then flows from the armatures (A) of No. 1 motor through lead (A1), contact bar (4) on reversing switch (D′), lead (19) and (R5), through all of the resistance devices (R), lead (BR1), contact bar (29) on braking switch (B′), leads (F1M) and (F2M), through the fields of both motors. From the field of No. 1 motor the current flows through lead (E1M), contact bar (33) on braking switch (B′), lead (G), and through the coils (H) of the brake device. From the field of No. 2 motor the current flows through the lead (G) to the coils (H) of the brake device. From the coils (H) of the brake device the current flows through the lead (BC), contact bar (31), on the braking switch (B′), leads (F1C) and (F2C), through the contact bars (3) and (1), respectively, on the reversing switch (D′), and through leads

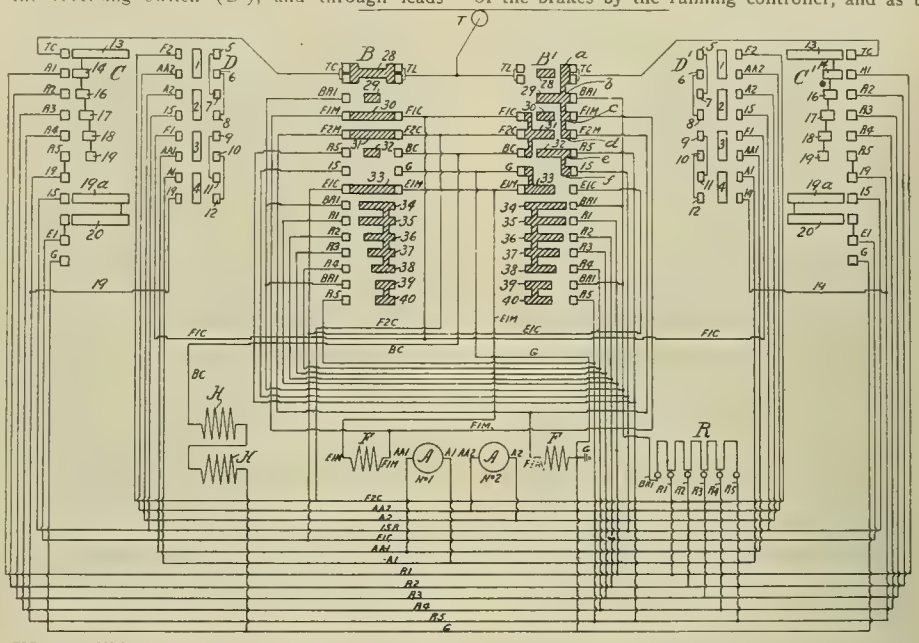

FIG. 1. CONNECTIONS FOR CAR OPERATION AND ELECTRIC BRAKING, WITH TWO MOTORS AND CONTROLLERS.

(AA1) and (AA2) to the armatures (A) of the motors. From the armature of No. 2 motor the current flows through lead (A2), contact bar (2) on the reversing switch (D′), lead (15), contact bar (32) on the braking switch (B′) and lead (R5), where it joins with the current from the armature of No. 1 motor in the branch leading to the resistance devices (R).

When the brakes are applied the current in the local braking circuit may be controlled either by the running controller (C′) or by the braking controller (B′). If the running controller (C′) be

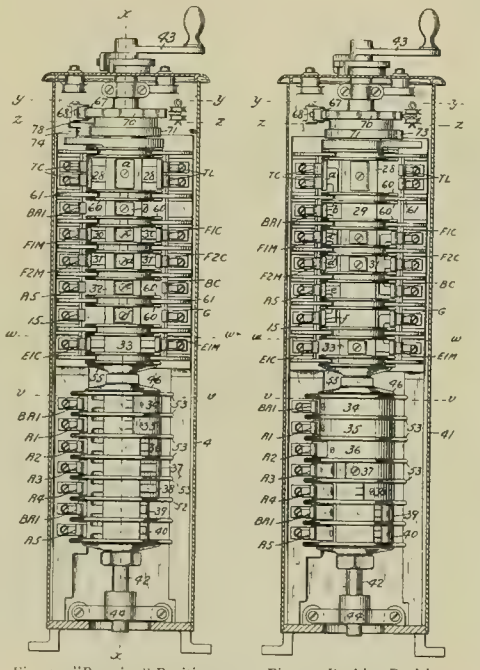

Fig. 2. "Running" Position. Fig. 3. Braking Position.

BRAKING SWITCH AND CONTROLLER

moved to the right so as to make contact between the bars (13) (14) and the terminal points (TC) and (R1), the current will be shunted around a portion of the resistance and the main portion of the current will pass out of the resistance devices (R) through the lead (R1) instead of passing through the whole of the resistance, and as the controller is moved farther to the right the resistance in the braking circuit will be further diminished. To increase the resistance after it has been thus diminished the controller should be moved back to the left.

In order to control the current in the local braking circuit and thereby control the braking force by operating the same handle by which the braking switch is moved, a resistance-controlling device is provided on an extension of the shaft on which the braking switch is mounted, also means whereby the controlling device may be operated after the brakes are applied without moving the braking switch.

If the braking controller (B′) be moved so as to bring the bars (34) (35) in contact with the points (BR1) and (R1) the current will be shunted around a portion of the resistance in the same manner as already described in referring to the control of the brakes by the running controller, and as the braking controller is moved farther in the same direction the resistance in the braking circuit will be further diminished until, when the contact bars (39) and (40) make contact with the points (BR1) and (R5), the current will be shunted around all of the resistance devices (R) and the resistance in the braking circuit will be a minimum. By movement of the braking controller in the opposite direction the resistance in the braking circuit may be increased until the controller is returned to the position which the switch and controller (B′) occupies in Fig. 1 of the drawings, the current then passing through all of the resistance devices (R). A further reverse movement of the handle of the braking controller will then shift the brake switch and take off the brakes.

The combined switch and resistance-controlling device, which, as a whole, may be referred to as the "braking controller," is shown in elevation in Figs. 2 and 3, the casing 41 being shown in section, the parts being shown in the running position in Fig. 2 and in the first position for braking in Fig. 3.

The braking controller may be located on any part of the car; but it is preferred that it should be so located that the operating handle may be conveniently manipulated by the right hand of the motorman, and in view of this fact it will probably be most convenient to locate it alongside of and to the right of the running controller on the platform of the car.

If the reversing switch at either end of the car—that is, at either end from which the car is being operated by the running controller—be moved into the reversed position for running backward, it will be seen from an inspection of the diagram Fig. 1 that the braking switch and resistance-controlling device may be operated to apply and control the brakes as in running forward.

The invention of Messrs. Newell and Dewson, covered by the second patent mentitoned, relates to electric brakes for cars in which the motors are adapted to be connected up as generators in a local brake circuit. The principal object of the invention is to provide an improved braking controller and circuit connections whereby the current in the brake circuit may be more readily and effectually controlled by means of a shunt around the fields of the generators having an automatically operated opening and closing device and manually operated means for varying the resistance in the shunt circuit.

Another object is the provision of additional holding and priming points and circuit connections whereby in certain positions of the braking controller the line or power current may be utilized for energizing the brake magnets or for priming the fields of the generators preparatory to the closing of the local generator circuit. An improved arrangement of fuses is so located with reference to the shunt circuit as to permit the blowing out of the connection across the armature leads on either side of the shunt-circuit connection.

Fig. 4 is a diagram showing the contact points and circuit connections of an ordinary car equip-

ment of two motors and a running controller with the improved braking controller applied thereto, and Fig. 5 shows a series of diagrams illustrating the circuits corresponding with the various positions of the braking controller.

The invention is designed to be used in connection with any of the usual electric-car equipments, and for the purposes of illustration the same is shown as applied to the ordinary two-motor equipment having a standard series-parallel running controller (C) and reversing switch (D).

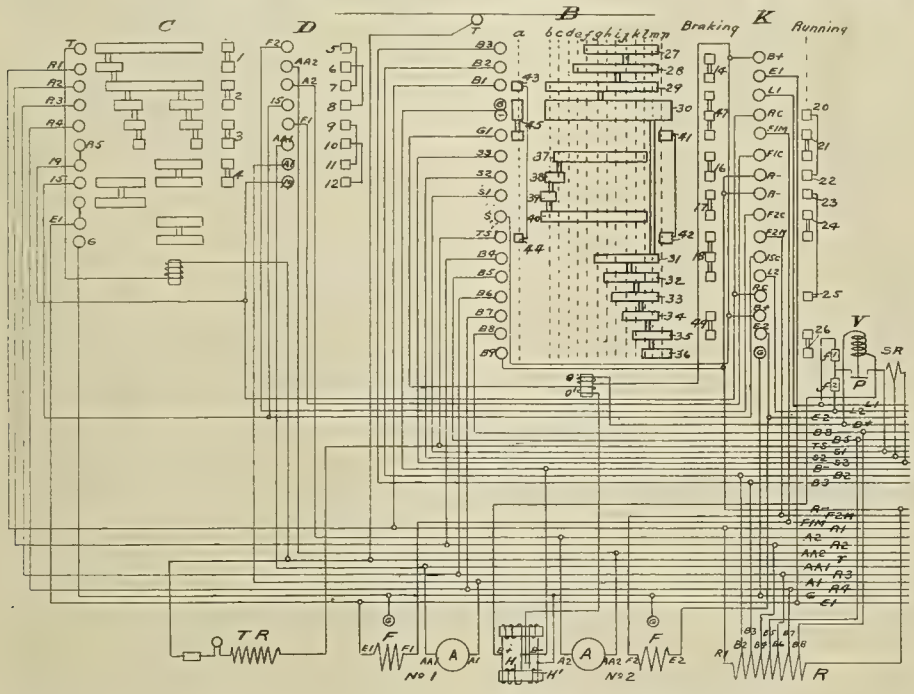

FIG. 4. CONNECTIONS OF TWO-MOTOR CAR WITH BRAKING CONTROLLER APPLIED.

According to the preferred construction the braking controller comprises two movable parts or switches (B) and (K), carrying different sets of movable contacts, the latter being adapted to occupy either one of two positions for running or for braking, respectively, and the switch (K) being so connected mechanically with switch (B) that the movement of the latter from its off position to its first braking position (marked a), or vice versa, operates automatically to throw the switch (K) to its braking position or to its running position, respectively.

Heretofore electric-car equipments have been provided with a braking controller adapted to cut off the line or power current and to connect up the motors to operate as generators in a local circuit containing brake magnets, the current being controlled by a variable resistance in said circuit. In addition, this improvement provides a shunt circuit containing a variable resistance around the fields of the generators when operating to supply current to the brake circuit, the shunt circuit being opened or closed by a voltage regulator, the coil of which is located in the main brake circuit, and the variable resistance in the shunt circuit being controlled by additional contact bars on the braking controller. In order that the car may be held on grades after being stopped and the generators have ceased to generate current in the brake circuit, the braking controller may be provided with additional contact points in either its initial position or final position, or both, for supplying line current to the brake magnets, and the line current may also be utilized to prime the fields of the generators in the initial braking position of the braking controller for the purpose of insuring the rapid building up of current in the local brake circuit when the same is closed by further movement of the braking controller.

Referring to Fig. 4 and considering the braking controller (B) to be in its off position with switch (K) in position marked "running," the reversing switch (D) in its forward position and the running or power controller (C) moved to its first running position, the course of the current from trolley (T) or source of power will be as follows: To the initial bar of the controller (C), thence to first resistance bar and lead (R′) through main resistance (R) and by lead (R—) to switch (K), thence by contact bars (22) (20) and (23) (25) to lead (R) (C) and to (19) on reversing switch (D), connecting bar (4) to lead (A′), through armature (A) of motor No. 1, lead (A) (A′) to reversing switch (D), connecting bar (3) and lead (F′) to (F′) (C) on switch (K), connecting bar (21) and lead (F′) (M) through field (F) of motor No. 1, lead (E′) to connecting bars on running controller (C) and lead (15) to reversing switch (D), connecting bar (2) to lead (A^2) of armature of motor No. 2, lead (A A^2) to reversing switch, connecting bar (1), lead (F^2) to (F^2 C) on switch (K), connecting bar (24) to field of motor No. 2, lead (E^2) to switch (K), and by contact bar (26) to ground (G).

Further movements of the running controller (C) serve to vary the resistance and to connect the motors up in parallel, the operation of which is well understood by those familiar with the art. When it is desired to stop or check the speed of the car, the running controller (C) is thrown to its off position and the braking controller (B) is moved to its first braking position. During this movement the switch (K) is automatically thrown to its position marked "braking." In the position of the circuit represented in the first diagram of Fig. 5 the shunt circuit around the fields of the motors is open and has no effect, the line current being passed through the field coils of the motors to energize the same preparatory to closing the local brake circuit. When the braking controller is moved to its next braking position (marked b), the contact points for the line or trolley connection are cut out and the motors are connected up in parallel in the closed local brake circuit, the shunt circuit around the fields also being closed with no resistance. As the motors are then driven by the momentum of the car they act as generators, and current flows from the armatures of both motors (Fig. 4) by respective leads (A′) and (A^2) to reversing switch (D), contact bars (4) and (2), respectively, to leads (19) and (15), to (R) (C) and (15) (C), on switch (K), by contact bars (47) and (18) to (F′) (M) and (F^2 M) and the fields of the respective motors, thence by leads (E′) and (E^2), contact bars (14) and (49) the two branches of the current unite at switch (K) in lead (B +), passing through coil (O) of blowout magnet and coil (V) of voltage regulator to the main brake-magnet coil (H), lead (B—) to bars (30) and (29) of braking controller (B), lead (B′), through main resistance (R), lead (R—) to switch (K), where the current divides on bars (16) and (17) to (F′ C) and (F^2 C), thence to (F′) and (F^2) on reversing switch, and by contact bars (3) and (1) to return leads (A A′) and (A A^2) of the respective motors, thus completing the circuit, as indicated in the second diagram (position b) of Fig. 2.

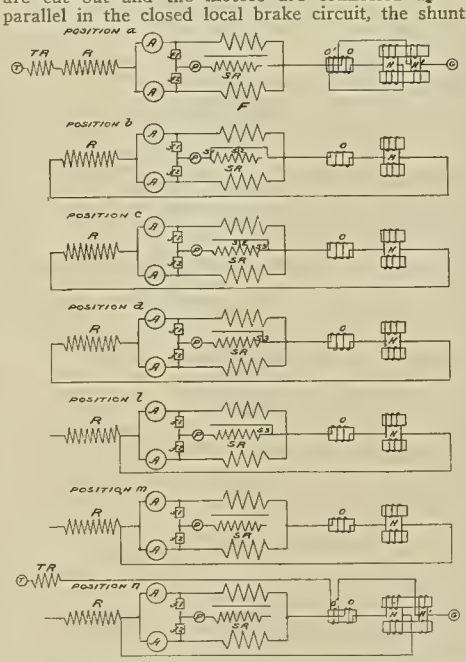

FIG. 5. CIRCUITS CORRESPONDING WITH VARIOUS POSITIONS OF BRAKING CONTROLLER.

In this position at ordinary speeds the current immediately builds up sufficiently in the coil (V) of the voltage regulator to close the switch (P), thereby closing the shunt around the fields of the generators through leads (L′) and (L^2), which form an equalizing connection across the field leads of the generators, thence by (S′) to contact bars (39) and (40) on the braking controller (B) and lead (S) to (B +).

As there is little or no resistance in the shunt for this position, the fields of the generators are weakened to prevent an excessive current being built up in the brake circuit.

If a stronger braking current is desired the braking controller may be moved to the next position (marked c), in which all of the circuit connections are the same as in position (b), except that the shunt connection is broken at (S′) and closed at (S^2), thereby inserting a certain amount of the shunt resistance (S R) in the shunt circuit and to that extent increasing the strength of the fields and the current in the brake circuit. A further movement of the braking controller to position (d) serves to open the shunt connection (S^2) and includes all of the resistances (S R) in the shunt circuit, thereby further strengthening the fields by sending through the same nearly the entire current of the brake circuit. Further movement of the braking controller to the successive positions (e) to (l) serves to cut out successive sections of the main resistance (R), as will be readily understood by referring to contact bars (27) to (36) and contact fingers (B′) to (B^9) of the braking controller (B). In the next position (marked m) the bars (37) and (40) are disconnected from contact fingers (53) and (S), thereby entirely opening the shunt circuit and maintaining the generators in the closed local circuit with the brake magnets and no resistance, which is the position for a maximum braking effect. In making a full stop the braking controller is usually brought to this latter position at the final portion of the stop, and then as the current ceases when the car stops the brake magnets may not be able to hold the car in case the stop is made upon a grade. It is therefore desirable to be able to supply the brake magnets with current from another source at this point, and with the improved braking controller this may be done by moving the same to the additional position (n), in which the bars (41) and (42) connect with contact fingers (G′) and (TS), thereby supplying current from the line or trolley (T), through supplemental resistance (TR), to coil (O′) of blowout magnet and supplemental brake-magnet coil (H′) to ground (G). Either position (a) or position (n) may be used as holding points for supplying the brake with current from an auxiliary source.

Another feature relates to the arrangement of the fuse-blocks (f′) and (f′), which are located in the equalizing cross connection between the motor-field leads, one on each side of the branch connection to the shunt (S), whereby when the shunt is cut in by the closings of the switch (P) of the voltage regulator (V) should either fuse blow out by an excessive current through the equalizer the other motor or generator would still remain connected up through the other fuse-block with the shunt for controlling the speed of the car. The voltage regulator (V) is designed to close the switch (P) of the shunt as soon as the fields of the generators have built up sufficiently to generate the desired current to properly control the brake magnets, and for light braking effects the resistance in the shunt and correspondingly the strength of the fields is manually controlled by the positions (b), (c) and (d) of the braking controller.

The line current may be used in the first or preliminary position of the braking controller for both priming the fields of the generators and for energizing the brake magnets, so that as the controller is further moved to its successive positions, including the shunt-contact connections, the fields will be sufficiently energized to rapidly build up a current of sufficient strength to properly control the brake and close switch (P) of the automatic voltage regulator in the shunt. The use of the voltage regulator insures the building up of the fields to give sufficient current for braking at all speeds.

When the braking controller is first thrown to any of its braking positions in which the shunt contact points are engaged, it will be seen that if there was no means for temporarily maintaining the shunt open the fields of the generators would be very slow in building up and generating sufficient current for the brake circuit, but with the new arrangement, including the automatic voltage regulator, the switch (P) of the shunt remains open temporarily, thereby at first diverting all the current through the fields and causing the same to build up promptly and generate sufficient current to control the brake magnets, at which time the shunt is then automatically closed.

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DATES AHEAD.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

THE PLACING and grouping of lighting units is of great importance. Mr. W. D'A. Ryan of Lynn, Mass., made some observations in Boston at a sectional meeting of the Illuminating Engineering Society a few weeks ago on this subject which are worthy of attention. He remarked that, generally speaking, in commercial lighting it is desirable to place lamps as high as possible. By the selection of suitable reflectors the intensity of the illumination in the horizontal plane, say three feet above the floor, can be produced with the same lamp whether placed eight, 12 or 15 feet above the floor, provided the light in each case is equally confined to the floor area or not permitted to rise above an equivalent point on the walls. There seems to be an impression that the use of a large number of small lamps is generally desirable. On the contrary, Mr. Ryan contends that commercial lighting can be done to better advantage by concentration as far as consistent with low intrinsic brilliancy and good distribution. There is nothing more trying to the eyes than a room lighted with long rows of exposed lamps installed at short intervals. This argument not only applies to incandescent lamps, but Mr. Ryan says that it is also considered good engineering to group arc lamps in units of three, five or more for the lighting of large areas, such as drill halls, riding academies, auditoriums, etc. By the use of proper diffusers, uniform and pleasing results can be obtained.

IN CONSIDERING "The Application of the Electron Theory to Electrolysis" at a recent meeting of the Faraday Society in London, Mr. E. E. Fournier d'Albe made some observations of quite general electrical interest. He said that the electron theory, by postulating the existence of material carriers of all electric charges, is practically an extension of the ionic theory to solids and gases, and it thus brings into line the processes of metallic and electrolytic conduction. In both cases the conductivity of a body is defined by the number of ions (in the wide sense) it contains in unit volume and by their average mobility. In a centimeter cube of copper, for example, a current is conveyed by some 400 trillion free electrons; in a centimeter cube of milli-normal hydrochloric acid the current is conveyed by some two trillion hydrogen and chlorine ions. In a one-millimeter copper wire carrying one ampere the electrons will move at about one centimeter per second. It is not yet clearly understood, says Mr. Fournier d'Albe, why free electrons should be observed in a vacuum and a metal, but that there should be none in a liquid. It is supposed, however, that it is the close packing of the metallic atoms which renders possible a frequent exchange of electrons between one atom and another, and while free the electron is able to fall along the potential gradient and thus constitute a current. In an insulator the electrons are effectively bound up with the atoms or molecular groups; in an electrolyte mobile charged groups are formed, which can follow the electromotive force.

Not all students of physics are disposed to accept the electron theory, however. One such doubting Thomas was present at the Faraday Society meeting in the person of Mr. John G. A. Rhodin, who was decided in his views. He considered that the electron theory, like the atomic theory, merely complicated matters, and was unnecessary. The conception of infinite divisibility was a necessary one in physics as in mathematics, if our reason was to be satisfied. Both in chemistry and physics we know of mathematical relations only, and hypotheses are only crude images. The ether and electrons were invented because certain phenomena could be the more easily treated mathematically by means of these conceptions. A simple theory of ions was all that was necessary for understanding electrolysis; more hypotheses were not wanted.

But this summary treatment of the electron theory did not receive general support, although another speaker expressed some doubt and wanted to know why there were no free electrons in liquids. To this question the author of the paper answered that perhaps free electrons were prevented from existing in liquids by their great mobility in face of little resistance. The general impression seemed to be—as it is probably with the majority of physicists everywhere—that the electron theory deserves cautious support, but it still leaves puzzling gaps, which must be studied earnestly.

PERHAPS the technical school undertakes too much when in four years it endeavors to give the foundations of a general education and a technical training as well. At any rate, the task is a most difficult one, in the opinion of Dr. Henry S. Pritchett, the retiring president of the Massachusetts Institute of Technology, who gives expression to his doubt in his annual report, presented last month. There is a tendency to give boys who have the means first the education of the college and afterward the specialized training of the technical school. On this point President Pritchett says: "The number of such students is growing. Under this tendency there will gradually be differentiated two classes of technological institutions—one, the undergraduate institution, similar to the technical college of today, aiming to give a technical training and so much of a general education as is possible in four years; the other, a graduate school of applied science, intended for men whose work is wholly professional and who have had already a general education. The present epoch is, therefore, one of transition for the college of technology, and we may safely anticipate in the next decade some sort of crystallization along the lines which I have just mentioned."

It is a fact that many of the graduates of our present technical schools are not generally well educated. In English, in particular, a large proportion of these young men are deplorably deficient. Perhaps the suggestion that there be the undergraduate institution and the professional school may meet this difficulty to some extent, although, unfortunately, it would be rather hasty to assume that the man who came to the post-graduate technical school with a degree as bachelor of arts was therefore to be judged a person well informed, for his years, in general affairs, and able to express his ideas clearly and correctly in the English language.

Another point made by Dr. Pritchett is worthy of attention, and we may quote again from the president's report:

It is to be remembered that the chief purpose of the school of technology is to train practitioners in applied science, just as it is the chief purpose of the medical school to train practitioners in medicine. It is necessary that there should be that about the technical school which may encourage and inspire the small minority of those who come to the life of the teacher and investigator; but the main purpose of the school is that which I have mentioned. For this reason it is important that the student should have the viewpoint of the practitioner of engineering, just as it is important that the medical student should have the viewpoint of the practitioner of medicine; and, to bring this about, the teacher in the technical school should himself be a practitioner, just as the teacher in the medical school usually is. It is one of the advantages in the teaching of medicine that the practice may be so readily brought into the clinic before the students; and we may well imagine what sort of physicians and surgeons would be turned out if their instruction lay wholly in the hands of men who were teachers rather than practitioners.

This is well put and should be pondered by those who consider that it is in some way undignified and unprofessional for those who teach electrical engineering to practice electrical engineering. Why, indeed, should one not practice what he preaches? The professor may very well keep himself in touch with the needs of the day by accepting commissions (which do not interfere with his college work) and he may very advantageously form a "clinic" with his students by discussing the reasoning, the adaptation of means to ends, the paramount necessity of cutting your coat by your cloth in the matter of the money available, the calculations involved, the drawings, the report, and the like, touching upon an actual problem in hand. It is evident, too, that the governing authorities of "Tech" believe this to be sound doctrine, for they have engaged as professor of electrical engineering an engineer who practices his profession as well as teaches it.

Of course it is not expected that the technical school will turn out completely equipped engineers, but the students should have as much practical work as possible.

Chicago Council Passes the Traction Ordinances.

At a session of the Chicago City Council which began Monday night, February 4th, at 8:15 and ended shortly before four o'clock in the morning, the traction ordinances for the Chicago City Railway Company and the Chicago Railways Company (Union Traction Company) were passed by a vote of 56 to 13. These ordinances are the result of years of negotiations bearing on a complicated legal situation and further complicated by the advent of municipal-ownership agitation. The council committee on local transportation, which submitted the ordinances, has succeeded in embodying in the grants what it believes will give the people a modern traction system and still protect the city in every way.

The issue is now up to the voters. The ordinances contain a referendum clause that they shall not become operative unless a majority of the votes cast on the little-ballot proposition at the election of April 2d are in the affirmative. In case a majority of the votes cast are in the affirmative the ordinances will become effective after their acceptance by the companies, which are given 90 days from passage to file bonds and accept the ordinances.

Mayor Dunne and his adherents made every effort to postpone action by the council until after election, and they offered numerous objections and amendments to the measures. Amendments from this source were rejected. A number of amendments from aldermen favoring the general provisions of the ordinances were accepted These were mainly on technical points and not of vital importance.

Last week two petitions asking that the ordinances be submitted to the voters at the spring election were filed with the election commissioners. Both petitions contained more than the required 86,000 names, it is said. There have been many charges of fictitious signatures, but these have not yet been investigated.

It is probable that this question will be voted on at the April election: "For the approval of ordinances substantially in the form of the pending ordinances (reported to the City Council of the city of Chicago on January 15, A. D. 1907), authorizing the Chicago City Railway Company and the Chicago Railways Company, respectively, to construct, maintain and operate street railways in said city and providing for the purchase thereof by the said city or its licensee."

The ordinances, as readers of the Western Electrician know, are 20-year grants, with a provision by which the city may purchase on six months' notice. The city gets 55 per cent. of the net earnings and the companies 45 per cent. Millions of dollars are to be expended in improvements, extensions and betterments.

Increasing Usefulness of the Aurora, Elgin and Chicago Electric Road.

The usefulness of the Aurora, Elgin and Chicago third-rail electric railway was enlarged on February 2d, on which date the new electric road between Elgin and Belvidere, Ill., was put in operation by the Elgin and Belvidere Electric Company. The new line will connect with the Chicago road at Elgin, and at Belvidere it will make connection through Rockford and Freeport, Ill., with Beloit and Janesville, Wis. By an agreement between the Aurora, Elgin and Chicago company and the new road it will be possible to travel by electric railway continuously from Chicago to Janesville, a distance of about 135 miles.

Passenger traffic on the Aurora, Elgin and Chicago road makes a satisfactory showing compared with a year ago. The milk-hauling business is increasing rapidly. Last month the company's milk trains handled 425 cans of milk daily as compared with 290 cans in the corresponding month a year ago. The newspaper trains which distribute the Chicago morning papers to the towns and cities along the line are still in successful operation.

A feature of the company's service is the buffet parlor cars. Three trains carrying such cars are run daily. Several handsome new cars of this type have been added lately. This service permits patrons to get their meals while en route.

The establishment of an express business on the Aurora, Elgin and Chicago line has been postponed for a time. Permission to operate express cars over the leased tracks of the Metropolitan Elevated from Fifty-second Avenue to the downtown station was denied by the City Council some time ago. Then it was decided to employ automobiles to carry packages between the Fifty-second Avenue terminal and downtown express offices. This plan has not proved feasible, however, principally on account of the bad condition of the streets in the neighborhood of Fifty-second Avenue, and some other plan will be tried.

Electrical Exports for December and for the Year 1906.

Electrical exports from the United States in the month of December, 1906, amounted to a total value of $1,463,501. The total value of electrical exports for the year 1906 was $16,655,510. In a detailed report in the New Years issue of the Western Electrician covering electrical exports for the year 1906 the total value was placed at $16,747,790. In getting this figure the value of exports for the month of December was estimated. Official figures now at hand for December show that the discrepancies were comparatively small. Goods classified as electrical appliances were estimated at $800,000 and were in fact $827,646; electrical machinery was estimated at $760,000 and the official figures are $635,835.

Exports for the month of December, 1906, fell off $62,216 compared with December, 1905. The figures are as follows: Electrical appliances—December, 1906, $827,646; December, 1905, $685,425. Electrical machinery—December, 1906, $635,855; December, 1905, $840,292. Total—December, 1906, $1,463,501; December, 1905, $1,525,717.

Considering only goods classified as electrical machinery, the following countries were the largest purchasers from the United States in December, 1906: British North America, $182,691; United Kingdom, $100,627; Mexico, $95,856; British Australasia, $37,155; Brazil, $33,282; Japan, $33,121; France, $30,745; British Africa, $20,947; British East Indies, $19,679; Central American states and British Honduras, $10,849; Argentina, $5,854; Germany, $5,464; Hongkong, $1,842.

British North America was the largest purchaser of electrical machinery from the United States in the whole year 1906, having purchased $1,943,983 worth. The United Kingdom was second, $1,219,392; Mexico third, $1,048,959, and then, in order, Japan, $960,146; Brazil, $530,494; Cuba, $437,327; British Australasia, $369,550; France, $276,750; British East Indies, $221,662; British Africa, $181,950; Argentina, $168,256, and Germany, $101,192.

Iowa Street-railway Convention.

Preparations are well advanced for the fourth convention of the Iowa Street and Interurban Railway Association, to be held in the Lafayette Inn, Clinton, Iowa, on April 19th and 20th. Secretary L. D. Mathes, who is general manager of the Union Electric Company of Dubuque, is arranging an excellent programme, including a paper on "The Steam Motor Car—Its Value for Interurban Service," and others on "Freight Handling," "Amusements," "Train Dispatching" and "Peak or Rush-hour Traffic." This association, although young in years, has done good work. Mr. Hild's paper of last year on "Gasoline Motors for Street-railway and Interurban Service," which attracted wide attention, may be mentioned as an instance of the value of the papers and discussions. Street-railway men of Iowa and neighboring states should not fail to attend the Clinton convention. It is also to be noted that the supply men are cordially invited to be present. Space for exhibits will be provided. P. P. Crafts, general manager of the Iowa and Illinois Railway Company, Clinton, Iowa, will gladly answer questions concerning hotel reservations, etc. F. J. Hanlon of Mason City is president of the Iowa Street and Interurban Railway Association.

Appraisal of Milwaukee Street-railway Properties.

The physical valuation of the Milwaukee street-railway properties, including both city and interurban mileage, is now being determined for the Wisconsin State Board of Assessment and the Railroad Commission.

The valuation staff has been drawn in part from the corps hitherto engaged in the valuation of steam roads in Wisconsin and in part from The Arnold Company of Chicago, which recently had charge of the valuation of the street-railway properties of Chicago.

Prof. W. D. Pence, member of the American Society of Civil Engineers, engineer for the two state commissions, has charge of the valuation, and with him are associated Bion J. Arnold, president of The Arnold Company, consulting engineer; C. M. Larson, chief roadway inspector; Prof. John G. D. Mack, chief mechanical inspector, and George Weston, chief electrical inspector.

Chicago Automobile Show.

The Sixth Annual Automobile Show, which was opened at the Coliseum and First Regiment Armory, Chicago, on the afternoon of February 2d and continued until February 9th, was pronounced the largest and most successful show ever held in this country. Over 300 exhibitors were housed in the two spacious buildings, it being the first time in the history of the automobile that every American-made machine was exhibited at one show.

One feature of the show which attracted the attention of experts was a new ignition system which provides for the use of a Simms-Bosch high-tension magneto and storage battery, through one set of spark plugs only. This does away with the extra idle set of spark plugs generally used, which usually becomes foul when not in use. The new system of ignition is said to be one of the most important patents brought forth this year in the automobile industry, as it combines nearly all the good features of the lowest magneto ignition without the annoyances heretofore incidental to that system.

Following are the names of the firms that exhibited electric vehicles, electrical accessories, etc.: Babcock Electric Carriage Company, Buffalo, N. Y.; Baker Motor Vehicle Company, Cleveland, Ohio; Electric Vehicle Company, Hartford, Conn.; Woods Motor Vehicle Company, Chicago, Ill.; Columbus Buggy Company, Columbus, Ohio; Pope Motor Car Company, Toledo, Ohio; Pope Manufacturing Company, Hartford, Conn.; Rauch & Long Carriage Company, Cleveland, Ohio; American Electrical Novelty and Manufacturing Company, New York city; Chicago Battery Company, Chicago; Dayton Electrical Manufacturing Company, Dayton, Ohio; Electric Storage Battery Company, Philadelphia, Pa.; Motsinger Device Manufacturing Company, Pendleton, Ind.; National Carbon Company, Cleveland, Ohio; Oliver Manufacturing Company, Chicago; Remy Electric Company, Anderson, Ind.; F. J. Alvin, Chicago; Atwater-Kent Manufacturing Works, Philadelphia, Pa.; T. Alton Bemus, Boston, Mass.; Jos. Dixon Crucible Company, Jersey City, N. J.; National Battery Company, Buffalo, N. Y.; Vesta Accumulator Company, Chicago; Witherbee Igniter Company, New York city; Chicago Pneumatic Tool Company, Chicago.

A new feature was shown by the Woods Motor Vehicle Company, Chicago, in the controlling apparatus of one of its electric automobiles. In starting the car, the lever is brought forward to the first speed, and, if necessary, to the second speed. When it is desired to stop the car, the lever is thrown clear forward beyond the second speed, with the result that the current is cut off and the machine brought to a standstill in a few seconds. In order to start the car again it is necessary to push the lever right back and bring it forward again.

Mr. S. A. Miles, the manager of the show, is general manager of the National Association of Automobile Manufacturers. Mr. Miles spent 11 months in planning the exhibit and the remaining month of the old year in working to get it together.

An important feature in the Pope-Waverley electric automobile is in the distribution of the weight of the storage battery, some of the battery cells being placed in the rear and some in front of the machine, thus making the vehicle comparatively easy to handle.

The Baker Electric Vehicle Company of Cleveland exhibited three machines which were greatly admired, viz., the Baker runabout, Baker Queen Victoria and the Baker inside-driven coupé. The coupé body is placed upon what is known as the company's "L" chassis, and is interchangeable with either the Queen Victoria or runabout bodies. Thus the owner of either one of the three carriages may practically have two carriages in the purchase of an extra body. The batteries used in the three machines are composed of 24 cells.

The exhibit of the Rauch & Lang Carriage Company of Cleveland was most attractive, the stanhope and coupé receiving much attention. The batteries used in each machine consist of 24 cells of 108 ampere-hours capacity and are at all times coupled in series, thus eliminating all possibility of an unequal charge or discharge.

Among the bills introduced in the Senate of the Legislature at Springfield, Ill., was one by Senator Gardner making it unlawful for any person or corporation to string electric wires over the tracks of any railroad company except at such place or places and in such manner as shall be approved by the Railroad and Warehouse Commission.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

II.—Elements of Electricity.

Manifestations of Electricity.

Just what electricity is we do not know, and while there are a number of theories as to its nature, their discussion is out of place in an elementary work of this kind. The laws governing the manifestations of electricity, however, have in most cases been very accurately determined, and in designing electrical machinery of all kinds, and in the measurements of currents, resistances and other electrical properties, calculations and observations may be made with the utmost precision —in fact, with a far greater precision than is obtainable in any other branch of engineering.

There is a very intimate relation between magnetism, static electricity and dynamic electricity, although each manifests widely different properties. Static electricity is produced in several ways, such as by friction, induction, heat, etc., and it manifests itself as a charge on the surface of bodies. It has much fewer practical applications than dynamic electricity, which relates to the flow of current in circuits, and the latter is therefore more widely applicable to engineering problems. The relation between the two, however, makes a general knowledge of static electricity essential to the electrical engineer, as it becomes an important factor in connection with high-potential work.

The production of static electricity is generally explained by the well-known experiment of rubbing a glass rod with a silk handkerchief, when both the glass and the silk acquire the property of attracting small particles of wood, paper, etc. After these small particles have come in contact with the rod or silk, however, they will be repelled. This is explained by the hypothesis of a positive and a negative electricity, which in many respects is analogous to the theory of magnetism explained in the previous chapter. A glass rod rubbed with a silk handkerchief will contain a charge of positive electricity, and if the end of this rod is brought near a pith ball suspended by very fine thread the ball will immediately be attracted to the rod; but after touching the rod it will swing in the opposite direction, indicating repulsion. This seems to indicate that the electrified rod, like the magnet, is surrounded by a field of force, and objects coming within the influence of this field have charges of electricity induced upon them, similarly to the induced magnetism in a piece of iron brought near to a magnet. This induced electrical charge is of the opposite polarity to the charge on the glass rod.

When the pith ball referred to has come into actual contact with the glass, however, it is charged with the same kind of electricity as the glass, after which repulsion is manifested between them. From this it will be seen that bodies with unlike charges of electricity attract each other, while those with like charges repel each other. It can be shown by simple experiments that a charge upon a conducting body lies merely upon the surface, and does not extend into the body.

Conductors and Insulators.

Conductors are those substances which readily permit electricity to pass through them. Insulators are substances which do not permit the free passage of electricity, and are also called non-conductors. There is, however, no distinct line drawn between conductors and non-conductors, but the two terms, rather, are merely relative. There is no such thing as a perfect conductor, because every known substance offers more or less resistance to the passage of a current, and there is no such thing as a perfect insulator, as no substance can be found that will entirely prevent the passage of electricity.

Among the good conductors may be mentioned silver, copper, gold, aluminum, zinc and other metals. Partial conductors include carbon, graphite, acids, saline solutions, water, dry wood, paper, etc.; and among insulators may be mentioned wood, silk, sealing wax, sulphur, rosin, guttapercha, india rubber, shellac, paraffin, ebonite, glass and dry air. Silver is the best conductor and dry air is the best insulator of electricity. Pure copper, however, has nearly as great conductivity as silver, and, being much cheaper, is used almost exclusively in electrical engineering work. Porcelain and glass are among the best insulators, and are largely employed for insulating wires. Water is a fairly good conductor, and it is for this reason that there is considerable difficulty in obtaining good insulation in damp places.

The effect of heat is to change the conductivity of metals as well as the resistance of insulators. Heat converts many insulating solids into conductors by making them liquid, as, for example, ice, which is an insulator when solid, but a conductor in a fluid state. It is also found that the loss of electricity in dry air increases perceptibly with the temperature. When the pressure of current reaches a certain limit electricity will pass through a non-conductor. A discharge of electricity under these conditions is called a disruptive discharge, and the capacity of a non-conductor to resist disruptive discharges up to certain limits is called its dielectric strength.

Materials which are to be used in insulating the various parts of dynamo-electric machines should have a very high insulation resistance, and this resistance should remain high through the range of temperature to which the machine is liable to rise. They must also have sufficient dielectric strength to avoid any possibility of disruptive discharge between the conductors which they separate. The chemical composition of such insulating materials must not be changed by any heat to which they may be submitted, and they must possess physical properties which will permit them to be distorted, bent and twisted, without injury.

Of the materials in general use for insulating purposes, mica is the best, as it possesses the most dielectric strength and highest insulation resistance. Its chemical composition is not affected by heat, but it is mechanically weak. Pieces of mica when cemented together by shellac, linseed oil, etc., are, when carefully built up, nearly as good insulators as pure mica, and possess nearly the same dielectric properties. They are much stronger than mica and permit of the bending and working to a far greater degree.

Linseed oil is also used as a binding material for various fibers which are dried and baked in the shape of insulators. Shellac is also used as a binder for fibrous materials; but insulators made in this way are brittle and crack upon bending.

Vulcanized fiber is commonly used for insulation, and is made by treating paper fiber chemically, after which it is dried. Vulcanized fiber, however, absorbs moisture and is liable to warp upon drying. It is also brittle when heated.

A mixture of asbestos and rubber, called vulcabeston, is a good insulator and is mechanically

CONDENSER.

strong. On account of its composition it is able to withstand comparatively high temperatures.

Paper is largely used as an insulator for cables at the present time. While the insulating properties of paper are fairly good, it is very weak mechanically, and can only be used in connection with lead sheathing to exclude moisture and protect it from abrasion.

Condensers.

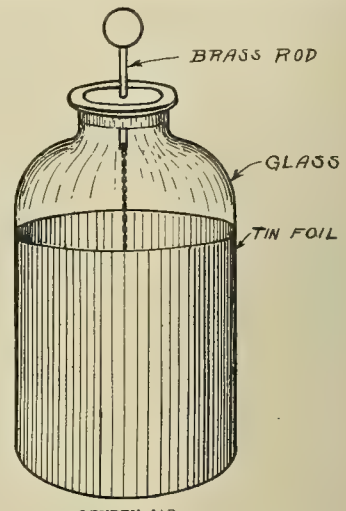
A condenser is a device for accumulating a large charge of electricity upon a small surface, and mechanically it consists of two conductors separated by a non-conductor. The Leyden jar is a well-known example of a condenser. This consists of a glass jar lined for about two-thirds of its height with tinfoil, and also covered upon the outside with tinfoil to the same height. A metallic rod having a knob on its upper end passes through the stopper of the bottle, and a chain depends from this rod, connecting it with the inside lining of tinfoil.

By holding the knob at the top of this jar against any source of electricity, such as an electrical machine, the jar is charged. If the knob is in connection with the positive current, positive electricity is accumulated on the inside coating, and negative electricity on the outside coating. The thinner the glass, the greater the capacity of the jar, but there is a limit to this, as if the glass is made too thin, there will be a disruptive discharge through the glass between the two tinfoil coatings. The negative charge on the outside of the jar either passes to the earth through the hands of the operator, or must be led off by a wire connected to the earth.

The positive charge inside the jar acts through the glass by induction to repel a positive charge to the earth and attracts a negative charge on the inner face of the outer coating.

In order to secure powerful charges, a battery of jars of this kind may be used. In this case all of the knobs of the different jars would be connected together and all the outer coatings also connected together. It could then be charged and discharged like a single jar.

To discharge a condenser, the inner and outer coatings are connected through a conductor. If the



LEYDEN JAR.

charged jar is held in one hand and the other hand is approached to the knob, the jar will be discharged through the arms and body, and a severe shock will be experienced.

The charge in a condenser in reality lies on the opposite surfaces of the glass or other dielectric separating the metallic coatings. This has been proved by removing the coatings after charging. Condensers for commercial purposes are usually made of sheets of tinfoil separated from one another by sheets of mica, paraffin paper, oiled silk, etc. The sheets are alternately connected to the opposite poles of the condenser, as shown in the diagram.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

"Motorizing" of Dynamo.

O. A., Chicago: What is meant by a dynamo "motoring?" What is the cause and what the effect?

Answer.

The question evidently refers to the "motorizing" of a dynamo; i. e., when a machine normally operating as a dynamo has its current reversed so that it is driven as a motor. This may happen when several dynamos are connected in parallel and when either the field of one of the units is sufficiently weakened or the energy of its prime mover is decreased—if, for instance, the supply of steam, in the case of a steam engine, or of gas, in the case of a gas engine, is sufficiently reduced or entirely cut off. The effect will depend entirely on the attendant circumstances. The ammeters will, of course, be reversed and thus indicate that the current is going into the dynamo. If the field is very weak or open, the machine may "run away" and tear itself to pieces. Under some conditions the engine connected to the dynamo might be wrecked.

The Induction Motor Defined.

O. A., Chicago: Why do they call an alternating-current motor an induction motor, and not so with a direct-current motor?

Answer.

All alternating-current motors are not induction motors. The induction motor consists of two principal electrical parts the same as other motors, but the alternating current is led directly into only one of these parts. This part is called the stator, i. e., the stationary part, corresponding to the field of the direct-current motor, though quite different from it. The rotating part, called the rotor, which corresponds to the armature of the direct-current motor, has no electrical connection with the cir-

cuit. The alternating current in the stator induces a current in the circuits of the rotor and thus creates a magnetic field, which, with the field of the stator, produces the torque. This type of motor is called an induction motor because the rotor current is set up by induction.

First International Exposition of Safety Devices.

Among the exhibits shown at the first international exposition of safety devices which was opened at the American Museum of Natural History in New York on the afternoon of January 29th, was a "fool-proof" elevator lock of such mechanism that the elevator cannot be started so long as the door is open. In this lock there is an electric switch, making contact in the edge of the elevator door. Connected with the switch is an electromagnet so adjusted that when the circuit is broken by opening the door the magnet releases a plunger. This in turn slides into a catch in the control wheel of the car operator, making it impossible to start the car up or down until the door is shut and the magnet draws the plunger back again.

One of the most extensive exhibits in the show is that of a company making a device to regulate the speed of engines and by the same mechanism furnishing a means of stopping the engine in any manufacturing establishment from a dozen or a hundred points around the plant. The fundamental device in this instance is that for keeping an engine from overspeeding. Two steel rods, each bearing an iron ball and fitted to a horizontal shaft, are connected with the main shaft.

As the shaft revolves, the tendency of the iron weights is to fly out from the center, after the fashion of a centrifugal governor on an engine. The rods, to which weights are attached, are so adjusted that when a certain speed is reached the pull exerted by the revolving weights draws a contact plate at the end of the shaft away from a shoulder and breaks an electric circuit. Meantime, to the throttle of the engine has been adjusted a sprocket-chain so that as the engineer opens the throttle he winds up weights that run over pulleys near by. When the electric circuit is broken these weights are released, and they automatically close the throttle.

The exposition was held under the direction of the American Institute of Social Science.

Technical Publicity Association.

"Sales Night" of the Technical Publicity Association was held at 111 Fifth Avenue, New York city, on January 31st. The association received the first report of its circulation committee. The companies represented at the meeting were: Yale & Towne Manufacturing Company, Johns-Manville Company, American Woodworking Machinery Company, F. R. Almond Manufacturing Company, General Electric Company, Crocker-Wheeler Company, American Locomotive Company, Cameron Steam Pump Works, New York Telephone Company, New York Edison Company, B. F. Sturtevant Company, A. A. Griffing Iron Company, A. Allan & Son, Goulds Manufacturing Company, Prentis Tool and Supply Company, J. G. Brill Company and the Lidgerwood Manufacturing Company.

J. Robert Crouse, organizer and manager of the Co-operative Electrical Development Association, described his plan to stimulate the use of electric current, and A. L. Doremus, head of the sales division of the Crocker-Wheeler Company, spoke on the relation of advertising to sales. W. J. Marsden, of the Yale and Towne Manufacturing Company, made some remarks on export trade. The next meeting will be called "Railroad Night," at which a prominent railroad advertiser will be the principal speaker.

American Street and Interurban Railway Association.

At the recent meeting of the executive committee of the American Street and Interurban Railway Association held in New York the cities of Boston, Mass., Atlantic City, N. J., and Norfolk, Va., were considered as the place for the 1907 convention. A committee was appointed to visit several places and report. It was reported that a suite of rooms in the new Engineers' Building in New York city had been secured as headquarters.

Among other committees President Beggs announced that on heavy electric traction, which consists of Calvert Townley of New Haven, E. B. Katte of New York, and L. B. Stillwell of New York. Secretary Swenson, in an informal report covering the affairs of the association, stated that since October 1, 1906, the active membership of the American Street and Interurban Railway Association had increased from 200 to 237 companies and the associate membership from 113 to 156. The secretary estimated that the income of the parent association for the current year would amount to $26,000, a revenue that would cover the expenditures contemplated under the plan of expansion now animating the association and its allied societies.

Flexible Cord Must be Tested.

After several meetings of the joint committee formed by representatives of the insurance interests and the advisory committee of the flexible-cord manufacturers, it was deemed advisable to devise ways and means of testing all flexible cord, both pendant and portable, manufactured under the rules of the National Board of Fire Underwriters, as recommended by the Underwriters' National Electrical Association. This is to restrict the introduction into commercial use of any cord which would prove inferior to the National Electrical Code standard, so as to protect reliable manufacturers against inferior goods, in competition.

Specifications for these factory tests have been drawn up by the committee and are as follows: "Each coil of duplex cord shall be tested dry by the application of 1,500 volts alternating current simultaneously to each of the two conductors, contact being made on bare copper wires at either end of the coil, and care being taken that the other ends of the conductors do not come together. Alternating current is to be supplied from a transformer with an actual working capacity of at least five kilowatts."

These factory tests will be conducted in a similar manner to those now carried on under directions of the Wire Inspection Bureau in the manufacture of National Electrical Code rubber-covered wire.

Stamps will be issued by the Wire Inspection Bureau and sold to the different manufacturers at a charge of 2½ cents per thousand running feet of cord tested. These stamps are to be attached to the coils of tested cord by the manufacturers themselves, and are to serve as a guarantee that cord so stamped has successfully withstood the tests specified by the bureau. They will be furnished for 250-foot, 500-foot and 1,000-foot coils, as desired.

The majority of flexible-cord manufacturers have recently agreed that on and after March 1, 1907, all National Code cord manufactured by their companies shall be made up under the new specifications and duly tested, and will bear identification mark of the Wire Inspection Bureau.

It is understood that a reasonable time will be allowed, after the date mentioned, for the disposal of Code cord not bearing the stamp of approval of the Wire Inspection Bureau, on all such cord manufactured before March 1, 1907, and with this understanding, the April list of "Electrical Fittings" will contain the names of flexible-cord manufacturers agreeing to the tests of the Wire Inspection Bureau and using stamps as guarantee that these tests have been properly made.

No cord will be considered as having been tested which does not carry an identification stamp. Stamps are to be securely fastened to the shipping tags attached to the coils. All stamps are to be canceled by the manufacturer when used, the date of manufacture of cord, also, being plainly shown.

Hugh T. Wreaks, 43 Cedar Street, New York city, is secretary of the Wire Inspection Bureau, and it is from a circular issued by him that the above information is obtained.

Chicago Jovian Club.

Thirty-eight members of the Sons of Jove met at Vogelsang's, Chicago, on January 31st for the purpose of forming a Jovian club in Chicago. The meeting proved to be an enthusiastic one and many important matters were discussed. W. W. Low of the Electric Appliance Company was elected chairman of the board of the local organization. The other officers elected were: Treasurer, W. P. Crockett; secretary, A. D. Blocker. The following-named gentlemen constitute the board of directors: Francis Raymond, Perry Boole, T. G. Grier, S. J. Fralich, C. A. S. Howlett, A. O. Einstein, W. S. Goll, F. Z. Sweet and A. L. Millard. The club meets every week at Vogelsang's for lunch and every month in the Chicago Edison Building, 139 Adams Street.

Wave Motor at Atlantic City.

At Youngs Pier, Atlantic City, N. J., which will be well remembered by those who attended the 1906 convention of the National Electric Light Association, a new wave motor has been installed that is lighting a portion of the pier. It is said to be the first really successful contrivance of the kind in use. It is a big float or buoy and so arranged that the motion of the swells will work it, no matter at what angle the waves run. This motor drives a compressed-air engine, which fills large tanks. The tanks in turn feed a compressed-air motor, which drives the dynamo that furnishes the current for the lighting.

Cable to Panama.

The purpose of the United States government to obtain a cable, the termini of which shall be under the control of this country, is taking practical shape in an agreement which will immediately be put in the form of a contract with the Central and South American Telegraph Company for the laying of a cable from Sandy Hook, N. J., to Guantanamo, Cuba, and thence to Colon across the isthmus to Panama, connecting with the Pacific cable line. The conditions of the contract are substantially the same as those with the American Pacific Cable Company.

Free Wiring in Grenoble.

A new contract has been entered into between the municipality of Grenoble, France, and the Société Grenobloise, which controls the electric lighting of the city. Current is secured from distant hydraulic plants. According to the terms of the contract, which are of some interest owing to their unusual nature, the lighting company is obliged henceforth to put in the wiring free of charge to subscribers at the rate of one lamp per room. All houses are to be wired by the company and are to contain a minimum of 20 lamps. For the lamps to be installed above the free wiring mentioned, the cost of wiring must not exceed 70 cents each, with reductions for fixture wiring which are to be agreed upon with the subscribers. In relation to the charge for lighting current the contract stipulates that the current which is used by subscribers who benefit by the free wiring is to be charged for by the company at the regular rates. In the case of previously installed wiring, which has been carried out either by the municipality or by the lighting company, the price per hundred watt-hours is increased by one-tenth of a cent.

South Side Elevated-railway Extensions.

Leslie Carter, retiring president of the South Side Elevated Railway Company, Chicago, says that the third track intended for express service between Forty-third and Twelfth streets has been completed with the exception of straightening out the curve at Twelfth Street, and this he thought would be completed in about six weeks. The Englewood main or westerly line has been completed, and work on the south branch, Englewood, he thought, would be finished by July 1st. It is hoped to turn over the east line to Lake Michigan ready for operation in the early summer. The Stock Yards line, he thought, would be open next fall. The new lines, when completed, he said, would have eight stations on the main line toward Englewood; three stations on the south branch, Englewood; five stations (two of these double) on the line east to the lake, and seven stations on the Stock Yards line. The gross passenger earnings of the company in 1906 were $1,721,213, as compared with $1,647,987 in 1905.

Electricity as an Article of Import and Export.

The fact that electricity is an article of import and export at Niagara Falls, where electric power generated on the Canadian side of the river is transmitted to the American side, has been mentioned in a previous issue of the Western Electrician.

A similar case has arisen between Italy and Switzerland in which the Italian government concedes to that of Switzerland the right, on behalf of the town of Stabio in Ticino Canton, to draw electrical power for industrial and illuminating purposes from water supplies on Italian territory, and principally from the Vizzola torrent.

The power will be distributed not only in the town of Stabio itself, but in a wide district around. The amount of water rent to be paid to Italy has not yet been stated.

Sage Endowment Fund for Rensselaer Institute.

Mrs. Russell Sage has given $1,000,000 to the Rensselaer Polytechnic Institute of Troy, N. Y., the fund to be used in establishing a new department to be known as the "Russell Sage school of mechanical and electrical engineering." The announcement was made by Dr. Palmer C. Ricketts, president of the institute, at the annual meeting of the alumni association held on February 1st. The late Russell Sage was a trustee for the institute for more than 10 years.

"Sunbeam" Tungsten Lamps.

Experiments are now being conducted by the engineering department of the Sunbeam Incandescent Lamp Company of Chicago on tungsten metallic filaments, and as a result of recent developments the Western Electric Company reports that it will, no doubt, be among the first of the companies which will be in position to furnish these lamps to the trade. The lamp is an 80-candlepower lamp with a total wattage of 100, or 1¼ watts per candlepower. The lamp is not yet offered for sale.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER VII. (*Concluded*).

Syntonic Wireless Telegraphy and Direct Waves.

It might be well in passing to refer to an instrument which has recently been developed for the purpose of measuring electric waves. In Germany the device is called an ondameter, while in America it is referred to as a wave-length standard.

Hertz-Bjerknes expounded the theory of determining the frequency by the resonance. The German instrument is made up of a closed oscillation circuit, the capacity of which may be altered within wide limits. When subjected to the action of any given oscillating system, the ondameter oscillates in sympathy therewith. A Reiss thermometer is employed to give the current indications, the readings of the thermometer being proportional to the squares of current intensity. When perfect resonance is obtained the resulting currents are at a maximum, indicating identical wave lengths in both systems.

In Fig. 67 is shown a view of the De Forest-Ives frequency meter, and Fig. 68 is a diagram of the circuits of the device.

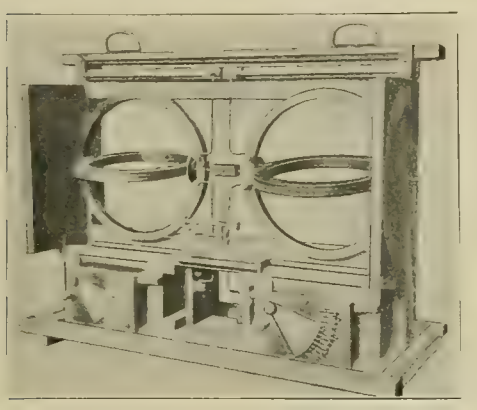


FIG. 67. IVES-DE FOREST INSTRUMENT FOR MEASURING ELECTRICAL WAVE LENGTHS.

It may be seen that the wiring arrangement is simply that of a closed-circuit oscillator, including the regulation spark gap (S), the terminals of the latter being connected to opposite condensers (C_1) (C_2), which in turn are connected with the variable inductance coils (r_1) (r_1') (r_2) (r_2'), which lead to the contact bar (b).

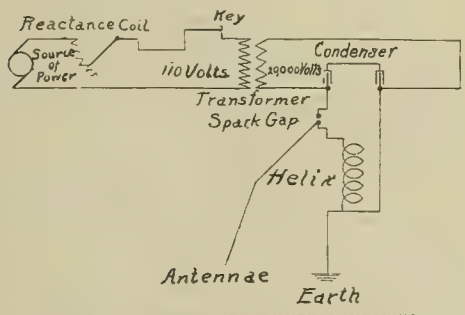


FIG. 71. DE FOREST TRANSMITTER CIRCUITS.

A very convenient form of glassplate-tinfoil condenser is used, the capacity of which is regulated by the sliding contacts shown on either side at the base in Fig. 67. Values of capacity from 200 to 22,000 abstatfarads are obtainable. The inductance coils are made up of a single coil of No. 10 hard-drawn copper wire mounted on hard-rubber rings. The large rings shown in a vertical plane in Fig. 67 are about 12 inches in diameter, and are permanently fixed in that position. The inside rings are mounted on a horizontal axis, and are 10 inches in diameter. The inner inductances may be rotated as required, connection being made between the stationary and moving coils by brass brushes. Semi-circular dials, the indicators of which are mechanically connected with the inner ring, show at a glance the angle through which the ring is moved; thus the inductance of the standard may be altered as desired. In the De Forest instrument a hot-wire ammeter is used to give maximum current indications in place of the Reiss thermometer used in the ondameter.

CHAPTER VIII.

Arrangement and Wiring of Apparatus Used in Practical Operation by Various Wireless-Telegraph Concerns.

In Russia the name of the lately deceased Popoff has been closely associated with all wireless-telegraph development in the czar's domain. In England Lodge, Fleming, Preece and Muirhead have made great progress in the art. In France Branly, Du Cretet and Rochefort have had their masterly investigations, and the results obtained were ill rewarded by government confiscation.

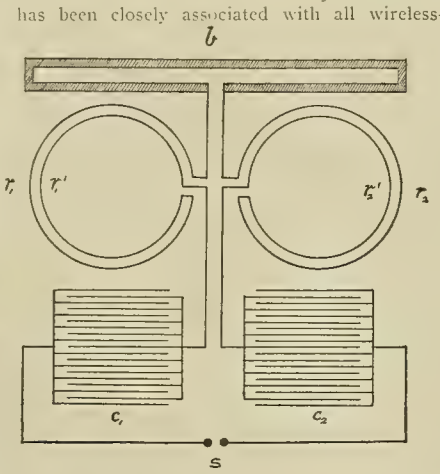


FIG. 68. CIRCUITS OF IVES DE FOREST WAVE-LENGTH MEASURER.

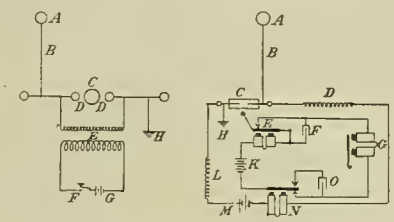


FIG. 69. TRANSMITTING AND RECEIVING CONNECTIONS IN WIRELESS SERVICE.

In the German Empire the wonderful strides which have been made in wireless signaling are due to the efforts of Slaby, Braun, Ruhmer, Mendelstam, Brandes, Drude, Schloemilch, Donitz and others.

In America very important discoveries have been made by De Forest, Fessenden, Shoemaker, Massie, King, Pupin, Stone, Wildman, Squier, Ives, Murgas and others.

To Mr. Marconi remains the distinction of having conducted investigations and erected commercial stations in most of the civilized countries of the world, as well as having established profitable commercial service on the high seas.

Recently Dr. De Forest has invaded English territory and installed stations in England and Ireland, and Professor Fessenden has in view the establishment of transatlantic service, using Fessenden apparatus.

In the present state of the art there is no standard arrangement of apparatus or of office wiring. Even in the various systems employed changes are constantly being made as new facts are brought to light. However, it is well to familiarize ourselves with present equipment in use, its disposition and its efficiency, if we are to continue to make progress.

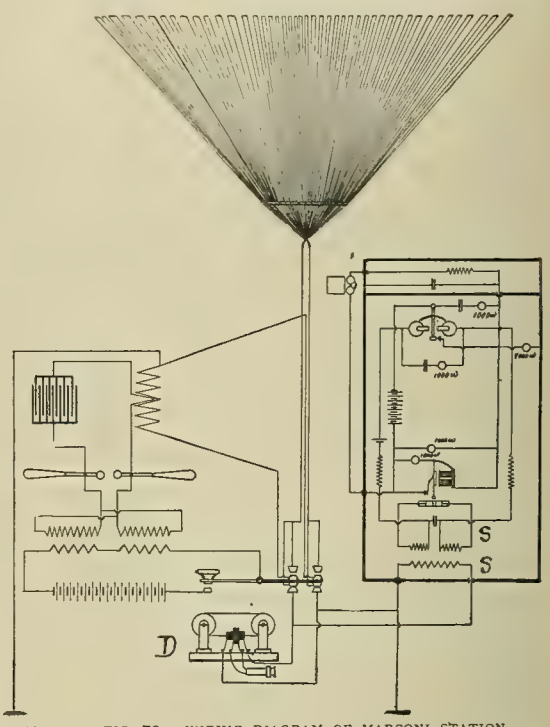


FIG. 70. WIRING DIAGRAM OF MARCONI STATION.

Fig. 69 shows a diagrammatic view of the orthodox transmitting and receiving connections of a simple open system.

Fig. 70 gives a complete wiring diagram of a Marconi station. The receiving side shows magnetic detector and coherer connections. The transmitter of the multi-coil type, the aerial transformer

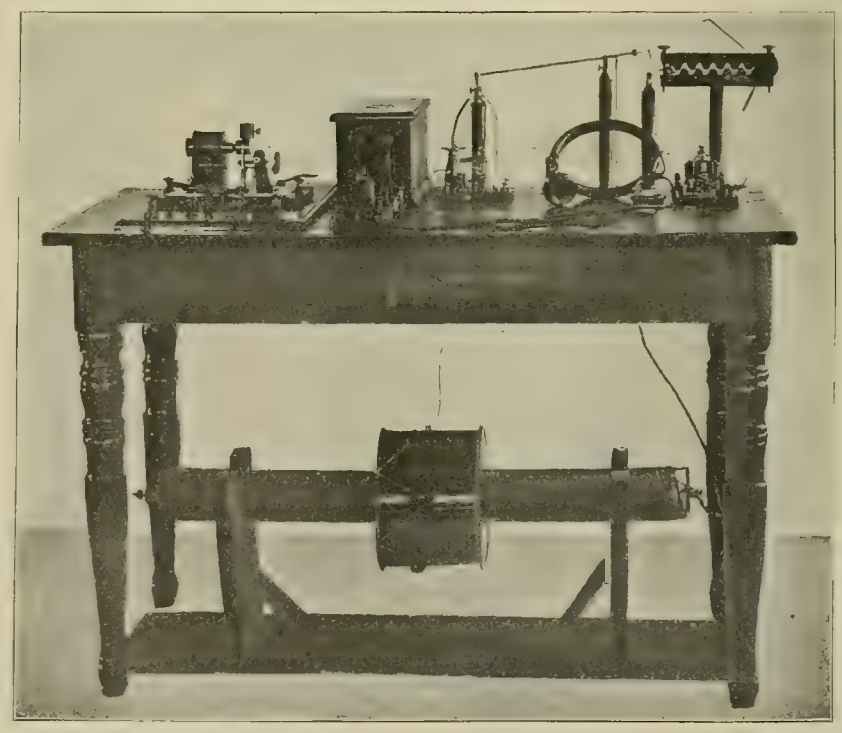


FIG. 72. A SET OF FESSENDEN WIRELESS APPARATUS.

NOTE.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

and the pyramidal type of antennæ or aerial, are also indicated. The Marconi company is at the present time engaged in the construction of a high-power station at Clifton, in the south of Ireland. The station should be completed early in 1907. It is from this plant that the Marconi people expect finally to establish commercial transatlantic service, the American station being located on Cape Breton.

Fig. 71 shows the wiring of a De Forest installation of transmitter circuits.

Fig. 72 shows a view of a complete set of Fessenden apparatus.

Fig. 73 shows a complete diagram of the receiving and sending circuits of the Stone system.

The greatest actual progress which has been made in wireless telegraphy has been made in Germany. The reason for this is that the German emperor has personally encouraged the investigations. The German government has made liberal appropriations to cover cost of research, and the professors of the great technical schools of the empire have been provided with every facility for carrying on the work. In addition to these favorable circumstances, the various German systems have been combined into a workable and manageable concern. The "Telefunken System," as this combination is called, maintains a manufacturing plant in Berlin which employs about 200 skilled electricians and mechanics. In the neighborhood of Berlin there are eight experimental stations used for testing purposes, and the company has equipped and installed about 100 stations along the Baltic and in other parts of Germany.

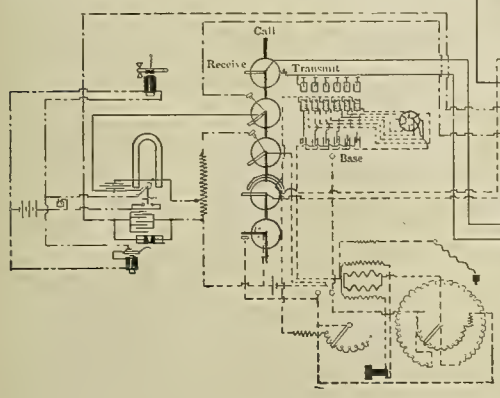


FIG. 73. SENDING AND RECEIVING CIRCUITS OF THE STONE WIRELESS SYSTEM.

Figs. 74 to 77, inclusive, show wiring diagrams of the transmitting and receiving circuits of the Telefunken system. The operation of these various circuits will be evident to those who have followed closely what has been said regarding tuned circuits.

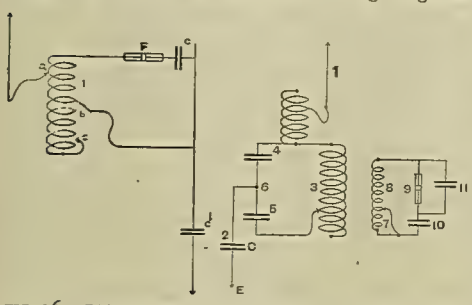


FIG. 76. TELEFUNKEN CIRCUITS OF TIGHTLY COUPLED RECEIVER.

FIG. 77. TELEFUNKEN LOOSELY COUPLED RECEIVER CIRCUITS.

[*To be continued.*]

Mr. Houtz Introduces the Bovine Defense.

The Indianapolis correspondent of the Western Electrician tells a rather amusing story: "Homer Houtz, a farmer living near Bluffton, Ind., objected to the surveyors of an interurban electric-railway company entering upon his premises to survey a line through his farm, and the foreman told him that he (the foreman) had papers from the government granting the party the privilege of making the survey. Houtz immediately went to his barn and turned a savage bull into the field. The surveyors were compelled to make a hasty retreat into an adjoining field. The foreman took refuge on top of a high fence, and Houtz yelled to him to show the bull the papers from the government. Some arrangements will have to be made to get across the Houtz farm. Other farmers are fighting the line and want to borrow their neighbor's bull to get rid of the surveyors."

The Utilization of Blast-furnace Gases.[1]

By J. E. Johnson, Jr.

Mr. Junge says: "These gases were formerly wasted either by inefficient methods of transformation or by blowing them into the air. They were, therefore, called 'waste gases' and were marked in the columns of plant economics as having no commercial value whatsoever." As far as blast furnaces are concerned, the top of the furnace has been closed with the purpose of leading off these gases to points of utilization, for 30 years in the writer's personal recollection and for 15 or 20 years before that time.

As regards the method of transformation, it has, in many cases, been very wasteful; the poorest type of boilers, the most uneconomical type of engine, being employed at blast furnaces, but as blast pressures have arisen, demanding more work from the blowing engine, the economy of the machinery has been increased in much greater ratio, so that, for 10 or 15 years past, there has been a strongly marked tendency, at every works which desired to keep up with the procession, to install an economic type of boiler (generally water-tube) and cross-compound condensing blowing engines, with Corliss valve gear, a combination which it is safe to say will yield a horsepower with one-fourth the quantity of gas employed under the old regime.

This tendency is so universally prevalent that the standard of comparison with the gas engine must no longer be the old type of uneconomical boilers and engines, but the best modern type of steam machinery, whose economy would probably be not worse than 16 pounds of water per horsepower per hour. That the gas engine has a decided advantage in fuel economy over an engine even of this type is not to be denied, but it seems probable that the advantage is not in the ratio of 3 to 1, as claimed by Mr. Junge, but much more nearly 3 to 2; in other words, instead of saving two-thirds of the gas used by such apparatus, the gas engine cannot save under commercial conditions probably much more than one-third. To account for the apparent disregard of even this considerable saving, it is necessary to realize the conditions of blast-furnace operations—a thing which power experts have seldom been able to do.

This subject is so large that it is impossible to give an adequate idea of it in a brief discussion of this kind, and it would, moreover, be out of place here. It is, however, safe to say that there is no apparatus in metallurgy in which the capital invested and the value of the output are both so high as in the blast furnace. There is, therefore, a very heavy fixed charge of labor, interest, depreciation, and other factors, amounting to from $1.50 to $2.50 per ton of iron produced, which goes on just the same whether the furnace is in operation or not. In many cases, furthermore, the steel works are an adjunct to the blast furnace immediately dependent upon it for their operation and having a still larger interest charge against their output. A suspension of operations, therefore, at a blast furnace means not only loss of profit on iron not made, but also the loss of this fixed charge. The result is that the machinery and the furnace must be reliable in the first, second and third places and economical in the fourth.

Any attempt to regard the blast furnace as an adjunct to the power plant may be technically correct, but is commercially foredoomed to failure, as the following illustration will show: A certain large steel works in this country has adopted the gas engines for blowing purposes and also for electrical generation. Three of the furnaces were connected to the gas main supplying this machinery. Two of these, for some reason which is immaterial to this discussion, went out of commission temporarily, and the third one was supplying gas for the gas engines. It had steam blowing engines, available for its own use, but the furnace superintendent had never caused a shutdown to the electric station, and he was very anxious not to do so. This third furnace began to show symptoms of those sudden ailments to which blast furnaces are liable, and for the remedy of which a stop was necessary, but the superintendent was determined that he would not shut down the gas-engine plant and would not stop this furnace until he could get one of the others into operation. By doing so, he saved the gas-engine plant from a shutdown, but when the relief furnace was put on, the other was in such a state as to demand 10 days of terrific work and expense, with practically no output during that time. As this furnace was probably making in the neighborhood of 400 tons a day, worth something like $15 a ton at the furnace, the loss of output during this 10 days amounted to $60,000 or thereabouts, while the loss in fixed charges and profits was possibly not less than $20,000. This may be taken as a typical case of a possible occurrence at a plant with gas-driven blowing engines—of course, not a very frequent occurrence, but sufficiently expensive in every sense to compensate for its rarity. The benefits, on the other hand, which are to be obtained by gas-driven blowing engines through the utilization of surplus power, are to be obtained in only a slightly reduced degree by the use of good steam machinery.

At the plant of which the writer has charge we are now constantly on the edge of being short of steam, but we have under construction a cross-compound condensing engine of Nordberg build, and have under reconstruction our boiler plan, so that we shall be able to use 125 pounds of steam pressure, and will have, when we are done, a first-class plant of water-tube and horizontal tubular boilers. We are so sure that we shall then have a large excess of steam that we now have on the ground, ready for erection, a large air compressor and power engine combined, for transmitting air a mile to the mines, developing power for various purposes, driving the washer, running the pumping plant at the river, running all the shops at the plant, etc.

From previous experience with a similar type of blowing engine and much poorer boilers at another plant, we are perfectly certain that we shall have ample steam for these purposes, and expect to have available 400 or 500 horsepower more at the least calculation, all from a 100-ton stack, running with a moderate coke consumption. We have under contemplation the erection of an auxiliary plant which will utilize some of this surplus power in addition to the uses already mentioned.

Does not this seem very much like the story of the advantages to be obtained by the use of the gas engines? Is not the difference much more one of degree than of kind? Does the gas engine mark the epoch in contrast with good steam ma-

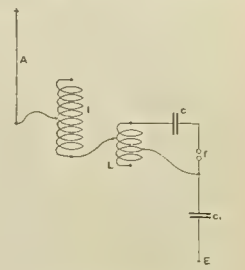


FIG. 74. TELEFUNKEN TRANSMITTER CIRCUITS ON SHIPBOARD.

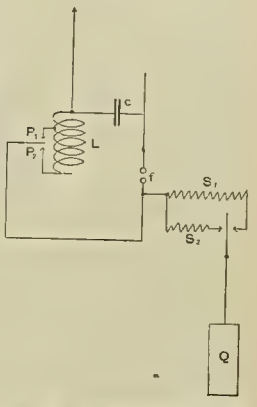


FIG. 75. TELEFUNKEN TRANSMITTER CIRCUITS FOR PORTABLE SET.

1. This is part of the discussion on F. E. Junge's paper "On the Evolution of Gas Power," read before the American Society of Mechanical Engineers in New York city on December 5, 1906. (See Western Electrician of December 15th.) It is particularly interesting as representing the conservative side of the blast-furnace power question. Mr. Johnson is a practical blast-furnace man, being general manager for the Princess Furnace Company of Glen Wilton, Va.

chinery or only in comparison with poor? These are questions which will be answered according to the balance between the commercial and the scientific perceptions of each individual. There is no question that for large plants of three furnaces or more, which can safely count on a supply of gas from at least one of these at all times, the gas engine will eventually come to be used for blowing engines and other power purposes, especially if the location of the plant is such as to provide a market for the surplus power thus made available; but at the isolated plant, where the engines drive the furnace and the furnace drives the engine, as long as all goes well, they are valuable—but not when things go badly. It would be an intrepid manager who would stake all on the use of a gas blowing engine. Not merely because the gas blowing engine is less dependable than the steam engine (though it undoubtedly still is), but because the supply of gas is liable to fail suddenly, just at the time when it is needed most, a condition which can be met in the steam-driven plant by simply burning coal under the boilers already in use, but in the gas-driven plant it would require the starting of an idle gas producer, with the loss of several precious hours.

I may explain that this condition arises from the fact that furnaces sometimes "stick," that is to say, the stock in the anterior of the furnace becomes packed and impermeable to the blast, the pressure rises enormously, and at the same time but little blast forces itself through, cutting off almost entirely the supply of gas from the furnace to the power plant. It is absolutely essential at such times that the engines continue to run against that heavy pressure without a moment's intermission, under penalty of losses in labor, money and anxiety, which are frightful to contemplate. It is no exaggeration to say that a three-hour loss of time under such circumstances might result in a loss equal to one-half the value of the blowing plant. The furnace man is compelled on this account to regard machinery, not as an end itself, but as a means to an end, and I have frequently thought that, while all well-regulated schools of mechanical engineering should have a course on the scientific use of machinery, all metallurgical schools should have a course on its deliberate, scientific and commercial abuse. The refinements which constitute the glory of mechanical engineering are utterly insignificant in the presence of the necessities of metallurgy, if considered from the commercial point of view.

The time of the gas engine is undoubtedly coming; but let it not be too readily assumed that the metallurgical industries deserve to have the finger of scorn pointed at them because they have not instantly adopted so great a scientific improvement.

Annual Convention of the Crocker-Wheeler Company.

At the annual convention of the Crocker-Wheeler Company, held at the main office and works in Ampere, N. J., January 23d to 26th, it was brought out that the company did more business in 1906 than in any previous year since it was founded 18 years ago. In the alternating-current generators of large capacity its business has gone ahead rapidly, as also has been the case with the direct-current motor department. This line of motors for driving machine tools, printing presses and every other kind of machinery has developed extraordinarily during the last year.

One of the features of the company's progress is its successful exploitation during 1906 of its form W motor. This almost indestructible motor was the subject of an inspiring talk by Gano Dunn, chief engineer and first vice-president of the company, at the annual convention in January, 1906, where it was first introduced to the Crocker-Wheeler selling men. During the last year some of the greatest steel works have accepted this motor as a valuable development in electric drive for steel mills.

Mr. Julian Roe, manager of the Chicago territory of the company, which includes Illinois, Indiana and several other states, reports an interesting meeting and good prospects for the future. On Friday evening, January 25th, the convention gathered at dinner at the University Club, New York. As usual, the personnel of the company remains almost exactly the same as it was at the previous annual convention.

Those at the convention and shown in the picture are the following-named:

Beginning at the left hand, upper row—J. R. Wilson, W. C. Appleton, H. B. Hussey, R. N. C. Barnes, C. W. Startsman, A. P. Olds, J. B. Milliken, H. C. Petty, G. H. Hall, H. Fuller, H. J. Sage, W. S. Watson, F. W. Kreps, S. Russell, Jr., H. M. Gassman, H. Lomas, J. M. Smith, M. E. Weissblatt, D. N. Force, Jr., Julian Roe, R. B. Treat, L. S. Horner, H. Pikler, C. N. Wheeler, H. A. Knoener, F. Young, A. Hartmann, B. A. Schroder.

Front row, beginning at left—Rodman Gilder, R. J. Randolph, Jr., H. L. Patteson, A. L. Doremus (second vice-president), S. S. Wheeler (president), Gano Dunn (first vice-president), W. L. Brownell (treasurer), F. B. DeGress, G. W. Bower.

CROCKER-WHEELER MEN AT AMPERE CONVENTION.

Small Power Motors Operating Beer Pumps.

In the industrial and commercial field there are numerous operations requiring small amounts of power which have usually been laboriously performed by hand, owing to the lack of some convenient and inexpensive driving mechanism. With the growth of the electrical industry and its extension into new lines of work, more attention has been given to the development and perfection of small power motors. In hotels, saloons and breweries there are many applications, such as bottle cleaners, automatic air compressors, beer pumps, etc. In Fig. 1, a Westinghouse one-eighth-horsepower small power motor for alternating-current circuits is shown driving a type A single-cylinder beer pump, for hotel and saloon use, manufactured by the E. R. Brown Beer Pump Company of Boston, Mass. A Brown type B single-cylinder beer pump driven by a similar motor is illustrated in Fig. 2.

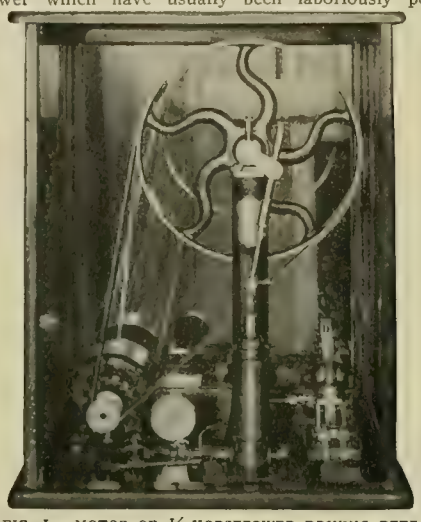


FIG. 1. MOTOR OF 1/8 HORSEPOWER DRIVING BEER PUMP.

These motors are compact, extremely neat in appearance and thoroughly reliable in operation. They are built for both alternating and direct-current circuits, either 115 or 230 volts. The direct-current motors are either shunt or series wound and the alternating-current motors are wound for 25, 60 or 133 cycles. The base of the motor consists of separate casting, the frame being drilled and tapped so that the feet may be fastened in any one of four positions, adapting them to use on floor, wall or ceiling.

Classification and Damping of Electrical Instruments.

A magnetized sewing needle suspended on a silk thread in a coil of wire will indicate "flow of current." This is an instrument—a crude form of instrument. When you surround this moving element with other modifications and refinements; when you replace the silk cord by a very delicately constructed shaft with hardened point bearing on sapphire jewels, and refine the form of the moving element, provide a scale, the calibrations of which have been compared with certified government standards, you are starting on the way to manufacture an "instrument of precision."

As the case and the works of a watch have no intimate relation to each other, so the external form, that is, the case of a switchboard instrument, has no particular relation to the type of works, or the principle on which the instrument depends.

You can indicate either the amount of current or its intensity by a number of different types of movements. The accuracy with which they indicate and the permanency of their indications, as compared with standards, vary with the method of applying the underlying principles adopted by the different manufacturers.

This company, in placing its line of instruments on the market 14 or 15 years ago, endeavored to construct each type on the principle which would operate to the best advantage for the work that particular type of instrument had to perform. The various types of instruments are shown, as—

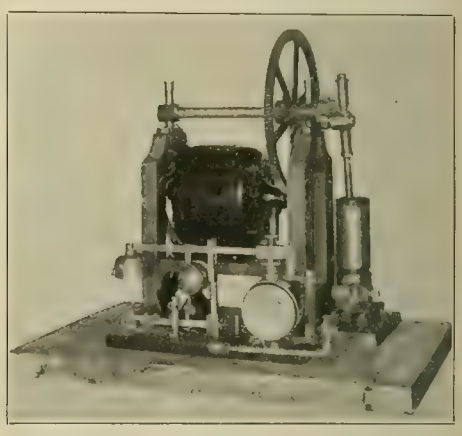


FIG. 2. ANOTHER ARRANGEMENT OF MOTOR-DRIVEN BEER PUMP.

First—The moving-coil dynamometer principle, used for voltmeters and wattmeters, suitable for operation on both alternating and direct current.

Second—The iron-vane type of instrument, which will measure both quantity of current and its intensity, and is used for ammeters and voltmeters, both alternating and direct current.

Third—The permanent-magnet dynamometer-principle instrument, which is also used for ammeters and voltmeters, but which, on account of its field being made by a permanent magnet, cannot be used on alternating current.

All of the movements would be unsuitable for operation in any commercial circuit of today, or for anything except laboratory testing or on any fluctuating load, if provision were not made for the damping of the needle. This damping effect is accomplished in three different ways:

First—By means of a very light and delicate vane of aluminum, moving in a closed air chamber, the resistance of the vane to the air holding back the first and subsequent throws of the needle, so that it takes its position of indication quickly.

Second—An oil chamber partly filled with non-volatile, non-vaporizing and non-freezing oil solution (which oil retains a constant viscosity through a large range of temperature), in which a small paddle on the needle shaft moves, thus retarding the "throw" of the needle.

Third—An electrically damped instrument, consisting of a coil of wire moving in the magnetic field, tending to create an electromotive force in itself, thus effecting a retarding movement or damping action upon the coil, this coil being attached directly to the shaft carrying the pointer.—From "Electrical Instruments," issued by Wagner Electric Manufacturing Company, St. Louis.

A bill has been introduced in Congress for a further immediate appropriation of $50,000 for the purpose of continuing the investigation of the black sands of the United States and especially the processes for the electric smelting of iron ores.

GENERAL TELEPHONE NEWS.

The Monson Automatic Telephone Company will erect a factory in St. Paul, Minn.

The Auburn (Neb.) Telephone Company is extending its lines into the country.

The Early Telephone Company of Early, Iowa, will extend its line to Odebolt and Schaller.

W. C. Johnson has succeeded to the telephone business of Prophet & Johnson at Hartville, Mo.

J. E. Mitchell has just completed a telephone line from Havana, Ark., to Riley and Walnut Tree.

The Home Telephone Company of Auburn, Ind., will rebuild its system. About $10,000 will be expended.

George H. Glass will succeed W. J. Stademan as manager of the Independent Telephone Company in Kearney, Neb.

The Taos (N. M.) Telephone Company has been incorporated with a capital stock of $10,000 by F. C. Ellis and others.

A. L. Keith and others of Van Buren, Ark., are about to organize a telephone company with a capital of $20,000.

The Acme Telephone and Manufacturing Company of Albia, Iowa, has been incorporated with a capital stock of $25,000.

The New Era Telephone Company of Oklahoma City has been incorporated with a capital stock of $20,000 by J. W. Wilson and others.

The Dublin (Tex.) Farmers' Rural Telephone Company has been incorporated with a capital stock of $20,000, by J. G. O'Brien and others.

Morganfield, Ky., wants an Independent telephone system, and is prepared, it is said, to grant a franchise to a responsible firm or corporation.

The Dane and Fairview Telephone Company of Fairview, Okla., has been incorporated with a capital stock of $15,000 by Brice Lowell and others.

The American Union Telephone Company of Philadelphia has been formed with a capital stock of $25,000,000 for the purpose of establishing a new telephone system.

A telephone bill introduced in the Illinois Legislature would compel all telephone companies to interchange service with other telephone companies doing business in the same territory.

The Yakima Valley Telephone Company has been incorporated, with Sunnyside, Wash., as the principal place of business, by W. P. Sawyer and R. D. Young. The capital stock of the new company is $25,000.

A storm which visited Portland, Ore., on January 28th played such havoc with electric wires that electrical communication and transmission was entirely demoralized for a while. Telephone wires received damage amounting to $100,000.

Fire on January 21st did great damage in the business section of Viroqua, Wis. The buildings occupied by the Wisconsin Telephone Company (Bell) and the La Crosse and Interurban Telephone Company were among the principal ones destroyed.

Because the Bell Telephone Company at Toronto, Canada, insisted on increasing the working hours from five to eight a day, according to a daily-newspaper dispatch, about 400 girls went on strike on January 31st. The company offered more remuneration, but the girls said that they could not stand the physical strain.

In a fire which destroyed a building adjoining that occupied by the Chicago Telephone Company at Franklin and Washington streets, Chicago, on February 3d, 50 girl operators were threatened with suffocation from the smoke which poured into the main exchange of the telephone building. Several of the girls were overcome, but none were seriously injured. They stuck to their places and answered calls up to the last moment. For three hours the main and toll exchanges of the telephone service were out of commission.

The Pacific Telephone and Telegraph Company, which has succeeded the Pacific States Telephone and Telegraph Company and the Sunset Telephone Company, by merger, completed its organization at a meeting held in Martinez, Cal., recently by electing the following officers: President, Henry T. Scott; vice-president, Louis Glass; second vice-president, E. J. Zimmer; auditor, T. E. Sherwin; secretary and treasurer, F. W. Eaton. The office of general manager, held by Louis Glass, was abolished. The papers in connection with the merger have been filed by the attorneys representing the two old companies.

The Southwestern Telephone News says: "All the large telephone companies throughout the United States are discouraging the use of the word 'phone' as an abbreviation of telephone. They even go so far as to request advertisers to use the words 'telephone number' in their advertisements instead of 'phone number.' We think this is a good move and have adopted it for some time, but we still find that some of our employes use the objectionable substitute. The officers and employes of the company are requested not to use the word 'phone' and to discourage its use by others in so far as they courteously may."

The following telephone companies have recently been incorporated: Central Telephone and Electric Company of Dallas, Texas, $15,000; the Council Hill (I. T.) Telephone Company, $2,500; the Farmers' Telephone Company, Aurora, Neb., $10,000; the Maywood (Neb.) Quick Telephone Company, $2,500; the Wehdem-Brenham Telephone Company, Wehdem, Texas; the Niles (Okla.) Telephone Company; the Mountain View Telephone Company of Hydro, Okla., $2,000; the Blue Ridge Telephone Company, Fargo, N. D., $1,000.

In listing the stock of the Mackay Companies on the Stock Exchange at New York on January 23d there was brought out the information that the company is the largest stockholder in the American Telephone and Telegraph Company, besides having stock holdings in a large number of important subsidiary Bell concerns. That the Mackay companies had acquired a large holding in the Bell company was shown in the last annual report, but that it was the largest stockholder came as a surprise. More than $9,000,000 has been expended for this purpose, it is said.

Telephone News from the Northwest.

The Board of directors of the North Dakota Independent Telephone Company held a meeting in Minneapolis at the office of the president, H. R. Lyon, and arrangements were made for a number of extensions and improvements.

St. Cloud (Minn.) men are working on a telephone device with which they expect to utilize water pipes for transmitting the sound.

The Rochester Telephone Company of Rochester, Minn., is planning to erect a new exchange building for the local exchange at a cost of about $25,000.

Judge William Lochren of the United States Circuit Court has ruled against the Northwestern Telephone Exchange Company in its suit against the city of St. Charles, Minn., to compel the latter to allow the company to install poles and wires there. The court holds that under the legislative act of 1893, cities and villages have authority to admit or keep out telephone companies as they may desire.

A local exchange is projected for Bowdon, N. D.

The Mutual Telephone Company at Churdan, Iowa, has moved into its new exchange building.

At the meeting of the Southwestern Iowa Telephone Association at Council Bluffs H. A. Kinney of Woodbine was elected president and J. F. Gleran of Denver secretary and treasurer.

The Advance Rural Telephone Company of Holstein, Iowa, has filed articles of incorporation.

The Wisconsin Telephone Company is reported as contemplating extending its line from Rhinelander to Ashland, Wis. R.

Indiana Telephone Items.

The directors of the Co-operative Telephone Company of Rushville have decided to erect a new $5,000 exchange building and install therein an automatic switchboard. The stockholders met on January 29th and ratified the decision of the directors. The estimated cost of the automatic switchboard is $26,000.

The farmers of Marshall County are organizing by townships to put in new telephone systems and connect up existing systems so as to have complete telephone service over the entire county. The first meeting was held in Plymouth, and interest manifested looks like a full county organization.

The City Council of Brookville has granted a franchise to the Brookville and St. Peters Telephone Company.

As evidence of the fact that great progress was made in telephony in Indiana during the last year, statistics recently completed show that there are 186,226 Independent and 64,229 Bell telephones in use in the state, exclusive of a number operated by small companies that made no report.

The Indianapolis Telephone Company, which has recently been complimented by the Commercial Club on its improved service, has paid into the city treasury $6,421, in payment of its license tax for the six months ended December 31, 1906. The yearly tax is $6,000, with $2 additional for each telephone in use over the first 6,000. S.

Central Union Men in Session.

The officials of the Illinois division of the service department of the Central Union Telephone Company held a meeting in Springfield last week. H. C. Rottger made an address and A. P. Allen of Indianapolis read a paper on the "Duties of an Inspector." F. A. DePeyster read a paper entitled "Recommendations for Additional Switchboard Facilities and Additional Operators." Both papers were followed by discussions. During a later session papers were read by C. M. Fosdick of Indianapolis, whose subject was "Recommendations for Additional Toll-line Facilities." and H. L. Haughton of Springfield on "Operating Rules."

CORRESPONDENCE.

Continental Europe.

Paris, January 22.—The new electric plant erected at Nice by the Société du Gaz et de l'Electricite is the first in France to use steam turbine alternators on the Curtis system. These groups have been constructed at the works of the Compagnie Francaise Thomson-Houston. At present there are running in the station two of these groups having a capacity of 800 kilowatts each. The alternators give three-phase current at 10,000 volts and 25 cycles. To regulate the speed of the groups a centrifugal governor is used. It acts by means of a controlling device upon a set of electromagnets which act so as to open or close the steam inlet piping. The plant also contains a bank of three single-phase transformers of 55 kilowatts each, which serve to lower the voltage of 10,000 volts to 220 volts in order to furnish current for the premises. In the plant has been installed a storage battery of 60 cells having a capacity of 300 ampere-hours on three-hour discharge.

From the new hydro-electric plant on the Caffaro, Italy, current is sent over a pole line to the cities of Brescia, Cremona, Manerbio and others lying within the region. The water is taken from the dam by means of a double conduit to the central station, which is equipped at present with three turbines of the Pelton type, giving 2,500 horsepower each. Coupled to the turbines are three-phase alternators built by the Oerlikon Company of Switzerland. These machines are designed for 10,000 volts and 150 amperes. Oil transformers of 3,000 kilowatts are used to raise the voltage to 40,000 volts. Each of the two lines which run from the station to Brescia is made up of two 6.5 millimeter copper wires. The overhead line is about 35 miles in length. At Brescia is placed a main transformer plant in which the line voltage is reduced to 3,600 volts. Near the transformer house is a sub-station which contains a number of motor-generator groups. Each of the latter consists of a 650-horsepower three-phase motor taking 3,600-volt current from the last-mentioned lines and direct coupled to a 450-kilowatt generator which delivers 150 volts and 3,000 amperes. These machines are provided with a somewhat unusual system of air cooling, in which the air blast is furnished by separate fans driven by electric motors.

Among the new telephone projects in France I may mention the fact that the General Council of the Seine-Inferieuse, upon the proposition of the prefect, has recently voted the emission of bonds to the extent of $540,000 in order to establish an international telephone system.

The Spanish railroad company, known as the Ferrocarril Palma-Soller, is engaged in drawing up the terms of the contract for a concession which is to be granted at Palma de Mallorca relating to the construction of about two miles of tunnel and the building of the railroad track between Palma and Alfabia. It is very likely that the company will use electric traction upon the new line. Bids for the electric outfit have already been proposed by a number of leading European firms. A new electric tramway which is now in construction is the Pamplona-Aoiz-Sanguesa line, and the work upon it is being carried out rapidly at present. The Compañia de Tranvias Electricos of Murcia is about to change over from animal traction to the electric system.

In the Zürich canton of Switzerland has been erected a weaving factory upon the most modern principles, and the leading feature consists in the arrangement of the looms. There are 234 looms which are each driven by an independent electric motor. Other machines in the establishment are also operated by electric motors. The lighting of the new factory is well carried out by arc and incandescent lamps. A. de C.

Great Britain.

London, January 23.—The discussion on Mr. Swinburne's paper on metallic filament lamps which was concluded at the Institution of Electrical Engineers a few days ago brought forth a lot of interesting facts and expressions of opinion. One portion of the paper, more of the "popular" order, was the statement that English lampmakers were slack in developing in the direction of new lamps. The representatives of the General Electric Company here quickly tackled the author and repudiated the suggestion. The lecturer replied that the activity at the works of the General Electric Company was due to the more than a trace of the Teutonic element which existed there. In the paper he had given the Germans credit for the greatest activity. Several speakers believed that the carbon lamp would not lose favor by the introduction of metal-filament lamps. Others thought the tendency to increase the power of light units a step in the wrong direction, while one speaker foreshadowed the return to low-voltage supply. The discussion was the best that has been held at the Institution this session.

A specification for a standard carbon-filament lamp has been issued by the Engineering Standards Committee and will be discussed at the meeting of the Institution of Electrical Engineers tomorrow night.

Two London railway dividends just announced are interesting. The Metropolitan railway dividend has dropped from 2¼ per cent. to one-half per cent., and that of the City and South London Railway—the pioneer tube railway—has increased from two per cent. to 2¼ per cent.

With the resumption of the meetings of the London County Council after the Christmas recess and the approaching elections of March there is great activity from the literature point of view. Special attention is being bestowed upon the electrical undertakings of the council and a most detailed and elaborate statement has been prepared concerning the tramways. It is solely in the interests of the "policy" of the council and as a justification that it has been published. The figures are interesting, but they have been published before with the same expressions of view, but they are brought up to date. It is calculated that nearly $2,000,000 has been paid to the relief of the rates out of tramway revenue in eight years, some two-thirds being received from the tramways in the north, which until April, 1906, were leased to a company which paid over a percentage of the profits. The capital expenditure not repaid totals nearly $25,000,000, part of which is repayable in 60 years and part in 25 years. The most debatable part of the whole tramway question is the amount charged to the accounts in relation to street improvements, but at the meeting today very little discussion took place upon the report as a whole.

One fact of technical interest in connection with the County Council's tramways is that the chief officer has invented a mechanical device which can be attached to the magnetic track brakes, allowing them to be applied by hand. At least this is the purport of a cutting that has come into my hands. It is difficult to receive information of this character for obvious reasons. G.

Dominion of Canada.

Ottawa, February 2.—At the annual general meeting of the shareholders of the Ottawa Electric Company the report of the directors showed that the gross earnings for the past year were $525,746, giving an increase of $76,112 over the year previous. After providing for the interest on bonds and loans and for mileage payments the net earnings were shown to be over 18 per cent. on the company's capital stock.

It is reported on good authority that the Canadian Pacific Railway Company is about to acquire the system of the Quebec Light and Power Company. This would mean the incorporation into the Canadian Pacific system of the electric line running from Quebec city to Ste. Anne de Beaupre. The summer traffic on that picturesque little line is now assuming large proportions, and the pilgrimages to the sacred shrine at Ste. Anne's is becoming large and difficult to handle.

The fact that Mackenzie & Mann, the Canadian railway magnates, allow their employes constantly to fly the Stars and Stripes over their railway offices at Sao Paulo, Brazil, strikes some Canadians as peculiar. There is quite a colony of Canadians in Sao Paulo, but in the eyes of Brazilians they all pose as Americans. It is stated that the Mackenzie & Mann projects there are a gold mine for revenue, and in operation the street-railway service is far superior to the Toronto railway system.

The new concern which is to supply electric energy to Montreal and vicinity has secured a lease of the Beauharnois Canal and will proceed at once to develop the power. W.

Winnipeg, Man., February 1.—The Town Council of Fort Saskatchewan, Alberta, has decided to install a municipal telephone system and to connect with the government long-distance line at Lloydminster. A central-energy system will be installed. Mr. Daniels is the mayor.

The Winnipeg Lakes Electric Railroad has received an extension of a year during which to commence construction. It is the intention of the company to build electric lines from Winnipeg, Man., to Lakes Manitoba and Winnipeg; also to Portage la Prairie. The capital of the company has also been increased from $50,000 to $5,000,000. T. G. Haig, Winnipeg, is promoting the company.

The City Council of Calgary, Alberta, has killed the proposition to supply power made by Messrs. Alexander and Budd and has applied to the Department of the Interior for rights to obtain water-power from the Kananaskis Falls.

The Melita-Arthur Independent Telephone Company, with headquarters at Melita, Man., has declared a dividend of 30 per cent. Several important extensions will be built in the spring.

When the government telephone campaign was in progress the speakers told the people telephone poles could be obtained for $1 and $1.50 apiece, but it is now found the price of this necessary commodity is anywhere from $7 to $11 apiece, and scarce even at that price.

The census of power users taken by the Winnipeg power committee shows that about 23,000 horsepower is used in the city. It is expected that plans for the new civic $3,500,000 power plant will be completed by the middle of February, when tenders for machinery will be at once called.

The Prince Albert (Sask.) Board of Trade has received from Charles H. Mitchell a detailed report on the Shell River power proposition. Mr. Mitchell recommends an initial development of 1,000 horsepower at a distance of 11 miles from the city. A second thousand horsepower could be developed on the same river at comparatively little cost. A. E. Doak is secretary.

Sealed tenders will be received by Magnus Peterson, secretary of the Board of Control, Winnipeg, Man., until noon, February 25th, for the construction of a single-track electric tramway from Point du Bois to Lac du Bonnet, a distance of 24 miles.

A dispatch from Rossland, B. C., says that through acquisition by shareholders of the West Kootenay Power and Light Company, of all the shares and charter of the South Kootenay Water Power Company, the West Kootenay Power and Light Company has been enabled to so arrange matters that it can now lawfully supply power and light and transact all necessary business in the district of Yale. R.

New England.

Boston, February 2.—The Fall River Electric Light Company has issued its annual statement covering the year 1906. The assets amounted to $945,777 and the liabilities were $834,377. The gross earnings were $240,345 and operating expenses $175,731.

The Narragansett Electric Light Company's power plant in Providence, R. I., was badly damaged by fire last Monday night.

A generator attached to a turbine engine in the Newton Street Railway Company's new power station in Waltham burst recently and caused losses of $10,000 on the generator and engine and $1,000 on the building. Cars in Waltham and Watertown were stalled for over an hour and the electric power and lighting systems were not got in working order for some time.

The Massachusetts Railroad Commission has issued its anual report. The commissioners do not recommend any particular kind of street-car fender, but give the electric-railway companies until May 1st to offer such fenders and wheel-guards as they want to use for the commissioners' approval. They favor the maintenance of wrecking crews by electric-railway companies, such crews to be furnished with jacks and other emergency tools. As they have not concluded their investigations into the matters of heating and ventilating street cars, the commissioners made no report on those subjects. Referring to the litigation over railroad companies acquiring control of electric railways, the commissioners say that it ought not to affect the management of electric railways.

The Detroit Edison Company's five-per cent. first-mortgage bonds, maturing in 1933 and amounting to $2,000, were sold at auction in this city Wednesday at 99⅝. One share of the Lowell Electric Light Company's stock was also sold for 197¼.

Hon. Warren W. Rawson, the well-known market gardener and seedman and the adopter of electric light as a forcer of plant growth during the night, celebrated the sixtieth anniversary of his birth Wednesday night. He was given a banquet at the Hotel Vendome in Boston.

In the Massachusetts House of Representatives Representative Lomasney of Boston has offered an order asking the Boston Transit Commission to inquire into the cost and advantage of a subway containing two tracks, to be constructed in place of the proposed elevated structure between the North Union Station and the Charles River, it being a part of the Boston and Cambridge rapid-transit system.

State Senator Chase of the Bristol company has asked for legislation authorizing savings banks to invest in the bonds of any street-railway, telephone or electric-light company incorporated under the authority of any of the New England States, New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan or Iowa whose total bonded indebtedness is not greater than its capital stock and which has paid regular dividends of not less than four per cent. for five years, providing the investment is approved by the bank and tax commissioners and the state treasurer.

Edwin H. Lord, A. M., who by many is given the credit of installing the first successful electric-lighting plant in America, died in Portland, Maine, on January 24th. He was born in Sanford, Maine, in 1850. He was principal of the Brewster Free Academy in Wolfboro, N. H., from 1887 until his death.

The Southern New England Telephone Company held its annual meeting at New Haven, Conn., Tuesday, at which General A. H. Embler, the treasurer, was elected secretary also, vice Victor M. Tyler, resigned. Morris F. Tyler was re-elected president and the directors were re-elected. The net earnings for 1906 were $351,514. Since 1898 the company's stations have increased 500 per cent. It has lines in every town in Connecticut. The average number of calls per day per station in 1906 was five, the total number of toll calls being 2,801,455, and about 75,000,000 communications were sent locally.

A Suffolk County Superior Court jury awarded $500 to Patrick Walsh, administrator of Henry P. Walsh, in his suit for $5,000 against the Boston Elevated Railway Company. The suit was for injuries caused by a spark from the elevated structure entering Walsh's eye. The Supreme Court decided that the company was responsible for such accidents. B.

New York.

New York City, February 2.—Final contracts have been awarded and ground is about to be broken for the construction of the remaining half of the Brooklyn Rapid Transit Williamsburg power station. The new half will be about 200 by 300 feet, and, like its forerunner, will rise 10 stories. This new addition will complete the company's plans and make a power house perhaps larger than ever before constructed or conceived and costing the great sum of $5,500,000. When fully equipped, as designed, the station will easily develop 100,000 horsepower, which can be increased under pressure to 150,000 horsepower. In case of breakdown of all the other stations this enormous power would be sufficient to move the 3,000 cars of the "B R T" with scarcely an effort.

As an echo of the automobile show the secretary's report shows that during the week over 15,000 outgoing telephone calls were registered at the public station, while 25,000 calls were made from the various booths.

At a fire which wiped out the large garage of the New York Transportation Company at Forty-ninth Street and Broadway, Manhattan, 150 electric cabs were destroyed. It was only by the most strenuous efforts on the part of the firemen that the newly installed rotary charging plant of the company, which represents machinery of great value, was saved.

Cars heated and lighted by electricity for the transportation of valuable horses is the latest addition to the New York Central's outfit, that company having ordered 20 such cars. This addition makes it possible for the aristocratic equine to travel amid the luxurious surroundings with which he is accustomed.

At noon, January 28th, the New York Central added 30 more trains to the multiple-unit electric-controlled cars running out of the Grand Central Station. The trains are run over the Harlem division; all the Croton and Yonkers trains are now run electrically to High Bridge. With the recent changes in the service the larger express trains are enabled to get out with less difficulty. The commuters of the Harlem division are in ecstasies of delight over the new equipment of that division. Dustproof, draftproof, electrically heated steel coaches, brilliantly lighted by arc and incandescent lights, and white chairs of fine wickerwork are such a departure from the old equipment that they are fairly dazed at the new conditions that have so suddenly come upon them.

The New York City Railway Company has opened a new line. The cars run from the Brooklyn Plaza of the Williamsburg Bridge to the Grand Central Depot without change of cars.

Under the persistent pressure of our energetic controller, Mr. Metz, the Interborough Railroad Company has paid a substantial amount on account of interest rental on bonds issued to construct the Subway. One check was for $369,926.18 for Manhattan and Bronx, another was for $4,740.05 for a portion of the Brooklyn-Manhattan division of the Subway now in operation.

The second annual report of the commissioners of gas and electricity shows that there are 162 corporations in this state furnishing electricity for light and power and 51 furnishing gas and electricity. In addition there are 35 municipalities which furnish electricity. D. E. P.

Southeastern States.

Charlotte, N. C., February 2.—The Southern Power Company has begun work in building a double transmission line from Charlotte, N. C., to Concord, 17 miles north. The double lines will be constructed so that one can be used in case of accident to the other. There will be two sets of poles and the two systems will be entirely distinct, occupying an 80-foot way the entire distance.

The Dorchester Public Service Corporation, formed in Baltimore, has been granted a franchise to furnish lights in Cambridge, Md., where a plant will be built to cost at least $70,000. A local corporation sought to have the franchise granting delayed, but the town commissioners accepted the terms of the Baltimore company.

The 534 miles of electric railway which the Public Service Corporation proposes to build promises to be the biggest electric interurban system in the South, with the possible exception of that now projected in Georgia, to run from Atlanta to several large towns in the eastern part of the state. The South Carolina scheme is backed by C. R. Van Etten, former manager of the Brooklyn Rapid Transit lines. Mr. Van Etten says that alternating current at 33,000 volts will be generated at three waterpowers and at a steam plant in the vicinity of Charleston. This current will be stepped down at sub-stations along the route so that it can also be sold by the corporation for lighting, heating and manufacturing use. The freight traffic will be

handled in cars of standard gauge, built on the plan of ordinary freight cars so that these cars can be switched on to steam lines. The motor cars will be like those of the New York, New Haven and Hartford line.

The proposed Public Service Corporation also expects to be able to divert considerable freight from Norfolk and Savannah to Charleston, the port town of the interurban system, and it also expects to be able to offer inducements in freight rates via steamer to and from Charleston. Charlotte is to be the northern terminus of the line of the extensive system.

To make the city attractive a committtee consisting of L. L. Breedlove and others has been authorized to secure estimates on plans for lighting the city of Norfolk during the Jamestown Exposition with electric arches and signs. The committee will report to the Two Hundred Thousand League committee and the illumination committee of the Citizens' Commission. Plans include numerous electric arches and swinging festoons.

The Consolidated Gas, Electric Light and Power Company of Baltimore has acquired the Roland Park Electric and Water Company. The lines of the first-named company are to be extended over the Roland Park territory as this suburb is developed.

Congressman Burton, on a recent visit to the South, said that he believed it was only a question of time before the Chattahoochee River, from Atlanta to Columbus, a distance of 100 miles, would be lined with manufacturing plants, deriving their power from the river. Columbus has been denominated "The Niagara of the South."

A legal fight has been precipitated between the town of Dublin, Ga., and the Dublin Telephone Company, the town claiming that the telephone company, which bought out a former company in Dublin, possesses no franchise, while the company claims that it bought a franchise when it secured control of the telephone system. It is also alleged that the company transmits telephone orders for whisky and that it is run in the interests of a whisky house in Macon, Ga., this being one of the causes leading up to the present peculiar fight over a franchise.

The Allis-Chalmers Company of Milwaukee will furnish the hydraulic machinery for the electrical development of the Ninety-nine Islands plant of the Southern Power Company near Blacksburg, S. C. The cost of the machinery is approximately $125,000. The Southern Power Company is also finishing up the equipment of its new plant at Great Falls on the Catawba River, and nearly all of the power has been contracted for already. The power will be transmitted to the chief station near Rock Hill, S. C., and from there will be distributed to a number of towns and cotton mills from 10 to 60 miles distant.

The contract for the new power plant of the Norfolk and Portsmouth Traction Company has been let to Schofield & Co. The plant will represent about $1,000,000 and will supply light and power for the Jamestown Exposition and for the increased traction needs of the occasion.

The Union Power and Water Company has been chartered at Raleigh, N. C., with $100,000 authorized capital. S. B. Shepherd and others are interested. The plant will be located in Western North Carolina.

The consolidation of interests controlling four large waterpowers on the Savannah River and the development of the same whereby nearly 60,000 horsepower will be available with about an equal amount further to be developed has been announced. The amount of money involved is close to $4,500,000, and the waterpowers are located at Hatton's Shoals, Gregg's Shoals, Calhoun Falls and Cherokee Falls. The work on the plant at Gregg's Shoals has been well advanced and following the completion of this plant will be the inauguration of work on the Calhoun Falls plant. The power will be distributed to cotton mills and other manufacturing plants in South Carolina and Georgia, the transmission lines extending over a distance of 200 miles.

The Consumers' Light and Power Company, with headquarters at Raleigh, N. C., and temporary plant near Sanford, N. C., has been granted a charter.

Dr. Harmon N. Morse, professor of analytical chemistry at Johns Hopkins University, Baltimore, is conducting experiments in cooking by electricity which, if successful, it is declared may succeed in bringing about a new era in the culinary art in this country. L.

Ohio.

Cleveland, February 2.—An involuntary petition in bankruptcy has been filed again the Yale Electro-Appliance Company of Cleveland.

The Supreme Court has decided that the Cincinnati Street Railway Company has a right to abandon a portion of its line in Winton Place that leads to the Spring Grove Cemetery. The village brought suit to have the regular schedule re-established and declared that the abandoning clause in the franchise was void. The Supreme Court upheld the Circuit Court in dismissing the petition.

Contracts have been awarded by the Toledo Railways and Light Company for the construction of seven buildings at Ottawa Beach. Three of them will be very large, especially the dance hall and the bath house.

The Indiana, Columbus and Eastern electric railway will lease its parks at Newark and Springfield and the one between Columbus and London. The company desires that the management be in other hands.

Some of the stockholders of the Ashland Gas and Electric Light Company have made application to the Common Pleas Court for the dissolution of the company on the ground that it has not made enough to pay dividends, after deducting expenses, for the past four years and that it owes debts which it cannot pay. The petition asks that the property be sold, and if any money remains after paying the debts that it be prorated among the stockholders.

A few Cincinnati capitalists have planned an electric road between that city and Middletown, and, it is stated, will push the project until it is constructed. It will pass through a number of thriving towns in the section between the two places. C.

Michigan.

Grand Rapids, February 2.—Probably no city ever prepared a more thorough schedule of its wants in the way of street-car service and concessions from the operating company than has the city of Kalamazoo in its discussion with the officials of the Michigan United Railways of the terms of a 30-year franchise. Aside from the reconstruction or extension of some half dozen lines the city makes other demands too numerous to mention.

The annual meeting of the stockholders of the Battle Creek, Interlake and Grand Rapids electric line was held in Battle Creek and the following officers elected: President, Donald McLeay, Prairieville; vice-president, Elijah Haney, Grand Rapids; secretary, E. B. Hosmer, Chicago; assistant secretary, H. Poulsen, Lapeer; treasurer, A. A. Aldrich, Hickory Corners. It is announced that the road will be built this year.

The Saginaw, Owosso and Lansing Railroad Company, capitalized at $600,000, has filed articles of incorporation. It plans to build from Saginaw to Lansing. The line will practically parallel the Michigan Central from Saginaw to Lansing.

The municipal lighting commission of Detroit has prepared a schedule of new lights which it intends to install this year. The total number is 207.

The Shiwassee Light and Power Company at its annual meeting in Corunna declared a semi-annual dividend of 4 per cent. to stockholders. The company now has a paid-up capital stock of $35,000. Officers were elected as follows: President, R. J. Colby; vice-president, Samuel A. Jarvis; secretary, H. A. Sprague, and A. A. Harper, treasurer.

The Grand Rapids Edison Company of this city has elected the following-named officers: President, Daniel W. McCool; vice-president, McGeorge Bundy; secretary and treasurer, Thomas F. Bechtel; general superintendent, A. F. Walker. The business of the company has shown a satisfactory increase the past year.

The St. Clair Edison Company, owned by the Detroit Edison Company, has taken over the entire plant of the Mt. Clemens Electric Company. Alex. Jacobi, manager of the Mt. Clemens company, will not be with the new company, it is said. B.

Indiana.

Indianapolis, February 2.—The Frankfort, Delphi and Northern Traction Company reports having secured the entire right-of-way between Frankfort and Delphi and franchises to enter Frankfort, Rossville, Pyrmont and Delphi. The company is headed by A. S. Strauss of Chicago as president and W. H. Cohee of Frankfort as vice-president and general manager. The company expects to break ground soon.

Two new interurban lines were opened up during the week. The Fort Wayne and Springfield interurban line between Fort Wayne and Decatur and the Shelbyville-Greensburg division of the Indianapolis and Cincinnati Traction Company.

The Grant, Miami, Cass and Western Interurban Company is the name of a new interurban which will be constructed on an air line between Marion and Logansport. The road will be 40 miles in length and will touch 12 towns.

Calvin P. Godfrey of Bluffton announces that contracts will be let in the spring for the construction of an interurban railway between Bluffton, Ind., and Norwalk, Ohio, a distance of 153 miles, by the Cleveland-Indianapolis Traction Company.

The Terre Haute Traction Company, which is building a line to Paris, Ill., announces that it has abandoned its efforts to secure a franchise over the two principal streets in Paris, and will acquire through proceedings in eminent domain a private right-of-way through the eastern part of the city to Washington Street and will establish a station within four blocks of the center of the city.

The work of setting poles between Seymour and Louisville for the Louisville and Indianapolis Traction line is progressing rapidly. The power house at Scottsburg is well-nigh completed.

It is announced that the government will establish a regular mail service on the Indianapolis and Cincinnati traction line between Indianapolis and Connersville.

Legislation is proposed in Indiana on the following bills: To authorize city councils to fix the rate for gas, electric light, heat, water and telephones; to assess for taxation city street-car lines and equipments independently of interurban lines though they may be a part of the same system; to prohibit the increase of the price of service for a commodity after it has been decreased by a corporation; to make it unlawful for railroads to run trains in which 75 per cent. of the cars are not equipped with power train brakes properly connected, tested and operated by the engineer; a two-cent-fare bill on railroads; to empower the Railroad Commission to enforce the interchange of traffic at junction points by a steam road, by electric lines and by steam roads and electric lines and to give the commission authority over interurban or electric lines the same as over steam lines.

The Chicago, South Bend and Northern Indiana Railway Company, recently incorporated with $7,000,000 capital to take over the properties of the Northern Indiana Railway Company, has executed a trust deed to the Central Trust Company of New York to guarantee the payment of five per cent. bonds amounting to $5,000,000. The money derived from the bond issue will be used in completing the extensions, for the construction and equipment of a new central power station, and for the taking up of outstanding bonds of the old company.

The City Council of Richmond having, by ordinance, prohibited the Indiana, Columbus and Eastern Traction Company from hauling freight through the principal street, and having arrested and fined the train crew for violating the ordinance, the traction company is now hauling the freight through the city on drays, where it is again loaded on the cars.

It is said that incandescent lamps are to be manufactured at the Fort Wayne Electric Works. S. S.

Illinois.

Peoria, February 2.—The Springfield City Council has passed an ordinance granting John H. Brinkerhoff a lighting franchise for 30 years. It provides for a bond of $5,000 to be placed in the hands of the city clerk, to be forfeited if work is not commenced in nine months and terminated in two years. An electric-light and heating corporation will be organized and incorporated at once.

F. W. Job of Chicago, head of the Decatur-Taylorville and Litchfield Traction Company, was in Taylorville this week. While there he said that eastern capital would build the proposed road if liberal franchises were granted and a right-of-way could be bought at a reasonable price. The survey will be commenced next week.

The Peoria Gas and Electric Company has been given a five-year contract for lighting this city on its bid of $65 for arc lights and $10 for 32-candle-power incandescents for all-night and every-night service.

At the recent meeting of the Illinois surveyors and engineers held here, L. Owens, assistant superintendent of the Peoria Gas and Electric Company, read a paper on the plants of the company. These officers were elected: President, Charles B. Burdick, Chicago; vice-president, A. N. Johnson, Springfield; trustees, R. S. Wallace of this city, superintendent of the Peoria Gas and Electric Company, and J. A. Moore of Chicago.

The district council of the International Brotherhood of Electrical Workers held their semi-annual meeting here this week.

The Wilmington Light and Power Company of Wilmington has been incorporated to operate an electric plant. The incorporators are J. H. Ray, A. J. McIntyre and J. C. Thompson.

G. J. Newton, engineer for the G. M. Gest Company of New York, is in the city to make plans for the underground work to be installed by the Peoria Gas and Electric Company this year.

The electric-light company of Washington is contemplating building a pole line to East Peoria to connect with the Peoria Gas and Electric Company's line there. The Peoria company is to furnish the Washington company with current at wholesale. The distance is 8½ miles and it is proposed to use 10,000-volt transmission. The present plant at Washington will be converted into an artificial ice plant.

A resolution has been presented to the City Council requiring that no man can run an electric car who has not been in the service of the company at least a month. This was referred to the police and judiciary committee, who held a council with representatives of the street-railway employes' union.

The Morton Light, Heat and Water Company of Morton has been incorporated.

What is perhaps the first shipment of live stock on an interurban was made this week, when a car-

load of mules was taken in an express car by the Illinois Traction Company from Springfield to East St. Louis. V. N.

Northwestern States.

Minneapolis, February 2.—George McNeil of Brookings, S. D., has accepted a position as superintendent of the electric-light plant at Wessington Springs, S. D.

There is talk of building a trolley line from Crookston, Minn., to Maple Lake and possibly to Erskine. A large power plant is also talked of.

Estimates are being made for the proposed concrete dam at Des Moines, Iowa, which is expected to furnish power for that city.

The Albia (Iowa) Electric Light and Power Company has sold its plant at Albia to the same persons who own the plant at Oskaloosa, Iowa.

The Marengo Midland Railway Company has been incorporated for the purpose of building an electric railway from Marengo to Oskaloosa, Iowa. It may also be extended from Marengo to Vinton and Cedar Rapids.

The City Council at Virginia, Minn., has voted to grant a franchise to the Mesaba Traction Company, promoted by F. B. Myers of Biwabik.

The Sioux City (Iowa) Traction Company is enlarging its power plant from a capacity of 1,000 horsepower to 2,500 horsepower. The improvements will cost about $75,000.

A franchise has been voted at Fairfield, Iowa, to the Iowa-Missouri Traction and Power Company.

William R. Hill and others have incorporated the Oshkosh (Wis.) Electric Company with a capitalization of $10,000. The company will manufacture electrical apparatus.

The Sherman-Luedtke Electrical Construction Company has opened for business at Menasha, Wis.

Bonds will probably be voted at Rochester, Minn., for the purpose of remodeling and enlarging the city's electric-light plant.

There is some talk of establishing an electric-lighting system at Langford, S. D. R.

PERSONAL.

Samuel Fairweather, Jr., has been appointed city electrician at Sheboygan, Wis., to succeed Gus Wilke.

L. E. Fischer, general manager of the Illinois Traction Company, has removed his office to Springfield.

Marshall Spivey, assistant superintendent of the electric-light plant at McLeansboro, Ill., has been appointed chief electrician of the state reformatory at Pontiac.

Howard L. Beach, railway expert of the Westinghouse Electric and Manufacturing Company of Pittsburg, recently delivered a midnight lecture at Washington Pa., to a number of employes of the Washington and Canonsburg Railway.

George A. Bowden, proprietor of the Youngstown Gas and Electric Fixture Company, died at his home in Youngstown, Ohio, on January 26th. He had been in business in that city about two years, having gone there from New York.

Prof. George C. Shaad has already entered upon his duties as assistant professor of electrical engineering at the Massachusetts Institute of Technology, succeeding Prof. William L. Puffer, resigned. Like Prof. D. C. Jackson, Professor Shaad went from the University of Wisconsin to the Boston school.

Friends of Mr. Thomas A. Edison in Chicago were somewhat alarmed by a circumstantial newspaper dispatch published on February 2d saying that Mr. Edison was seriously ill in Atlantic City. A telegraphic inquiry, however, brought the assurance that the story was a canard and that Mr. Edison is enjoying his usual good health.

Roland I. Phillips has been appointed assistant to R. M. Van Vleet, Chicago manager for the Cutler-Hammer Manufacturing Company. Mr. Phillips brings to the Cutler-Hammer company a wide experience in the controller business, having been connected with the Western Electric Company and J. L. Schureman & Co. of Chicago. He should prove a valuable acquisition.

C. E. Allen of the transformer engineering department of the General Electric Company at Lynn, Mass., will be transferred to the Schenectady works, where he will handle the commercial end of transformer work. Mr. Allen is a graduate of the Virginia Polytechnic Institute and has been employed at the Lynn works for a number of years.

Mr. H. Walton Heegstra has resigned his position as advertising manager for the Western Electric Company. Mr. Heegstra has only been with the Western Electric Company for a comparatively short period, but advertising experts in the electrical business have seen much to commend in his original advertising work for this company. His designs were unique and catchy, yet withal highly technical, and their originality was marked. Mr. Heegstra has several positions in view, but he is undecided whether he will return to New York or remain in the West. He has made many friends in the West and it will be a matter of regret to them if he should decide to leave Chicago.

Mason B. Starring, general manager of the Chicago City Railway Company, and Mrs. Starring were severely shaken up last week when their automobile ran down and killed a horse in State Street near Washington Street. The animal was jammed into the machinery of the automobile so that it was necessary to get a street-car wrecking crew before the machine could be released.

Leslie Carter, president of the South Side Elevated Railway Company, Chicago, for 10 years, resigned his position at the stockholders' meeting last week. He was succeeded by Marcellus Hopkins, formerly general manager. C. E. Nichols was elected a vice-president. Mr. Carter was later elected chairman of the board of directors. He has directed the development of the property for the last 10 years.

William Carroll, city electrician of Chicago, was confined to his home for over a week from the effect of a broken rib sustained in a severe fall on an icy walk. At first it was thought that one of Mr. Carroll's lungs had been pierced by the broken rib, but later developments proved this fear groundless. Mr. Carroll's many friends will be glad to know that the injury was not serious and that he is rapidly improving.

C. T. Alden has been placed in charge of the recently organized electrical department of W. S. Barstow & Co., New York city and Portland, Ore. Mr. Alden was formerly with the American Locomotive Company, Schenectady, as chief electrician and electrical engineer. M. O. Jenkins is assistant electrical engineer of this department, while J. P. Read is also on the staff, and R. R. Pomeroy is foreman of electrical construction.

Joseph T. Murray, a former partner of Thomas A. Edison, died in Springfield, Mass., on January 27th. He was born in Salem, Mass., May 12, 1834. Mr. Murray was an abolitionist and was interested in the "underground railway" for escaping slaves, before the War of the Rebellion. After the war he and ex-Secretary of the Treasury George Harrington controlled an automatic telegraph system. About 1870 he met Mr. Edison and they formed the firm of Edison & Murray, manufacturers of telegraph instruments. They brought out a stock-ticker system. At one time the Murray patents were estimated to be worth $1,500,000.

Mrs. Stella B. Arnold, wife of Bion J. Arnold, died at Colorado Springs, Colo., on February 1st. On the receipt of a telegram apprising him of his wife's serious condition, Mr. Arnold started immediately for Colorado Springs, but the end came just after he had started on his journey from Chicago. At the bedside of the deceased when death came were her mother, Mrs. Henry Berry, Miss Bertha Berry, her sister, her youngest son, Robert, and Mr. and Mrs. Ward S. Arnold. Two children, Maude L. and Stanley B. Arnold, were attending school in Boston, and, like their father, were unable to respond to a call which came suddenly at the last. Mrs. Arnold's death resulted from tuberculosis, from which she had been suffering for several years. Three years and a half ago her doctor advised her to leave Chicago, and accordingly she took her departure for Colorado Springs. With the aid of all the resources of modern science and every attention, the sick woman made a brave but unavailing fight for her life. At times it was thought she might recover, but the disease appeared to be deep-seated, and despite her heroic struggles to overcome its ravages she finally was compelled to surrender. Mrs. Arnold's bright intelligence and kindly and unselfish disposition endeared her to her family and her admiring friends. She always found it a pleasure to aid and comfort those in trouble, and her many kind acts will never be forgotten by those upon whom they were bestowed. Brief funeral services were conducted on Tuesday afternoon last at the family residence, 4713 Kimbark Avenue, Chicago, by Rev. Jenkin Lloyd Jones, the funeral party leaving in the evening for Reading, Mich., where interment took place on Wednesday. Mrs. Arnold's maiden name was Stella Berry, her birthplace being Reading, Mich. She would have been 45 years old had she lived one day more. She was a graduate of Hillsdale College, Hillsdale, Mich., and was married to Mr. Arnold in 1886. Accompanying the remains to Michigan were Mr. Bion J. Arnold, Miss Maude L. Arnold, Stanley B. Arnold, Mrs. Henry Berry, Misses Nellie and Bertha Berry, Mr. and Mrs. W. L. Arnold, Mr. and Mrs. W. S. Arnold and Messrs. R. J. Arnold, Harold Arnold, Gordon L. Arnold, Dwight K. Arnold and Lorenzo E. Dow.

ELECTRIC LIGHTING.

Brownsville, Texas, will erect an electric-light plant.

Ashland, Wis., will establish a municipal electric-light plant.

The Peoples' Electric Light Company of Wilmington, N. C., is being organized with a capital stock of $100,000 by J. O. Brock, R. W. Wood and others.

Neenah, Wis., has voted in favor of a municipal electric-light plant.

A $50,000 municipal lighting plant will be established at Fremont, Neb.

Fred Buchler of Sterling, Neb., will install an electric-light plant in that town.

The Carrollton (Ga.) Electric Company has been incorporated with a capital stock of $6,000.

The Pawtucket (R. I.) Electric Company has been authorized to issue $2,000,000 in bonds.

The McCool electric-light plant of McCool Junction, Neb., has been purchased by M. E. Borem & Co.

The citizens of Marengo, Iowa, have organized and incorporated the Marengo Midland Railway Company.

William L. Dows has petitioned the council for a franchise to establish a municipal lighting plant at Cedar Rapids, Iowa.

C. C. and E. B. King will establish an electric-light and power plant at Leaksville, N. C., to cost between $12,000 and $15,000.

The Newcastle Heat, Light and Power Company of Newcastle, Ind., has been reorganized. It will improve its electric plant.

The state commission of gas and electricity at Albany has denied the application to consolidate the lighting interests at Watertown, N. Y.

The Wilmington Light and Power Company of Wilmington, Ill., has been incorporated for $15,000 for the purpose of operating an electric plant.

The Northern Light and Power Company of Red Bluff, Cal., has been incorporated to build a power plant with a capacity of 7,000 horsepower.

The Sherbrooke Power, Light and Heat Company of Sherbrooke, Quebec, expended last year $40,000 in the construction of a new power house.

Jasper E. Brady of Chicago has asked permission of the City Council at Parsons, Kan., to construct and operate an electric light and power plant in that city.

The Rutland (Vt.) Railway, Light and Power Company has installed a large transformer in its Castleton station, preparatory to lighting the village of Castleton.

The Shawnee Lighting Company has sold to the Shawnee Gas and Electric Company its lots on Main Street for $129,000. The latter expects to erect a new building soon.

The Strasburg (Pa.) Electric Light, Heat and Power Company has been incorporated with a capital stock of $50,000 and will apply for a charter to begin the construction of electric lines.

The Board of Control at Covington, Ky., has appropriated $20,000 to aid in building an electric plant for which $75,000 in bonds have been voted. The estimated cost of the plant is $106,000.

Plans for the new power house of the Citizens' Light and Street Railway Company of Cleveland, Tex., are being drawn and will be finished within a short time, so that bids may be asked for the construction of the plant.

The village of Vanderbilt, Mich., has granted the Parks & Kelly Shingle Company a 10-year franchise to light the village with electricity and furnish current for private use. The company's plant was recently destroyed and it is now being rebuilt.

The Northern Colorado Power Company of Greeley, Colo., has ordered $25,000 worth of material for its street-lighting system. All of the old wires and arc lamps of 2,000 candlepower will be taken down and in their stead better wires and lamps of smaller power, but more of them, will be substituted.

An effort is being made to have Congress appoint a commission to investigate matters of interest in connection with the electric lighting and street railways of Washington, the commission to consist of three members of the House and two of the Senate, the investigation to be made at an expense not exceeding $25,000.

Clarence H. Geist of Philadelphia has purchased the Michigan City (Ind.) Light and Power Company's plant for $150,000. Mr. Geist is at the head of an eastern syndicate which owns a score of plants in various parts of the country, those in the Middle West being at Hammond, Valparaiso, South Bend, East Chicago, Indiana Harbor and Lansing, Mich.

The city electrician of Atlantic City, N. J., has devised a plan by which iron or steel arches may be erected on the Board Walk to sustain a variety of novel effects in electric lighting. At present the thousands of electric lights along the promenade are sustained by wires. The plan is to erect four or five such arches to each block and make per-

manent the lighting effects of the Board Walk which have been such an attraction to thousands of frequenters.

The office of Indian Affairs for the Interior Department has issued invitations for proposals for an electric-light plant to be constructed in connection with the construction of a hospital building at Carlisle, Pa., the bids for which will be opened March 8, 1907. Full information can be secured through the office at Washington, D. C.

The La Crosse (Wis.) Gas and Electric Company has filed articles increasing the capital stock from $600,000 to $900,000. The action was made necessary owing to the extensive improvements being made on the plant of the company and the installation of new machinery, with a corresponding increase of power and facilities to handle a growing business.

A bill introduced into the Pennsylvania Legislature at Harrisburg provides that after June 29, 1907, it shall be unlawful for any sleeping cars on the railroads in the state to be lighted with anything other than electricity. The bill is intended to lessen the chances of such terrible havoc and loss of life as occurred in the wreck on the Pennsylvania Railroad at Lochiel in May, 1905.

The city of Bloomington, Ill., is in the market for the following equipment for its electric-light plant: One horizontal cross-compound non-condensing Corliss engine direct connected to a 300-kilowatt alternating-current generator, speed 100 revolutions per minute; one high-speed simple engine direct connected to a 75-kilowatt alternating-current generator, speed 240 revolutions per minute; one 300-kilowatt alternating-current generator, revolving field, engine type, two-phase, 60-cycle, 2,300-volt, direct connected to cross-compound Corliss engine, 100 revolutions per minute, with motor-driven exciter; one 75-kilowatt alternating-current generator, revolving-field, engine-type, two-phase, 60-cycle, 2,300-volt, direct connected to high-speed simple engine, 240 revolutions per minute, with exciter; 450 alternating-current street arc lamps, together with regulators, transformers and switchboard.

ELECTRIC RAILWAYS.

The Rochester, Syracuse and Eastern Railway Company has been authorized to issue $7,000,000 in bonds.

The New York, New Haven and Hartford Railroad is establishing electric service on its Middleton branch.

New York capitalists have financed the Battle Creek (Mich.) and Coldwater electric line, and the road will be built at once.

The Corn Belt Traction Company of Bloomington, Ill., has been incorporated to construct a line from Bloomington to Champaign. The capital stock is $100,000.

The directors of the Rome Railway and Light Company of Rome, Ga., have authorized an issue of $500,000 in bonds. Improvement of equipment will use up $200,000.

G. J. Lampton of Louisville, Ky., is interested in constructing an electric railway in Hardin County. The Commercial Club of Glasgow, Ky., has taken the matter in hand.

Work on the 74-mile Frey electric-railway line from Springfield to Cincinnati, Ohio, will be commenced early in the spring. The distance, it is thought, will be covered in two hours by the new cars.

The right-of-way for the proposed interurban railway connecting the towns of Temple, Marlin and Waco, Texas, has been donated by farmers living along the route. The distance is about 60 miles.

The Gary, Hammond and Eastern Street Railway Company of Chicago has applied to the Hammond (Ind.) City Council for a 50-year franchise to operate a street railway from West Hammond, Ill., to Gary.

The Grant, Miami, Cass and Western Interurban Company is the name of a new interurban railway which will be constructed on an air line between Marion and Logansport, Ind. The road will be 40 miles in length.

The stock necessary for the construction and equipment for the proposed traction line between Richmond, Ind., and Hamilton, Ohio, has been disposed of. An effort will be made to secure the necessary right-of-way.

The Chicago City Railway Company is about to begin the construction of a large car barn on Vincennes Road at Seventy-seventh Street. The building, which will cover almost 150,000 square feet of ground, will cost $250,000.

Among the new lines which the Illinois Traction Company will probably build during the coming summer is one from Danville to Sidell, in the southwest corner of Vermilion County. The line will branch off the Danville-Ridgefarm Road at Vermilion Grove, and will be built through Indianola and the rich farming country of Carroll and Sidell townships.

The Kansas Union Traction Company has asked the City Council of Parsons, Kan., for a franchise to operate an electric car line within that city. The same company has a franchise to build an interurban line from Parsons to Coffeyville, Kan.

J. W. Andrews of New York city, a member of the American Society of Civil Engineers, recently made a tour of inspection of the proposed route of the Iowa and Missouri Traction and Power Company. The main power house of the company, it is said, will be erected at Keosauqua, Iowa.

The Owosso-Lansing Railway Company has been incorporated with a capital stock of $600,000 for the purpose of building an electric railway from Saginaw, Mich., to Lansing, touching at Owosso and other intermediate towns. John L. King of Syracuse, William K. Kady and others are the incorporators.

A company is being organized to build an electric railway from Hickman, Ky., to St. Louis. The company will be capitalized at $50,000, with the privilege of incurring an indebtedness of $2,000,000. The road will cross the Ohio River at Metropolis or Brookport, Ill., and will pass through Paducah, Ky.

The Okanogan Electric Railway Company of Spokane, Wash., has been incorporated with a capital stock of $3,000,000. The company proposes to build an electric line from Nighthawk to Loomis and other neighboring towns. A. M. Dewey, L. B. Bevis, L. K. Armstrong and a number of others are the incorporators.

The Central Interurban Traction Company, recently incorporated, St. Louis and Jefferson City, Mo., has asked the municipal authorities for a franchise to operate a three-cent-fare electric line in St. Louis. It is reported that Mayor Johnson of Cleveland is interested in the corporation, the capital stock of which is $50,000.

The Durango (Colo.) and Pine River Railroad Company has been incorporated for the purpose of building an electric railway from Durango 30 miles to the rich farming regions on the Florida and Pine rivers. The new company is capitalized at $400,000, and all the stock, it is stated, has already been taken up. Electric power to operate the proposed road will be generated by the waters of the Pine River.

A trolley ride to Cleveland, Ohio, from Chicago becomes a possibility owing to the sale of the Northern Indiana Railway Company's interests, consisting of traction lines between Goshen and South Bend and between Laporte and Michigan City, as well as the street-railway systems of South Bend, Goshen, Elkhart, Mishawaka, Laporte and Michigan City. The property was purchased by the Dieterich-Murdoch syndicate for $4,000,000.

Bills have been introduced in the Senate and House at Washington, D. C., by Senator Hopkins and Representative Rodenberg of East St. Louis for the construction of a bridge across the Mississippi River by the St. Louis Electric Bridge Company to provide an entrance into St. Louis for the suburban electric system operated by the Illinois Traction Company in the southern part of the state.

An explosion of a gasoline tank in the North Clark Street car barns of the Chicago Union Traction Company on January 31st caused a disastrous fire, which wrecked the buildings and destroyed 105 electric cars of the Halsted Street, Wells Street, North Clark Street and Evanston lines. The loss was more than $200,000, as estimated by Superintendent R. R. Hertzog and Fire Marshal Horan. While the loss is severe to the company, it will hasten the installation of the new cars on the line.

POWER TRANSMISSION.

The Telluride Power Company will build a large new power plant at Grace, Idaho.

The Washington Water Power Company will place its lighting and power wires underground in Spokane. Conduits will be laid inside the fire limits.

The Edison Electric Company of Los Angeles has practically finished a 60,000-volt transmission line from its 25,000-horsepower hydro-electric station on the Kern River, a distance of 128 miles from Los Angeles, consisting of six cables carried on steel towers from 30 to 75 feet high. The power house, which is built of concrete with iron roof, is equipped with five three-phase generators, each of 3,200 kilowatts, built by the Allis-Chalmers Company, Milwaukee, direct-connected to hydraulic turbines. The canal is about 12 miles long, with a carrying capacity of 700 cubic feet per second and a head of 270 feet. Five sets of step-up transformers are used, each 2,250 kilowatts. The transformer station in Los Angeles has four compartments, each containing three transformers of 750 kilowatts each. The power thus transmitted is used in the operation of street-railway cars over the Los Angeles city and interurban lines.

The erection of a large city power plant in Salt Lake City has been begun by the Salt Lake Public Service Company, which was organized recently by Columbus (Ohio) capitalists. F. W. Wemple is financial agent for the company.

The Sanitary District at Chicago has begun suit at Joliet to determine whether the district can take for canal purposes the plant of the Economy Light and Power Company under proceedings to condemn the property. An amended bill was filed by the district's lawyers, and arguments heard.

PUBLICATIONS.

A circular issued by the Benjamin Electric Manufacturing Company, Chicago, describes the Benjamin wizard attachment plug, which, the company affirms, renders rotating and twisting of cord for either insertion or removal unnecessary.

General alternating-current data are given in Bulletin 74, just published by the Crocker-Wheeler Company, Ampere, N. J., entitled "Engine Type Alternating Current Generators." A number of views are shown of plants where Crocker-Wheeler alternators are installed, and the bulletin also goes into details describing the design of generators developed by the company. One of the peculiarities of the Crocker-Wheeler alternators is their ability to operate in parallel; it was largely for this reason that the California Gas and Electric Corporation installed three 4,000-kilovolt-ampere Crocker-Wheeler alternators in its San Francisco plant.

It is no trick nowadays to issue an advertising blotter, but to present to the public one that not only advertises an institution's product but does it in a unique and catchy manner is something of an achievement. This, however, has just been accomplished by Manager E. J. Kirkpatrick of the McRoy Clay Works in his recent blotter production entitled "The Kicker." Few people realize that Mr. Kirkpatrick as well as being an accomplished salesman is what might be termed a connoisseur in the matter of choice poems and bits of artistic creation. "Kirk's" poem on "The Kicker" is a "catchy" mixture of wit and wisdom, and, as some one has put it, could well be hung in several offices in the electrical business.

Machado & Roller, 203 Broadway, New York city, have issued a bulletin describing the Hartmann & Braun frequency-measuring apparatus, taken over by Machado & Roller as sole United States sales agents. The apparatus includes devices from the precision measurement of frequencies and speeds of a character that possibly cannot be had elsewhere. The range of the applications of the apparatus is very wide. It is asserted that the Hartmann & Braun resonance type apparatus is superior to other devices on the market for the measurement of frequencies and speeds. Voltage changes do not affect their accuracy, but merely, the distances from which readings may be observed. Variation in wave form, it is said, does not influence them.

The Electric Storage Battery Company of Philadelphia has recently issued a folder describing the application of Chloride accumulators and Exide batteries to stationary gas or gasoline engines. The folder illustrates the system of battery ignition with these cells, both in stationary form, where charging current is available, and in portable form, where it is necessary to carry the batteries to a convenient charging source. Illustrations, dimensions, weights, capacities and prices of the two-plate types of Chloride accumulator and of the Exide sparking batteries are given, with a diagram of connections, and a concise explanation is included, showing the method of determining the necessary resistance for cutting down the line voltage from an ordinary lighting circuit. The folder will be found useful to all operators of stationary engines, and will be forwarded from any of the sales offices of the company upon request.

Allis-Chalmers Company has issued a reprint of its valuable bulletin No. 1044 on the subject of the "H. Ward Leonard System of Multiple Voltage Control for Variable Speed Motors." The following illustrations are shown: Three-wire balancer for multiple-voltage system; slab milling machine driven by Allis-Chalmers motor; lathe driven by Allis-Chalmers motor; Allis-Chalmers motor-driving radial drill; type Y1 and Y2 controllers used in connection with three-wire H. Ward Leonard multiple-voltage system; Allis-Chalmers motor geared to turret lathe; balance for four-wire H. Ward Leonard multiple-voltage system; multiple-spindle drill driven by Allis-Chalmers motor; type X1 controller used in connection with the four-wire H. Ward Leonard multiple-voltage system; Fitchburg lathes driven by Allis-Chalmers motors operating on the H. Ward Leonard multiple-voltage system; Allis-Chalmers type N motor, open style. A "Comparison of Variable Speed Systems," given on page 16, should prove of much interest to electrical men.

SOCIETIES AND SCHOOLS.

On February 15th before the Western Society of Engineers, Mr. H. M. Beibel will read a paper on "Direct-current Compensators for Balancing Three-wire Circuits." At one of the April meetings E. B. Ellicott of the Sanitary District of Chicago will read a paper on "The Hydro-electrical Development of the Drainage Canal." Another meeting, scheduled to take place in April, will be held out of town.

The National Electric Light Association, which for years past has occupied offices in the Electrical Exchange Building, 136 Liberty Street, New York city, has moved into the new Engineers' Building, on West Thirty-ninth Street, which will hereafter be the headquarters of many leading technical societies. Of late years the association has rapidly outgrown its old offices, and has therefore been prompt to avail itself of the splendid facilities presented in the new home for engineering provided through the generosity of Andrew Carnegie. Although the building will not be formally dedicated before April, several societies are already occupying their new offices, and the association is one of the first to take up its work under improved and helpful conditions.

The twenty-first annual meeting of the Canadian Society of Civil Engineers was held at the Windsor Hotel, Montreal, on January 29th to 31st. On the evening of the 30th the society held its annual dinner at the hotel, when 200 engineers from every province of the Dominion were present. M. J. Butler of Ottawa, deputy minister of railways and canals, occupied the chair. G. W. Stephens, president of the Harbor Board, spoke of the work accomplished by Canadian engineers, referring especially to the devising and constructing of the only continuous railway across the Continent. Mr. Stephens also touched on the canal system, the construction of the greatest ship channel in the world, on the St. Lawrence River, and other works, which enterprises, he said, were achieved by the engineers of Canada. The society visited several places of interest in and around Montreal, and on the afternoon of January 30th were the guests at luncheon of the Canada Car Company.

MISCELLANEOUS.

Plans are on foot to combine the electric-light, traction and gas plants of South McAlester, I. T.

An act authorizing and empowering the city of Alma, Kan., by and through its mayor and council, to levy a tax not exceeding three mills on the dollar on all the taxable property within the city for the purpose of lighting the streets and alleys of the city, has been introduced in the Kansas Legislature.

A bill has been introduced into the Legislature at Albany which confers upon the New York Electric Music Company quite as extraordinary privileges as those now enjoyed by the telegraph and telephone monopolies. President O. T. Crosby of the Electric Music Company says: "We seek to put music into every home in the state, and we hope ultimately to bestow it upon every home in the country. All we ask is the privilege of putting up wires wherever we cannot secure them from other sources."

Dr. Harmon N. Morse, professor of analytic chemistry at Johns Hopkins University, has recently invented a new type of electric furnace which can be used for cooking purposes. The heat can be regulated to within less than one degree and maintained indefinitely. Dr. Morse is experimenting to determine values of various foodstuffs and the temperatures at which they must be prepared to obtain the best results.

The conditions which will beset the engineer of the twentieth century, says the Scientific American, will be exacting beyond anything we now know. The importance of a strong foundation in scientific principles cannot be overestimated, for scientific principles are only the laws of nature. These principles cannot be learned readily after a man has begun his life work. His whole energy will then be devoted to applying these principles correctly, not in acquiring them laboriously. It will be a prime necessity for the technical college of the future to lay these foundations broad and deep. It will be regarded as a weakness for a college to teach its students only the knacks of the profession, only just enough to be an ordinary draftsman, a tolerable surveyor, or first-class lineman.

Recommendation is made by the chief of the Bureau of Yards and Docks for a deficiency appropriation to repair, as far as possible, the damage done by the tidal wave and hurricane of September 27th last to the navy yard at Pensacola, Fla. Among other items mentioned is that of $2,000 for the replacing of telephone poles, wiring and electric equipment, and telegraph poles, for a distance of 2½ miles within the reservation, and another of $5,000 for electric-light and power poles, wiring and equipment. The list of damage and loss sustained included the generators, which were submerged in salt water, poles and cross-arms blown down, feeders, wiring, and lamps wrecked throughout the yard to the extent of $6,500. The electric motor at sawmill No. 9 was also submerged in salt water.

TRADE NEWS.

The Conover Motor Company of Paterson, N. J., has been incorporated for $20,000 by Edwin K. Conover and others.

The R. R. Moore Plumbing and Electrical Company of Wichita, Kan., has been incorporated with a capital stock of $30,000.

The C. H. Worcester Company, Chicago, producers of cedar poles, ties, etc., owing to its constantly increasing business, has found it necessary to move into larger quarters. The company remains in the Tribune Building, but the offices are now located on the seventeenth floor, in rooms 1708, 1710 and 1712, instead of room 1208, as heretofore.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until February 25th for the installation of a conduit and wiring system in the postoffice, courthouse and custom house at Superior, Wis., in accordance with the drawings and specifications, copies of which may be had at the above office or at the office of the superintendent at Superior.

The warehouse of the Western Electric Company at Denver, Colo., is reported to have been damaged by fire to the extent of $75,000.

The Franklin Electric Company of Davenport, Iowa, has changed its name to the Miller Machine Company. The company is capitalized at $50,000.

One of the latest among eastern producers to establish a western branch is the Bristol company of Waterbury, Conn., the well-known maker of Bristol recording instruments. This company recently opened a district office in Chicago at 753 Monadnock Building, with H. P. Dennis as western manager. Mr. Dennis is a graduate mechanical engineer and was connected with the factory at Waterbury for several years. He also represented the Bristol company at the St. Louis Exposition, and his appointment as manager of the company's western office is a well-deserved tribute to his ability and responsibility. Since his arrival in Chicago Mr. Dennis reports a thriving business as having been transacted by this newly established branch. The continuous information record furnished by the Bristol recording instruments such as by its recording thermometers, pressure gauges, recording voltmeters, ammeters and wattmeters is now indispensable where an accurate diagnosis of plant conditions is required. Another incentive to the establishment of the western office was the desire of the Bristol company to furnish its patrons with the quickest possible service; Mr. Dennis makes a specialty of this.

BUSINESS.

As one of its "Lamp Talks" the Buckeye Electric Company of Cleveland issues a bulletin which deals with the new Buckeye tantalum lamp, which is recommended for use on direct current only. The value of the tantalum lamp, of course, arises from the high efficiency, being two watts per candle, with a life of approximately 600 hours.

The Steel Gain Manufacturing Company of 7 South Clinton Street, Chicago, finds that its "Bull Dog" steel gain meets with much favor among users of poles and cross-arms. This device is a steel cross-arm support which makes braces unnecessary on five-foot or six-foot arms, saves the expense of cutting a gain and strengthens the pole instead of weakening it.

The Parker Hoist and Machine Company of Chicago calls attention to its large line of engines, derricks, cranes and hoists. In its new catalogue, No. 19, the company points out its excellent facilities for turning out goods of the best quality and most modern and convenient design. The catalogue illustrates and describes the machines mentioned, together with numerous appliances in the line.

The French Battery and Carbon Company of Madison, Wis., formerly known as the French Battery Company, makes the important announcement that it has the exclusive right in the United States to import the battery carbon products of Fabius Henrion, Nancy, France. The company is now prepared to offer to the trade battery carbons, carbon flour and enclosed arc-lamp carbons, as well as its "Fleur de Lis" dry cells.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 29, 1907.

842,163. Commutation of Currents in Armatures of Dynamos. Engelbert Arnold, Karlsruhe, Germany, and Jens L. la Cour, Edinburgh, Scotland. Application filed December 16, 1904.

Combined with a wave winding for an armature, the winding consisting of a number of parallel sections, are a commutator, the sections being connected to adjacent segments of the commutator, resistances connecting the sections, brushes of a width not greater than the combined widths of a number of commutator segments equal to one less than the number of armature sections, bearing upon the commutator, connections external to the armature between brushes of like polarity, and means for introducing electromotive force in the connections.

842,178. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 22, 1903.

The combination with a trunk line consists of a cord circuit to connect with its outgoing end and a called subscriber's line to connect with its incoming end, a retardation coil being legged to ground from one side of the talking circuit established by the connection of the cord with the trunk. A supervisory signal is associated with the cord circuit and placed in operative condition when the cord is connected with the trunk, and a trunk relay at the other end of the trunk is actuated when the cord is first connected with the trunk by current over one side of the same with suitable return.

842,200. Magneto. Herman Hess, Indianapolis, Ind. Application filed June 15, 1906.

The main hollow single-piece non-magnetic body has pole openings formed through opposite sides thereof, magnetic pole pieces forced into the openings and magnetic fastening members passing through the non-magnetic body into the poles. A pair of heads has shafting bearings formed therein, the heads closing the opposite ends of the main body and forming bearings for the armature shaft. The armature shaft and armature and a collecting member co-operate with the armature.

842,222. Catenary Suspension for Trolley Wires. George A. Mead, Mansfield, Ohio. Application filed November 23, 1904.

Combined are a support, a horizontal arm irregular in cross section, an insulator located above the arm and adjustably mounted thereon, means for securing the insulator in its adjusted position, a brace, one end of which is secured to the support above the insulator, and means operatively related to the free end of the arm and extending to a point above the insulator, to which the free end of the brace is secured.

842,241. Mechanical Ear for Trolley Wires. Thomas E. R. Phillips, London, England. Application filed August 1, 1905.

This device comprises an inverted U-shaped frame, a number of pairs of plates pivotally held within the frame by bolts, the plates having spacing ribs at their upper ends and adapted at their lower ends to engage and hold a trolley wire, and means for connecting up the frame to a span wire.

842,254. Process for the Electrolytic Refining of Metals. Alfred Schwarz, New York, N. Y. Application filed February 6, 1904.

A process of depositing a metal from its ore is covered, consisting in compressing the concentrates of the ore to be treated into solid masses or cakes and supporting such masses in a framework of an insoluble conductive material, and then subjecting the anodes to the action of a current in an electrolytic bath.

842,256. Electrolytic Cell. George O. Seward and Franz von Kugelgen, Holcombs Rock, Va. Application filed July 17, 1905.

An electrolytic cell having a central and an outer annular electrode and an intervening tubular non-conductive partition. A number of tubular water-cooled curtains are arranged concentrically one within another, insulated from one another, and have the space between them filled with insulating material. (See cut on next page.)

842,268. Dogging Mechanism for Time and Other Locks. Warren H. Taylor, Stamford, Conn., assignor to the Yale and Towne Manufacturing Company, Stamford, Conn. Application filed May 5, 1906.

With the automatically operating unlocking mechanism of a lock are combined a dogging device adapted to be positively moved into and out of the path of movement of a part of the unlocking means, electromagnetic devices adapted to move the dogging device positively in opposite directions, and means for energizing the electromagnetic devices.

842,269. Dogging Mechanism for Time Locks. Warren H. Taylor, Stamford, Conn., assignor to the Yale and Towne Manufacturing Company, Stamford, Conn. Application filed June 7, 1906.

The combination, with bolt-unlocking mechanism and devices actuated by a magnet for dogging the unlocking mechanism, consists of mechanical devices actuated by a time movement for releasing the dogging mechanism and moving same to an inoperative position.

842,273. Process of Reducing Compounds. Frank J. Tone, Niagara Falls, N. Y. Application filed December 16, 1905.

This method of reducing silicon compounds consists in forming a fused bath of the compound, together with a reducing agent and a flux, interposing the fused bath as a resistance conductor between electrodes, and reducing the compound. Silicids are formed by creating a fused bath containing a silicon compound, metalliferous material, a reducing agent and a flux, interposing such bath as a resistance conductor between the electrodes of an electrical furnace, passing sufficient current through the bath to reduce the compounds and form a silicid, and collecting the silicid.

842,285. Block Signaling System for Railways. Adoniram J. Wilson, Westfield, N. J., assignor

to the Hall Signal Company. Application filed August 21, 1906.

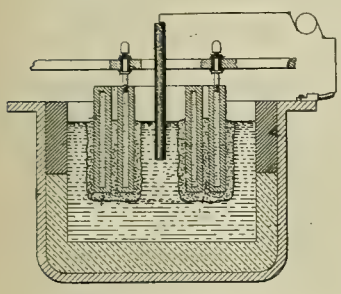
A train controlled electromagnetic device is provided for each block of the signalling system. There is a home and a distant signal for each block, a track relay for each block, a home-signal circuit, a distant-signal circuit and a shunt relay for the circuits. The home-signal circuit is controlled by the electromagnetic device of the block associated with the home signal and by that of the preceding block and also by the track relay of the second preceding block, the distant-signal circuit being controlled by the electromagnetic device and by the shunting relay of the succeeding block and by the home signal of the associated block. A portion of the distant-signal circuit of one block operates as clearing circuit for the home-signal circuit of the succeeding block through the medium of the shunting relay of the succeeding block so as to necessitate the use of only one through wire between blocks.

842,294. Safety Stop for Elevators. Herbert Y. Baldwin, Seymour, Conn. Application filed June 2, 1906.

A safety stop for elevators comprises a weight having housed within it an electromagnet, a pivoted armature therefor and locking means controlled by the armature. There are electrical connections, contacts adapted to close the circuit lying in the path of anything projecting from an elevator car and connections between the runs of a controlling rope and the weight, so that when the circuit is closed the armature will release the weight which will operate the controlling rope to stop the car.

842,301. Insulating Ring and Bracket. Frank B. Cook, Chicago, Ill. Application filed December 28, 1905.

A sheet-metal bracket formed as a channel to fit a sup-



NO. 842,256—ELECTROLYTIC CELL.

porting arm and a ring for carrying electrical conductors is covered by the patent. Insulation is conformed to the ring to insulate the inner portion thereof.

842,302. Bandage-winding Machine. John G. Crawford, LaGrange, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed March 25, 1905.

In a bandage-winding machine, the combination, with a rotatable winding spindle, consists of a motor for operating the spindle, mechanism for controlling the co-operation of the motor and spindle to regulate the speed of the spindle, and a common standard supporting all of the parts.

842,306. Telephone System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed May 8, 1901.

A cut-off relay has two differentially-wound coils in the line, and there are a battery and a line relay associated in the line, a cord circuit for making connections with the line for conversation, a supervisory relay of comparatively low resistance associated with the cord circuit, and means when a connection is established with the line for shunting one of the coils of the cut-off relay through the supervisory relay, whereby the cut-off relay is actuated and the line relay is cut out of circuit. (See cut.)

842,314. Pyrometer. George Heeley and Charles Féry, Paris, France; said Heeley assignor to La Compagnie pour la Fabrication des Compteurs et Material d'Usines à Gaz, Paris, France. Application filed November 11, 1905.

One claim covers an eyepiece arranged at one end of the casing, a mirror within the casing, a second mirror within the casing adapted to receive reflected rays from the first mirror and reflect the rays into the eyepiece, a thermo-electric pile the solder joint of which is within the casing close to the said second mirror, and an adjustable diaphragm arranged at the other end of the casing.

842,315. Single-track Signaling System. Robert J. Hewett, Westfield, N. J., assignor to the Hall Signal Company, a corporation of Maine. Application filed August 22, 1906.

There are 32 claims in the patent, one of which reads: In a single-track signaling system; a block provided with a set of one or more inrunning signals and a set of one or more outrunning signals; a selector circuit normally maintaining one of said sets at safety and the other of said sets at danger; means near each end of said block operable by a train to control said selector circuit and cause one of said sets of one or more signals to indicate safety and to cause the other said sets of one or more signals to indicate danger.

842,339. Apparatus for Electrically Indicating Weight. Charles Russo, London, England, assignor to Marconi's Wireless Telegraph Company, Limited, London, England. Application filed April 4, 1906.

A member for supporting the articles being weighed is adapted to vary in position in proportion to the weights supported, and there is a solenoid carried by the weight-regulated member, a second solenoid mounted so as to be stationary relatively to the first solenoid so that one solenoid will enter the other solenoid more or less according to the weight supported by the weight-regulated member, means for causing an alternating electric current to pass through the stationary solenoid to induce a current in the winding of the other solenoid in proportion to the extent to which one solenoid enters the other, an electrical measuring device in circuit with the solenoid in which the current is induced calculated to indicate the variations of the induced current upon a dial, and a dial having markings thereon adapted to show the weight of the articles being weighed.

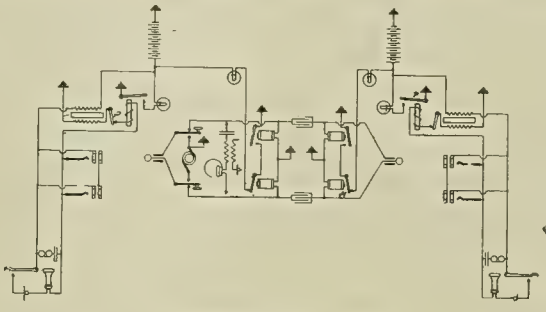
842,342. Electric Controller. Harry Sawyer, Muskegon, Mich. Application filed February 5, 1906.

A device of the class described contains spaced parallel vertical contact supports of insulating material, a lever movable between the supports, a brush holder within the space between the supports, means carried by the lever detachably engaged by the holder, and brushes mounted upon the holder, the brushes being adapted to engage the contacts, and being disposed transversely across the space formed between the supports.

842,358. Wireless Balance for Electric Generators. Robert C. Taylor and Edward Taylor, Brooklyn, N. Y., asignors to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed August 8, 1904.

In a braking system, a reservoir line, a reservoir and a pump are combined with means adapted upon the pressure in the reservoir line falling to a certain predetermined point to cause the pump to force air into the reservoir. A connection between the reservoir line and the reservoir has a movable member within, the opposite sides of which are respectively exposed to the pressure within the reservoir and the reservoir line, and the path of travel of which is limited by a stop and an electric contact, the movable member being adapted upon pressure in the reservoir line exceeding that in the reservoir to be forced against the electric contact and complete an electric circuit and cause the pump to force air into the reservoir.

842,366. Electric Block Signaling System. Adoniram J. Wilson, Westfield, N. J., assignor to



NO. 842,306—TELEPHONE SYSTEM.

the Hall Signal Company, a corporation of Maine. Application filed August 21, 1906.

The combination consists of a circuit having two multiple branches, a magnetic device with two opposing coils, one associated with each branch, each branch including the rails of a separate track side, the branches having a normal operative effect upon the magnetic device; means operable by a car for changing the normal operative effect of the branches, a signal normally indicating danger, and means operable by an approaching car to throw the signal to safety when the branches have their normal operative effect.

842,367. Electric Block and Block-section Signaling System. Adoniram J. Wilson, Westfield, N. J., assignor to the Hall Signal Company, a corporation of Maine. Application filed August 21, 1906.

A number of block sections each comprise a portion of a continuous return rail and an insulated rail section. Means for relaying from one section to a distant section comprise a differential electromagnetic device having two windings, one winding connected to the continuous return rail and one winding connected to the insulated rail section, so that their joint magnetizing effect is controllable by a train bridging the rails of the sections. A relay circuit is connected to the rails of the distant section and controlled by the differential device.

842,368. Power Plant. Frank Yeoman, Oroville, Cal. Application filed October 16, 1905.

The claim of the patent covers a power plant comprising a wall having a well open at its upper end at the top of the wall, provided with a water-inlet opening near its upper end, a chamber at the bottom of the well, a passage leading from the chamber to the top of the wall, water-discharge passages leading downwardly and outwardly from the chamber, a turbine having its casing in said chamber at the lower end of and communicating with the well, discharge pipes leading from the turbine casing to the discharge passages, and an electric generator in the chamber connected to and driven by the turbine.

842,377. Signaling Apparatus. George F. Atwood, East Orange, N. J., assignor to the Western Electric Company, Chicago, Ill. Application filed February 26, 1906.

A weatherproof telephone set is contained in an inclosing case having an upper and a lower compartment with a waterproof partition therebetween. Telephone apparatus is mounted in both the compartments and there is operative connection through the waterproof partition. A lid for the upper compartment forms the upper part of the case and affords access to the upper compartment, the lid having a tongue-and-groove connection with the upper part of the case to prevent the entrance of water thereto, and a removable side panel for affording access to the lower compartment, the panel having a weatherproof connection with the case.

842,389. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed February 27, 1904.

A battery comprising a number of cells has a duct extending into the interior of each of the cells, a conduit communicating with a number of the ducts, and means for connecting the conduit to the ducts, the connection permitting the removal of the cells and ducts without moving the conduit.

842,391. Thermopile. Henry Diecks, Eastport, Maine. Application filed January 11, 1906.

A thermopile is covered formed of radiating couples, the inner ends of the couples being semicircular in cross section and provided with screw threads, insulating washers arranged in the perforations and extending around the couples, and nuts arranged on the threaded portions of the couples and serving to confine the same in place.

824,405. Switch for Storage Batteries. Seth A. Leonard, Cleveland, Ohio. Application filed May 14, 1906.

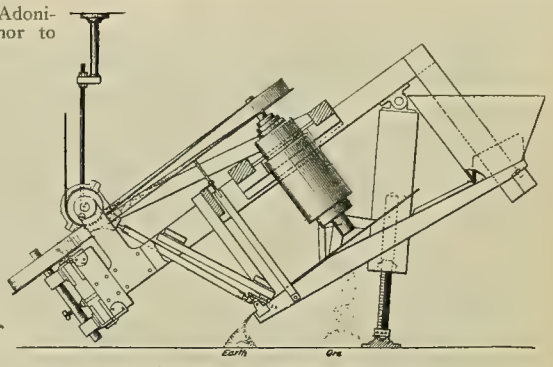
Opposite longitudinal slidable plates have contact and insulating surfaces upon their outer sides and means to operate the plates independently, and there is a series of brushes at the top and another series at the bottom of each of the plates respectively, the brushes being formed of laminæ of copper strips adapted to engage edgewise with the contact surfaces.

842,407. Extra-highly Vibrating Contact Breaker. Gustave Mamy, Paris, France. Application filed December 9, 1903.

A vibrating interrupter having a vibrating element, a centrally-fulcrumed spring-pressed oscillating lever adapted to normally contact with the vibrating element, the lever being insulated from the vibrating element and adapted to follow its movement during a portion thereof and a stop adapted to limit the movement of the lever in one direction.

842,409. Combined Annunciator and Jack for Telephone Switchboards. Martin V. Mehren, Genoa, Ill., assignor to the Eureka Electric Company, Chicago, Ill. Application filed June 2, 1904.

The combination with an annunciator and drop therefor consists of a restoring lever hung below the drop and pivoted between its ends and arranged to be actuated by the plug on insertion and to act upon the drop to restore the same.



NO. 842,583—MAGNETIC SEPARATOR.

842,410. Telephone Switchboard. Martin V. Mehren, Genoa, Ill., assignor to the Eureka Electric Company, Chicago, Ill. Application filed June 2, 1904.

In a combined jack and annunciator, the combination, with a jack socket, consists of a vertically-disposed lever hung below the drop and pivoted between its ends at the mouth of the socket and arranged to have its upper end act upon the drop and its lower end acted upon by the plug.

842,413. Electromagnetic Power Generator. Reinhold A. Miller, Indianapolis, Ind. Application filed March 14, 1906.

In an electromagnetic power generator are combined a suitable source of electrical energy, an electromagnet, a shaft, a crank on the shaft, vibrating armatures connected to the crank, a commutator on the shaft and a double brush mounted adjacent the commutator and electrically connected to the magnet, also means for bringing either set of brushes into effective condition for the magnet to reverse the direction of rotation of the shaft.

842,432. Electric Signal for Railways. Horatio Smelser, Ashton, Neb. Application filed October 7, 1905.

Head-end and rear-end signals are arranged at intervals along the track. There is an electric motor for operating each signal independently of the other signals, also branch electric conductors extending between the signals with each conductor connected with the motor of a rear-end signal and with the motor of a head-end signal, a main electric conductor extending along the track, and switch mechanism operating to complete the circuit from the main conductor through one branch conductor and simultaneously operating to break the circuit from the main conductor through another branch conductor.

842,457. Aerial Ferry. Samuel B. Harding, Waukesha, Wis. Application filed July 12, 1906.

An aerial ferry comprises a steel structure spanning a body of water from which is suspended a car on a level with the roadway. The car is operated by an endless cable passing around driving sheaves and operated by a pair of electric motors driving the respective sheaves.

842,514. Furnace-charging Apparatus. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed September 17, 1904.

Combined with a furnace are reciprocating mechanism in front of the same and mounted to move toward and from the furnace, an electric motor mounted thereon, a multiple-voltage circuit, and a lever controller having two active positions and movable in a single plane, the lever being arranged in its forward position to connect the motor to a low-voltage circuit, and in its rearward position to connect the motor to a high-voltage circuit and with the direction of the current through the motor field and armature reversed. (See cut on next page.)

842,515. Electric Motor System. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed September 17, 1904.

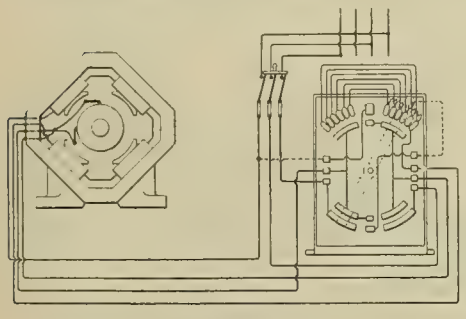
A motor has a multiple-voltage circuit therefor and a controller interposed between the motor and circuit and comprising a lever switch mounted to move in a single plane and to assume two working positions and a neutral position, the arrangement being such that the lever in one working position will connect the motor to a circuit of one voltage, and in the other working position it will connect the motor to a circuit of a different voltage and with the relative direction of the current through the field and armature reversed, and in the neutral position it will connect the motor field and armature in series and place the same in a closed circuit.

842,545. Electrical Connection for Railway Rails. Eugene Hayward, Clayton, Mich., assignor of one-third to John T. Lueder and one-third to John B. Morris, Chicago, Ill. Application filed August 21, 1905.

A bonding wire is concealed in a recess formed in abutting rail ends having an aperture therethrough. A contact plug is connected at each end of the recess and is fitted in recesses at the ends of the aperture.

842,546. Manufacture of Luminant for Electric Lamps. John A. Heany, York, Pa. Original application filed December 20, 1904. Divided and this application filed November 27, 1906.

The patent covers a filament for electric incandescent lights consisting throughout of substantially pure metallic titanium of high fusing point and electrically conductive which is stable at an efficiency at which a carbon filament, or a titanium carbon filament, will rapidly disintegrate, the light-emitting properties of the filament being due to the homogeneous metallic nature of the titanium. The process of forming a dense homogeneous titanium filament consists in producing a filament which consists exclusively of a conducting titanium compound in the desired shape, and then dissociating the titanium compound by passing therethrough an electric current in a vacuum, thereby eliminating the substance with which the titanium was combined with, and by means of the electric current shrinking and sintering the remaining pure metal into a dense homogeneous shiny filament.



NO. 842,514—FURNACE-CHARGING APPARATUS.

842,554. Electric Water Alarm. Albert Johnson, New York, N. Y. Application filed March 20, 1906.

Floats suspended from a spring are adapted to rise with water and permit the spring to make a contact.

842,565. Annunciator. Harry J. Kusel, Chicago, Ill., assignor to the Williams-Abbott Electric Company, Cleveland, Ohio. Application filed November 20, 1905.

An annunciator includes an electromagnet, a spool upon which the same is disposed, a casing within which the spool is contained and a locking device for holding the spool in position within the casing including one locking member carried by the spool and a companion locking member having a mounting substantially stationary with respect to the casing.

842,571. Insulation for Commutators. Max Meirowsky, Cologne-Ehrenfeld, Germany. Application filed July 13, 1905.

The one claim of the patent reads: Insulation laminæ for commutators consisting of calcined mica.

842,574. Electric Danger Signal. Alexander McCahon, St. Joseph, Mo. Application filed April 30, 1906.

The combination with the rails of a railway and wires having battery connection, consists of a bracket rigidly fastened on the rail, a hood supported by the bracket slightly aside from the rail and above the horizontal of the top of same, an insulated lining and the dovetail grooves therein for the wires.

842,583. Magnetic Separator. Charles J. Reed, Philadelphia, Pa. Application filed August 15, 1902.

With a non-magnetic disk and means for rotating it are combined an electromagnet having a curved segmental pole piece, the face of which is adjacent to the upper side of the disk and is eccentric thereto. An inclined chute is provided for the material to be treated extending in proximity to the bottom face of the disk, also means for effecting vibration of the chute to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field. (See cut on page 139.)

842,616. Battery Jar or Cell. Joseph Y. Bradbury, Somerville, Mass. Application filed October 25, 1906.

A jar or cell of fragile, non-metallic material, and a jacket or armor of flexible, fibrous material applied to the exterior surface to cover the bottom and greater portion of the sides and ends and to leave a portion of the outer surfaces of the sides and ends uncovered at the top. A substantially acid-resisting medium is applied to the fibrous armor to render it impervious.

842,617. Electrical Ignition Mechanism for Explosion Engines. Henri C. Brasier, Paris, France. Application filed July 12, 1902.

Mechanism is provided for actuating the movable electrode, comprising a shaft for the electrode, a boss keyed thereon, and a spring for the boss to operate the shaft by pressure in a line substantially tangential thereto and tending to keep the electrodes apart.

842,619. System of Pneumatic Control. Einar J. Bring, Wilkinsburg, Pa. Application filed July 25, 1906.

In a pneumatic-control system for electric motors, the combination consists of a series of pipes for fluid under pressure constituting a circuit of variable pressure, a second series of pipes for fluid under pressure, constituting a circuit of constant pressure, a number of pistons in the variable-pressure circuit of such diameter as to adapt them to compress a spring of known tension when acted upon by a predetermined pressure, and a number of valves in the constant-pressure circuit, each controlling the admission fluid to or the discharge of fluid from a cylinder in the constant-pressure circuit

842,624. Commutator. Allen F. Carver and James N. Stout, New York, N. Y., assignors to the American Inventions Company, New York, N. Y. Application filed November 25, 1905.

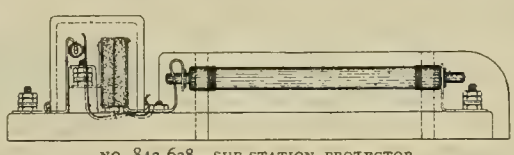
Combined with a translating device including an electromagnetic coil are a commutator comprising a contact piece in circuit with the coil, a reciprocating circuit maker and breaker for engaging the contact piece, means for operating the circuit maker and breaker, a condenser electrically connected with the contact piece and means for establishing communication with the condenser to reduce the spark at the moment of breaking circuit through the electromagnetic coil.

842,627. Starting Means for Internal-combustion Engines. Clyde J. Coleman, Rockaway, N. J., assignor to Conrad Hubert, New York, N. Y. Application filed September 17, 1903.

A non-starting engine having a rotating wheel thereon is started by an electromotor having field and armature coils connected in multiple, and a magnetic friction-clutch having circular pole-pieces fitted to rotate in peripheral contact with the rotating wheel of the engine and having energizing-coils connected in series with the field-coils of the electromotor.

842,628. Sub-station Protector. Frank B. Cook, Chicago, Ill. Application filed March 12, 1906.

An arrangement of electrical protective apparatus is covered comprising an insulating base, a tubular fuse mounted horizontally on the base, suitable spring clamping devices for the fuse, a thermal protector mounted on the base in line with the fuse and in circuit therewith, suitable contact springs for the thermal protector, a lightning arrester mounted vertically on the base and in line with the fuse and thermal protector, a contact spring and a ground terminal for the lightning arrester, the contact spring being connected to the circuit of the fuse and thermal protector and the ground terminal being adapted to ground the circuit of the fuse when the thermal protector operates, and suitable connection terminals for the circuit conductors. (See cut.)



NO. 842,628—SUB-STATION PROTECTOR.

842,673. Electrical Apparatus for Setting the Points and Signals on Railways. Lorenz Kottmair and Rüdolf Zwack, Munich, Germany. Application filed July 3, 1903.

A switch and signal apparatus for railroad tracks, comprising actuating devices for the track switches and signals and electrical means for actuating the actuating devices in one direction for making the line ready and for causing a return movement of the actuating devices, the electrical means having electric switches one for each actuating device, each electric switch when set closing the circuit for another actuating device.

842,730. Method of Making Electrical Conducting Bodies for Use as Contacts. Hermann Viertel, Charlottenburg, and Georg Egly, Lichtenberg, near Berlin, Germany, assignors to Gebrüder Siemens & Compagnie, Charlottenburg, near Berlin, Germany. Application filed September 22, 1906.

The method of making electrically conducting bodies for use as contacts consists in intimately mixing together metallic powders and carbon, pressing and molding the mixture, and heating the same until softening and alloyage take place.

842,740. Trolley. Pearl J. Wires, Osborn, Ohio. Application filed March 13, 1906.

The patent covers a current collector for street cars.

842,771. Battery Binding-post Attachment. George H. Cove, Roxbury, Mass., assignor of one-half to Frank R. Kimball, Boston, Mass. Application filed November 26, 1906.

A battery binding-post attachment comprising a U-shaped member having opposite approximately parallel arms provided at their free ends with wire-embracing tongues and having clamping jaws projecting inwardly from the arms in position to clamp the attachment in fixed position when the attachment is in wire-retaining position.

842,772. Party-line Telephone System. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed April 17, 1905.

Means are provided at the central office for throwing selective ringing-currents of different predetermined frequencies upon a line. There are a number of stations connected to the line, and a ringer at each station having its armature and clapper-rod normally held against movement in response to any but a strong force. Naked pole-pieces are adapted to touch the armature at the end of each stroke, whereby after initial vibration is set up in a ringer in response to proper current its moving parts will be exposed to a strong and cumulative force sufficient to insure full operation.

842,778. Telephone-exchange System. Benjamin O. Fox, Milwaukee, Wis., assignor of one-half to Michael S. Sheridan, Milwaukee, Wis. Application filed December 11, 1905.

A contact bearing is adapted, as the push-button of any several stations is forced inwardly, to move a circuit-closing arm in contact with the terminal of a conductor leading to a signal at a distant station, a second contact-bearing being adapted as the button is released to be brought in contact with a retaining-pawl which is adapted to engage the second contact-bearing of all the push-buttons in a single station and hold the same in a circuit-closing position until the receiver at such station is placed upon its supporting-arm. Actuating means connect with the supporting-arm of a receiver for throwing the retaining-pawl out of engagement with the contact-bearings of the several push-buttons as the receiver is placed upon its supporting-arm and there are means for releasing the pawl from engagement with the actuating means connected with the receiver-supporting arm as soon as the push-buttons have been released from the pawl, whereby the pawl may be drawn back to its normal position as soon as the contact-bearings of the push-buttons have been disengaged therefrom.

842,781. Insulated Crossover for Electric Railways. Edward E. Gilmore, Philadelphia, Pa. Application filed September 27, 1905.

Combined with a cross-arm having a bowed central portion adapted to carry a trolley-wire is another cross-arm provided with a central connecting portion adapted to carry a second trolley-wire, also a bearing element formed on the first-mentioned cross arm underneath the central bowed portion, an insulating disk secured to the second-mentioned cross-arm adapted to engage the bearing element on the first-mentioned arm, whereby adjustment of the cross-arms may be had, and an insulating-disk secured to the first cross-arm adapted to brace each cross-arm in any position to which it is adjusted.

842,801. Storage-battery Plate. William Morrison, Chicago, Ill., assignor to the Exmoor Storage Battery Company, Chicago, Ill. Application filed January 20, 1905.

A storage-battery support or grid is covered, consisting of a phosphorous alloy containing lead and antimony; lead, antimony and "phosphor-tin," or lead, antimony and tin.

842,822. Telephone System. Herschel R. Turner, Hoxie, Kan. Application filed May 12, 1906.

A number of stations are connected in multiple to the line-wires and each has a settable and a moving contact. A generator at each station is connected in multiple to the line-wares and there is a circuit-breaker in each generator-circuit and electromagnets controlled by the generator-current for operating the moving contacts.

842,827. Means for Operating Motor Vehicles. Clyde J. Coleman, New York, N. Y. Application filed February 11, 1901.

The combination of an engine and an electric motor is covered, connected together so that each is adapted to actuate the other. There is a speed governor for the engine whereby a substantially constant speed thereof is maintained, also electrical storage means and means controlled by the speed of the motor for connecting the motor, as a motor, with the storage means to start the engine, and for connecting the motor, as a dynamo, with the storage means when the normal speed of the engine has been attained.

842,829. Process of Making Commutators. Thomas Duncan, Lafayette, Ind., assignor to the Duncan Electric Manufacturing Company, Lafayette, Ind. Original application filed March 14, 1904. Divided and this application filed January 23, 1905.

The process of making commutators for meter-motors consists in fastening a strip of precious metal upon a strip of inferior metal to form a composite strip, dividing the composite strip into lengths which, when rolled, will form tubes of the diameter to be made, rolling the lengths into such tubes, slotting and separating the tube into commutator segments, and holding the commutator segments in fixed mechanical relation.

842,843. Safety Electric Switch. Arthur H. Williamson, Lachine, Quebec, Canada. Application filed February 3, 1906.

In an electric switch is a casing of insulating material, terminal poles mounted in the casing, switch-blades slidably mounted on one pair of poles and having notches adapted to engage the opposite poles, an insulating member connecting the switch-blades, a threaded post mounted on the insulating member, and a helical spring surrounding the post adapted to maintain the switch-blades in engagement with the poles.

REISSUE.

12,602. Electropneumatic Channeler. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed September 20, 1906. Original No. 805,195, dated November 21, 1905.

In the combination are a channeler, a presser connected with the channeler in practical working proximity thereto, a motor for actuating the presser and means for maintaining the practical working proximity of the presser to the channeler during the travel of the channeler along its line of cut.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 4, 1907:

420,444. Thermal Cutout. George Farrell, New York, N. Y.
420,469. Regulation of Electric Motors. Lemuel W. Serell, Plainfield, N. J., and Harvey L. Lufkin, New York, N. Y.
420,500. Electric Drill. Imle E. Storey, Boulder, Colo.
420,543. Electric Street-car Gear. Edgar Peckham, New York, N. Y.
420,544. Electric-car Gear. Edgar Peckham, New York, N. Y.
420,545. Electric-car Axle. Edgar Peckham, New York, N. Y.
420,552. Extension Electrolier. James E. Brown and John F. Brown, Brooklyn, N. Y.
420,594. Quadruplex Telegraph. Thomas A. Edison, Menlo Park, N. J.
420,611. Electric Brush. John E. Stephens, Cincinnati, Ohio.
420,622. Electrical Lock Switch. Edward N. Dickerson, Jr., New York, N. Y.
420,635. Staple for Electrical Conductors. Luther Stieringer, New York, N. Y.
420,641. Method of Electric Refrigeration. Mark W. Dewey, Syracuse, N. Y.
420,648. Insulating Compound. James B. Williams, San Francisco, Cal.
420,693. Electromagnetic Car Brake. Daniel S. McElroy, New York, N. Y.
420,697. Burglar Alarm. Noah M. Powell, Reger, Mo.
420,706. Electric Lamp Adapter. James Stewart, New York, N. Y.
420,710. Bipolar Prostatic Electrolyzer. Richard M. Bache, Philadelphia, Pa.
420,762. Electric Meter. James D. Bishop, Chicago, Ill.
420,764. Thermo-electric Generator. Charles S. Bradley, Yonkers, N. Y.
420,804. Conduit for Electric Railways. Delbert E. Johnson, Atlanta, Ga.
420,816. Electrically Reciprocated Tool. Harry N. Marvin, Syracuse, N. Y.
420,833. Autographic Telegraphy. James H. Robertson, Brooklyn, N. Y.
420,834. Electric Door Opener. George A. Seib, New York, N. Y.
420,850. Electrical Recording Instrument. Frank B. Wood, New York, N. Y.
420,851. Method of Electrically Recording Signals. Frank B. Wood, New York, N. Y.
420,852. Apparatus for Electrically Recording Signals. Frank B. Wood, New York, N. Y.

WESTERN ELECTRICIAN

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Maywood Power Station of North Shore Electric Company of Illinois.

The plan which the North Shore Electric Company has adopted of serving the near suburban district of Chicago is an interesting one. The territory to which electric current is furnished by this company lies just outside the city limits of Chicago and extends to Waukegan on the north, to Elmhurst on the west and to Chicago Heights on the south.

The list of towns and villages included in this territory and which are at present served by the North Shore Electric Company, with the general direction from the center of the city, is as follows:

North of Chicago—Waukegan, Libertyville, North Chicago, Lake Bluff, Lake Forest, Fort Sheridan, Highwood, Highland Park, Ravinia, Glencoe, Gross Point, Wilmette and Evanston.

Northwest of Chicago—Edison Park, Park Ridge, Desplaines and Niles.

West of Chicago—Maywood, Melrose Park, Elmhurst, River Forest, La Grange and Grossdale.

South of Chicago—Morgan Park, Harvey, Homewood, Flossmoor, Thornton, Chicago Heights, Steger and Crete.

These towns and villages have an aggregate population of approximately 200,000.

Originally these towns received current for light and power from 11 different central stations. Now the idea of the North Shore Electric Company, which has absorbed many of the older concerns, is to shut down these old power plants as rapidly as possible and to supply its entire territory with electric light and power from four interconnected, modern, central, electric power plants, one at Waukegan, one at Evanston, one at Maywood and one at Blue Island.

The first of these new plants to go into operation is the one at Maywood, the subject of the present article. A view of the turbo-generator room of the plant is given in Fig. 1. The exterior of the station is shown in Fig. 2. It should be remembered that the finishing touches in the completion of work on this plant have not yet been applied, which accounts for the slightly unfinished appearance in some of the pictures.

The Maywood plant, although the smallest of the four new ones being installed by the North Shore company, is modern and worthy of attention. It is located on the west bank of the Desplaines River and adjacent to the Galena Division of the Chicago and Northwestern Railway, being about 15 miles west of Lake Michigan. It is thus apparent that there are ample facilities for receiving coal by railroad, while the river supplies water for condensing and boiler-feed purposes. The property owned by the company at Maywood comprises 15 acres of land lying on both sides of the Desplaines River, thus providing ample space for coal storage, pole yard and for future growth.

The building, shown in Fig. 2, is of red brick, and while it is very plain it has some ornamentation and stone trimming. The boiler room is to the north and the turbine room to the south. Coal cars are run into the building at the north end and the coal discharged directly in front of the boilers, thus requiring a minimum amount of handling before the coal reaches the fires.

A plan showing the general arrangement of the station is given in Fig. 3, while Fig. 4 is a cross-section of the plant.

The turbine room is provided with a 15-ton electrically operated crane built by the Northern Engineering Works. It is shown in the general view, Fig. 1. This crane is capable of handling any part of a 1,000-kilowatt equipment.

Boiler Plant.

In the boiler room there are three Babcock & Wilcox boilers of 3,500 square feet heating surface each, giving steam at 160 pounds pressure and 100 degrees superheat. These are shown in Fig. 5. The present boiler room is large enough to contain four of these boilers. The stack is a self-sustained steel stack, being eight feet in the clear at the bottom and 180 feet high. It is lined to the top with fire block. The lining is nine inches thick for the first 60 feet, six inches for the second 60 feet and four inches for the top 60 feet.

To the west of the stack is the oil room and to the east are the boiler-feed pumps and feed-water heater. The feed-water heater is of the Webster open-heater type, having a capacity for heating 96,000 pounds of water per hour from a temperature of 60 degrees to 212 degrees when supplied with sufficient exhaust steam at atmospheric pressure. The feed-water pumps are of the outside, center-packed, bronze-plunger, Stillwell type. There are two of these pumps, either one of which is of sufficient size to supply all four boilers with feed water. Thus there is always a spare feed

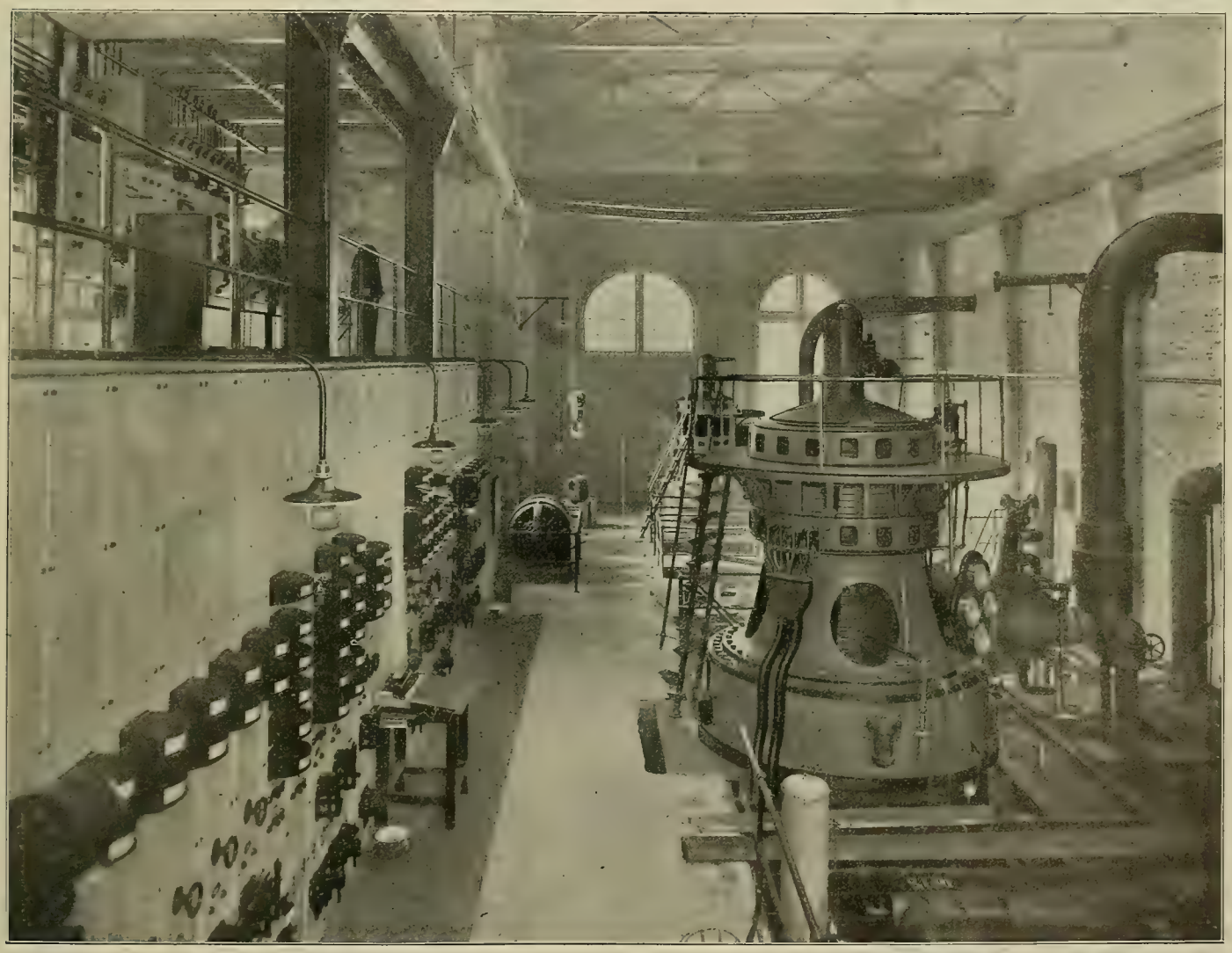


FIG. 1. TURBO-GENERATOR ROOM IN MAYWOOD POWER STATION OF THE NORTH SHORE ELECTRIC COMPANY.

FIG. 2. POWER STATION OF NORTH SHORE ELECTRIC COMPANY AT MAYWOOD, ILL.

pump. The feed-water heater and one of the boiler feed pumps are shown in Fig. 6.

Along the south boiler-room wall, which separates the boiler room from the turbine room, runs the 14-inch ferro-steel steam header. This steam header is arranged with a disconnecting valve, so that it can be divided into two sections for the purpose of making repairs on either section without necessitating the shutting down of the entire plant. There is also an auxiliary header for supplying steam to the various auxiliary machinery. This auxiliary header can be supplied with steam from either section of the main header.

Steam-turbine Equipment.

South of the boiler room is the turbine room, containing the generating equipment. This consists of two 500-kilowatt and one 1,000-kilowatt (nominal rating) Curtis steam-turbine units. One of the 500-kilowatt units and the 1,000-kilowatt unit are in operation. They are shown in Fig. 1. The second 500-kilowatt equipment is under construction.

The turbines are of the well-known Curtis four-stage type, which have been described many times. The only new feature is the hydraulically operated valve mechanism on the 1,000-kilowatt turbine, replacing the electrically operated valve mechanism formerly used. The hydraulic valve gear is positive in its actions, thus overcoming the difficulty of valves sticking, which is occasionally experienced with electrically operated valves. The hydraulic pressure necessary for operating the valve gear is 100 pounds and is taken from the same pumps which supply the oil pressure for the step bearings, it being merely necessary to introduce a reducing valve, since the step pressure is too high, varying from about 300 pounds in the smaller turbines to about 1,000 pounds in the larger units.

The 500-kilowatt units are equipped with condensing apparatus built by the Alberger Condenser Company. Each condensing unit consists of a 2,000-square-foot counter-current surface condenser, a horizontal rotative dry vacuum pump, a double-suction centrifugal circulating pump, direct-connected to an enclosed engine, and a duplex "monitor" wet pump. Perhaps the most novel and interesting feature about this equipment is the "monitor" wet pump, which has no external moving parts, the steam valves being contained in the pistons.

The 1,000-kilowatt unit is equipped with condensing apparatus built by the Wheeler Condenser and Engineering Company, and has 4,000 square feet of surface, an admiralty type of condenser, a rotative dry vacuum pump, a single-cylinder wet vacuum pump and a double-suction centrifugal pump.

Both of these condensing equipments are giving a vacuum of over 28 inches of mercury (referred to a 30-inch barometer) under all load conditions without any difficulty.

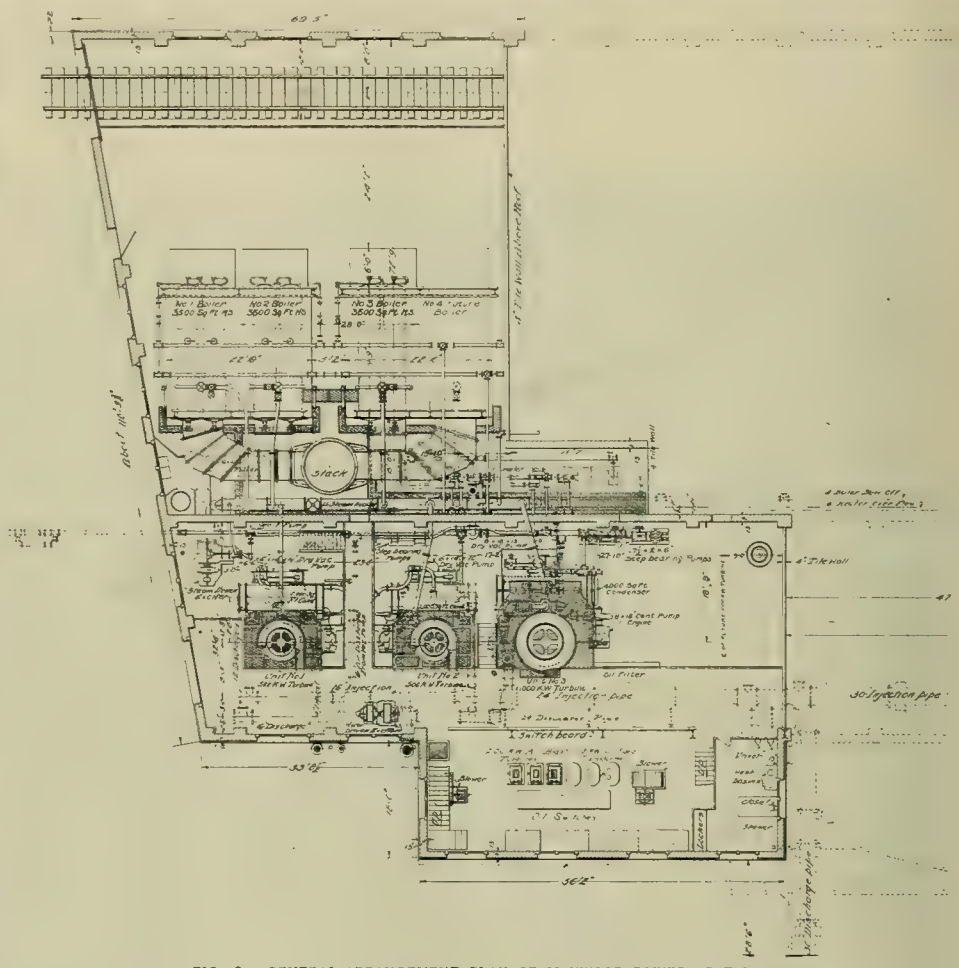


FIG. 3. GENERAL-ARRANGEMENT PLAN OF MAYWOOD POWER STATION.

Water Supply.

Circulating water supplied to the condensers for condensing the exhaust steam from the turbines is brought from the river through a 30-inch pipe which runs along the turbine-room floor, and the water, after passing through the condensers, is again discharged through a 30-inch pipe. The discharge end of the discharge pipe is sealed by running it about six feet below the surface of the river. Thus the whole system of intake pipe, condensers and discharge pipe, forms an inverted-U siphon, so that after the water has been put into circulation through the condensers the circulating pumps do very little work, it being necessary for the circulating pumps merely to overcome the friction of the water flowing through the condensers. At the river end of the intake pipe is the intake crib. This is built of three-inch oak planks, is 10 feet square at the top and 18 by 26 feet at the bottom, having a sloping front. The front of the intake crib is provided with an iron grill built of bars set 1½ inches on center, to keep out logs or other large material which may float down the river. Back of this grating are screens built of No. 10 wire, half-inch mesh. The object of the screen is to keep out fish, leaves and such smaller objects as may pass through the steel grating. These screens are removable, so that they can be cleaned when necessary.

Oil Circulation.

In the turbine room, besides the turbines and their condensing equipments, there are two sets of step-bearing pumps which supply the oil to the step bearings, the steady bearings and hydraulically operated valve gear of the turbines. The oil, after leaving the various bearings, flows to a Turner oil filter, which sets on the turbine-room floor. After flowing through the oil filter it flows to the suction side of the step-bearing pumps, thus completing its cycle. The same oil is used over and over again, and practically none is lost. Of course in its passage through the various bearings of the turbine the oil becomes somewhat heated; there is, therefore, provided in the oil filter a 1¼-inch pipe coil, through which cold water is circulated to cool the oil to normal temperature.

At the west end of the turbine room is a Yeoman sump pump for pumping oil. All the oil drippage from the various pumps and engines about the plant is piped directly to the oil sump. From here the oil is pumped (the pump starting automatically whenever the sump is full) to a Turner oil filter which is located in the oil room west of the stack, previously mentioned. After passing through the filter the oil is pumped to a gravity tank, located just under the roof of the building and over the oil room, by two small Worthington duplex pumps provided for this purpose. From the gravity tank the oil flows directly to the bearings of the various engines throughout the plant, thus requiring a mini-

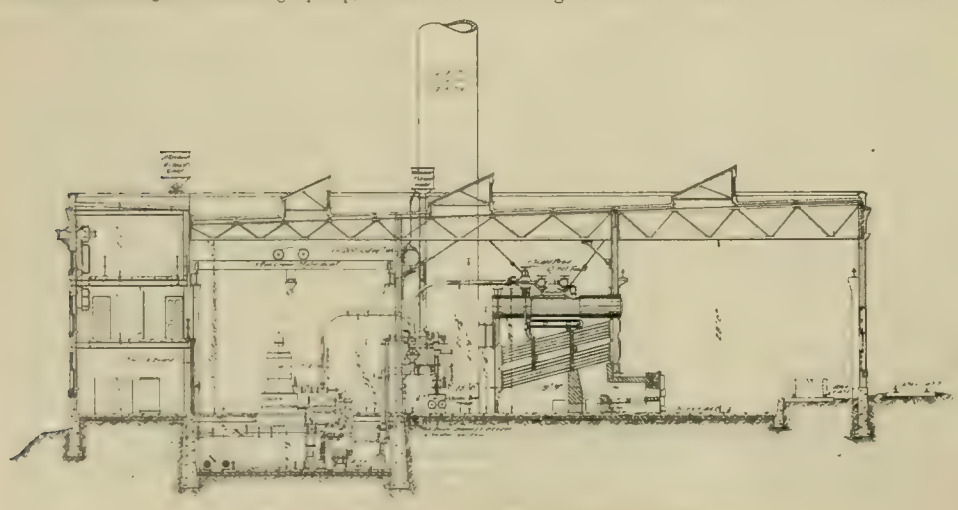


FIG. 4. CROSS-SECTION OF MAYWOOD POWER STATION

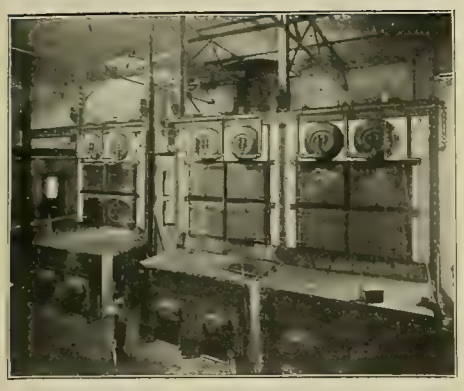


FIG. 5. BOILER PLANT IN MAYWOOD POWER STATION.

mum number of oilers and incurring a minimum loss of oil.

Drainage and Fire Pumps.

On the turbine-room floor is a Buffalo Forge engine direct-connected to a direct-current generator which is used for field excitation, and will be mentioned later in connection with the electrical features of the plant. The turbine-room floor is below high-water mark. There has, for this reason, been provided a system of drains under the turbine-room floor which lead into an iron sump at the east end of the turbine room. In this sump is a vertical-shaft centrifugal pump, direct-connected to a vertical motor above the floor. This sump equipment is of the well-known Yeoman type, automatically operated by a float in the sump. A by-pass has been provided, so that at times of low water any seepage from rain or other source can flow directly to the river without being pumped out.

Although the building is practically fireproof, there has been provided a Worthington duplex pump, which is arranged to take water from the river and discharge it into the various lines throughout the plant. Ordinarily, this pump supplies low-pressure service for washing purposes, but in case of fire the pump can be speeded up to give the necessary high pressure.

Electrical Equipment.

As mentioned above, the present generating equipment of the Maywood plant consists of one 500-kilowatt and one 1,000-kilowatt Curtis steam turbine, with one 500-kilowatt unit in process of construction. These vertical steam-turbine units are directly connected to General Electric A. T. B. 60-cycle generators of the same capacities. The generators are wound for 4,000 volts delta pressure, are star-connected and have a tap from the neutral point of the star winding brought out. All have an overload capacity of 50 per cent.

By referring to Figs. 1 and 3, it will be seen that the main switchboard is installed in an alcove to the left of the turbine room and flush with the turbine-room wall. This switchboard is composed of blue Vermont marble panels 90 inches high, the generator and three-phase feeder panels being 24 inches wide, while the single-phase feeder, exciter and regulator panels are 16 inches wide. The space between the top of the main switchboard and the floor above is filled in with marble slabs, which makes an effective screen for the bus-bars and wiring back of the switchboard.

Fig. 7 shows the main switchboard to better advantage; also the switchboard controlling the series alternating street and incandescent circuits, and the C-R regulators.

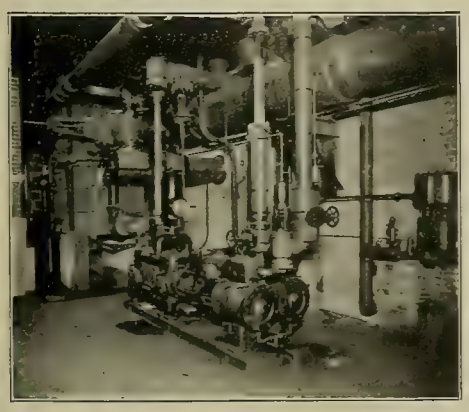


FIG. 6. FEED-WATER HEATER AND BOILER-FEED PUMP, MAYWOOD POWER STATION.

From the generators the main generator leads are carried in bituminized-fiber conduit to the generator panels. Each generator panel has mounted thereon a type F form K-3 4,500-volt 300-ampere four-pole single-throw oil switch. A four-pole switch was selected for this work, in order that the generator neutrals might be carried direct to the three-phase 4,000-volt four-wire bus without the installation of special disconnecting switches. Each generator panel also has mounted thereon three ammeters, three indicating single-phase wattmeters, one six-point potential receptacle, one four-point synchronizing receptacle, generator field rheostat control, reverse-current relay and generator speed indicator. The generator speed indicator consists of a horizontal edgewise frequency indicator with the mark corresponding to the 60-cycle point placed in the center of the scale. This is the zero point of the indicator; from this the scale is graduated in per cent. of generator speed. The left side of the zero point shows speeds below normal, the right side above normal.

Directly behind each generator panel are mounted the current and potential transformers which are installed on the generator side of the main generator leads; the current and potential transformers are mounted on the pipe framework which supports the switchboard panels at a sufficient distance in the rear to allow for instrument wiring and switch connection.

Form D-20 current transformers and 2,200-110 volt 200-watt potential transformers are used throughout on the 4,000-volt system. These transformers are all star connected and have their neutral points grounded.

The main 4,000-volt bus consists of four solid copper rods 1⅛ inches in diameter insulated with

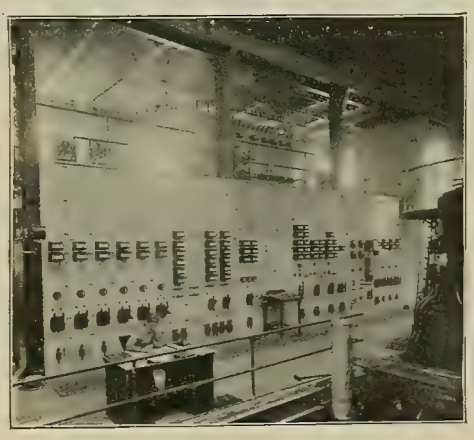


FIG. 7. MAIN SWITCHBOARD AT MAYWOOD.

varnished cambric tape. These buses and all of the 4,000-volt connections are supported on brown porcelain insulators mounted upon malleable-iron pins. These insulators were specially designed for this work and for similar work in stations and substations of the North Shore Electric Company. Varnished cambric insulated wire is used throughout for all connections from bus to switches and from switches to outgoing feeders.

By referring to Fig. 8, which shows the back of the main switchboard, the main 4,000-volt bus can be seen running lengthwise of the switchboard directly over the potential transformers.

From the main 4,000-volt bus the 2,300-volt single-phase and the 4,000-volt three-phase four-wire feeders are taken off. These feeders are taken from the main bus directly behind the panels which control them and run directly from the bus to the control switches mounted upon the panels.

Each single-phase feeder panel has mounted thereon a type F form K-3 two-pole double-throw manually operated oil switch. These switches are equipped with an automatic release arranged to operate from the 125-volt direct-current exciter bus in connection with type T form C-1 inverse time-limit relays.

In Fig. 7 six single-phase 2,300-volt feeder panels are shown at the extreme left of the switchboard. Each panel is equipped with a handwheel control for operating the 11-kilowatt type C-R feeder regulators, which are located immediately above the switchboard on the second floor. The inverse time-limit relays are also shown mounted on the sub-base of each feeder panel, as are also the voltmeters and ammeters above. Each voltmeter is equipped with a type V line-drop compensator. This compensator and its location as well as the potential transformers of each circuit are shown at the right in Fig. 8. Each single-phase 2,300-volt feeder is also equipped with a Fort Wayne type K five-ampere 110-volt integrating wattmeter, which is operated from the secondaries of the current and potential transformers.

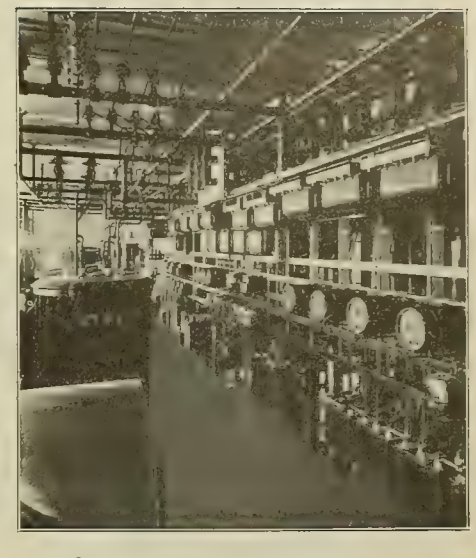


FIG. 8. BACK OF MAIN SWITCHBOARD, MAYWOOD.

Each three-phase four-wire 4,000-volt feeder is controlled by a type F form K-3 four-pole single-throw hand-operated oil switch. This switch is also provided with an overhead release, which is operated from the exciter bus in connection with a three-pole inverse time-limit relay. Each phase of the three-phase circuit is provided with a voltmeter and ammeter and has a type V line-drop compensator installed in the voltmeter circuit. The regulation on these circuits is obtained by means of 11-kilowatt type C-R pressure regulators.

Directly behind the switchboard on the main floor, as shown in Figs. 3 and 8, are located the step-up transformers and the high-tension switching equipment for the 20,000-volt transmission lines. The transformer equipment at present consists of two banks of single-phase transformers; one bank consists of three 75-kilowatt oil-cooled and the other of three 200-kilowatt air-blast transformers. These transformers have 2,300-volt primary coils with four 2.5-per cent. taps. The secondary coils are wound for either 10,000 or 20,000 volts and are at present connected for 10,000 volts delta pressure. These transformers have an overload capacity of 50 per cent. for one hour after an eight-hour continuous run at full load. Between the low-tension side of each transformer group and the 4,000-volt bus is installed a type F form K-3 three-pole manually operated oil switch. These switches are provided with automatic releases which are operated by means of inverse time-element overload relays set for about six seconds. On the high-tension side of these transformers, between transformers and

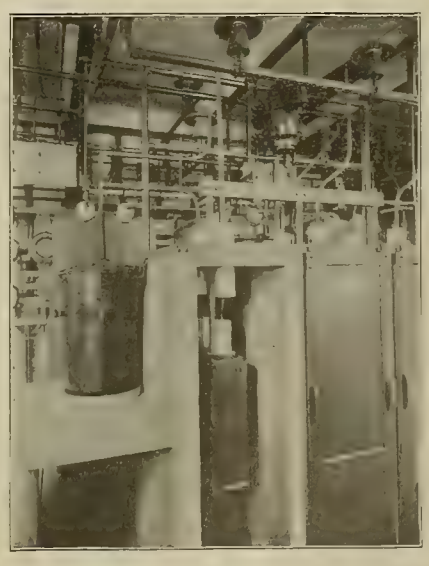


FIG. 9. 20,000-VOLT OIL SWITCHES IN MAYWOOD POWER STATION.

the high-tension three-phase bus, are installed type F form K-6 solenoid-operated oil switches. Each one of these oil switches consists of three single-pole elements mounted in separate concrete compartments, and remotely controlled from the main switchboard. The same type of oil switch is also installed on each of the outgoing high-tension transmission lines. These line switches have an automatic release which is operated by means of inverse time-element overload relays set for about four seconds.

Fig. 9 shows one of these type F form K-6 switches with its solenoid operating mechanism.

All of the high-tension wiring excepting the transformer connections is of bare copper wire supported by Locke 408-A insulators. Small brass turnbuckles are installed in this wiring for the purpose of taking up slack and keeping the wire taut. Type F-4 current transformers are used for actuating the overload devices and the ammeters on the high-tension lines. As no instruments excepting the ammeters are at present used, no potential transformers are required.

At the exit of each three-phase high-tension transmission line is installed a type V 20,000-volt lightning-arrester equipment and choke coil. These arresters are at present connected for 10,000 volts, that being the operating voltage of the lines at present. Fig. 10 shows one of these three-phase lightning arresters with lightning-arrester and line-disconnecting switches.

On the second floor directly above the main switchboard is located the switchboard for the control of the series alternating street arc and incandescent circuits. This board is shown in Fig. 11. It is made of blue Vermont marble panels similar to those of the main switchboard, each panel being designed to control one circuit. The first four panels at the right of this board are for the control of small constant-current transformers on each of the series alternating incandescent street circuits. The two lower plug receptacles on each panel control the primary circuit of the constant-current transformers, while the three upper ones are for the control of the transformer secondary. In the primary circuit of each of these transformers is installed a type T form D 2,300-volt expulsion fuse. These fuses are shown at the extreme top of each panel. This switchboard also has one panel for the control of the transformers supplying station lighting and sump pump previously mentioned. A three-pole single-throw type F form K-3 oil switch is mounted on this panel and is provided with an automatic release with an overload relay similar to the main switchboard equipment. This panel is shown at the left in Fig. 11.

On the third floor of the compartment occupied by the switchboard and other electrical apparatus are installed the constant-current series arc and incandescent street-circuit transformers. This floor also contains the high-tension transmission line lightning-arrester equipment, shown in Fig. 10, and also the lightning arrester and choke-coil equipment of the outgoing 2,300-volt single-phase and 4,000-volt three-phase four-wire feeders. All of this wiring is carried on an iron pipe frame, being supported by brown porcelain insulators and pins, as shown in the pictures. Part of this wiring may be seen at the top in Fig. 7.

Direct current for generator-field excitation and oil-switch control is obtained from two direct-current units. One of these units is a motor-generator set consisting of a 60-horsepower 4,000-volt 60-cycle three-phase motor direct connected and mounted on the same base with a 40-kilowatt 125-volt direct-current generator; the other unit is a steam-driven generator having a capacity of 25 kilowatts. The motor-generator set is shown at the end of the switchboard in Fig. 1. The steam-driven unit is not shown. In connection with these units is operated a type T-A125 voltage regulator. This regulator is arranged to operate on either exciter independently or with both operating in parallel. The main exciter leads run direct to the main switchboard, one panel being provided for each unit. Each unit is provided with a Thompson astatic indicating voltmeter and ammeter. These two panels may be seen in Fig. 7.

On the switchboard panel which contains the Tirrill regulator is also mounted a curve-drawing voltmeter and the oil switch for the control of the three-phase 4,000-volt motor of the motor-driven exciter set. All of the indicating instruments on the alternating-current systems are of the horizontal edgewise type; the voltmeters have scales arranged to indicate the actual star pressure of the generators and read from 0 to 2,650 volts. The one exception to this is the curve-drawing voltmeter, which has a scale of 0 to 130 volts.

Fig. 13 shows a general wiring diagram of the station, small wiring details being omitted.

Fig. 12 shows a section of one of the high-tension transmission lines. This line extends from Maywood to a sub-station at La Grange, Ill., the present transmission voltage being 10,000 volts. As the entire high-tension system is designed to operate at 20,000 volts the transmission line is at present equipped with insulators of ample capacity, as shown in Fig. 12. This pole line is designed to have an ultimate capacity of two 20,000-volt three-phase lines arranged in the form of inverted triangles. Fir cross-arms having a section of 4 by 5 inches are used throughout and carry Locke 408-A brown porcelain insulators supported on molleable-iron truss pins. No. 3 hard-drawn copper wire is used for this transmission line. This picture also shows the wood strain insulators which have been adopted for this class of work.

The small cross-arms shown in the picture support the company's private telephone line, which runs to the La Grange sub-station. This line consists of No. 12 hard-drawn copper wire mounted on Locke No. 45 brown porcelain insulators. These insulators are supported on Western Union one-half-inch steel pins. The telephone line is transposed every five poles, transposition being made by means of Locke No. 7 transposition insulators.

The high-tension transmission line is not transposed. Should it become necessary to cut in transpositions on the high-tension line this will be accomplished by inverting the cross-arm arrangement shown in the picture until the necessary number of spirals have been introduced.

The design and construction of this station was carried out under the direction of Sargent & Lundy, who are the consulting engineers for the North Shore Electric Company.

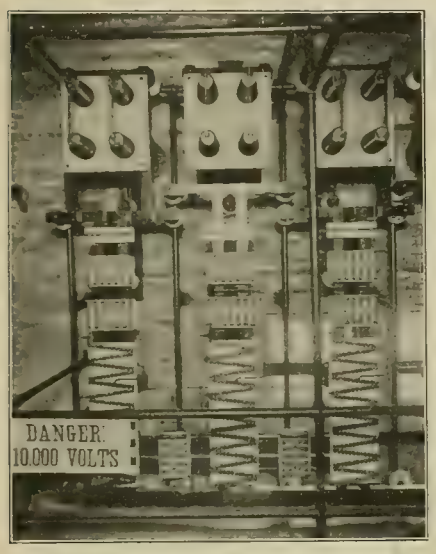


Fig 10. A 20,000-volt Lightning Arrester.

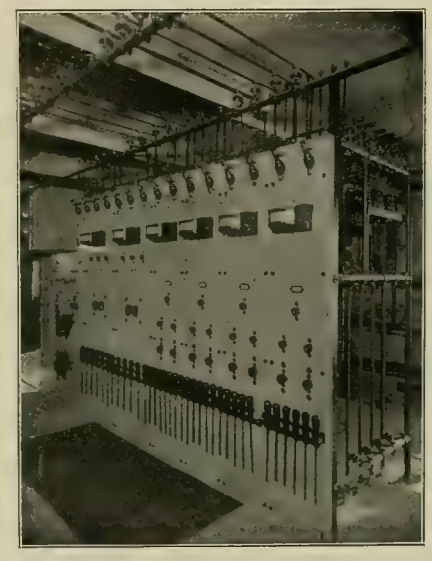


Fig. 11. Street Arc and Incandescent Switchboard.

Fig. 12. Part of the Transmission Line to La Grange.

MAYWOOD PLANT OF THE NORTH SHORE ELECTRIC COMPANY OF ILLINOIS.

Titanium for Lamp Filaments.

An interesting and instructive patent, especially in these days of progress toward higher efficiency in incandescent electric lamps, is that granted by the United States Patent Office on January 29th to John Allen Heany of York, Pa. It is entitled "Manufacture of Luminant for Electric Lamps," and the original application was filed on December 29, 1904. That application was divided, however, and the application for the present patent was filed November 27, 1906. The patent is brief, and it is worth while to quote it nearly entire:

"This invention relates to the manufacture of luminants for electric lamps made of very pure refractory metals, such as tungsten, titanium, zirconium, etc., or alloys of two or more of such metals, or of pure chromium, molybdenum, thorium, manganese, or alloys of such metals.

"My luminants have properties heretofore unattainable, such as being ductile and capable of standing a much higher temperature than any form of carbon or the carbids of such metals, and are more efficient than any hitherto known metallic filaments. They can withstand a much higher temperature and also convert the heat into light waves, and thereby have the properties of selective radiation. I utilize these metals, or osmium, cerium, niobium, tantalum, vanadium, or boron and silicon, either singly or mixed in a powdered form, as some of these powdered metals can be obtained by known processes, more or less pure, or I can employ the pure oxids, hydrids, nitrids, or metals in a very fine powder or in a colloidal state of the oxid or colloidal suspension of the pure metal, and with the dry powder use a lubricant or binder, such as water or paraffin, to form or shape them. They are then baked in an oven to drive out the paraffin or water, and in case the oxid is used the filament is reduced in pure hydrogen by external heat to the metal. The preliminary baking does not oxidize the metal, but merely strengthens it, and during this operation the binder is dissipated, leaving the filament formed of a refractory substance, strong, durable, and of good conductivity. The body is now heated by an electric current in a vacuum to drive out the hydrogen and to sinter or alloy the particles. If the filament is too large or rough, it may be rolled or drawn to the desired shape.

"This application * * * is directed particularly to a pure titanium filament and the method of producing it.

"As an illustration of a suitable process, titanium nitrids are produced by known processes—such, for instance, as the titanium dinitrid ($Ti\ N_2$) may be produced by heating the pure titanium dioxid in pure ammonia gas, although other titanium nitrids may be employed. The titanium nitrid is mixed with a very small percentage of water or paraffin and heated, as above described, to eliminate the water or paraffin, and the filament is then treated by an electric current in a vacuum to a sufficient temperature to decompose the nitrid, and a dense homogeneous pure titanium filament results, or the pure titanium metal, in a very fine powder, is squirted into shape by means of a suitable lubricant, such as water or paraffin heated gently to drive out all traces of the lubricant, and then sintered in a vacuum into a dense shiny pure titanium filament, or, if desired, titanium dioxid is converted into the colloidal state and formed into shape, dried by gentle heat, and heated in pure hydrogen to reduce the filament into the metal, although in this last-named operation it is quite probable that some or nearly all of the titanium dioxid is merely reduced to the suboxid (TiO); but as this substance is a good conductor of electricity it is admirably suited for further treatment; or the titanium metal is

converted into the colloidal state and formed into filaments, when in the desired consistency gently heated, and in both these last-described cases the filament is traversed by a suitable electric current in a vacuum to sinter and shrink the filament into a dense shiny homogeneous metallic filament.

"The luminant bodies are to be used in a vacuum or neutral gas to prevent any possible oxidization of the metal and give a greater light for the same expenditure of energy or the same light at a much less expenditure of energy than any form of electric luminant hitherto known. This wonderful and hitherto unknown efficiency may be attributed not only to the high temperature coefficient and the high temperature which the filament can withstand, but also to the shiny metallic surface of the luminant, which radiates the light rays in a remarkable manner.

"Should there be the slightest trace of carbon or of some easily fusible metal like platinum present in the luminant body, its efficiency will be so reduced as to render the body almost useless. A trace of carbon may permeate the filament of the lamp during the exhausting operation if care is not taken to prevent the vaporized oil of the pump from entering the bulb of the lamp and combining with the titanium filament."

The claims allowed are these:

"1. A filament for incandescent lamps consisting exclusively of metallic titanium in a dense, shiny coherent state and homogeneous throughout.

"2. A filament for electric incandescent lights consisting throughout of substantially pure metallic titanium of high fusing point and electrically conductive, which is stable at an efficiency at which a carbon filament, or a titanium carbid filament, will rapidly disintegrate, the light-emitting properties of the filament being due to the homogenous metallic nature of the titanium.

"3. The process of forming a dense, homogeneous titanium filament for electric incandescent lamps which consists in producing a filament which consists exclusively of a titanium compound in the desired shape and then dissociating said titanium compound in an inert environment thereby eliminating the substance which the titanium has combined with and shrinking the remaining pure metal into a dense, homogeneous shiny filament.

"4. The process of forming a dense homogeneous titanium filament for electric incandescent lamps which consists in producing a filament which consists exclusively of a conducting titanium compound in the desired shape and then dissociating said titanium compound by passing therethrough an electric current in a vacuum thereby eliminating the substance with which the titanium was combined with and by means of said electric current shrinking and sintering the remaining pure metal into a dense homogeneous shiny filament.

"5. The process of forming a dense homogeneous titanium filament for electric incandescent lamps which consists in producing a filament which consists exclusively of titanium nitrid in the desired shape and then dissociating said nitrid in an inert environment thereby eliminating the nitrogen of the nitrid and shrinking the remaining pure metal into a dense homogenous shiny filament."

Lighting of Electric-railway Cars.

The subject of the proper illumination of electric-railway cars was thoroughly covered at the recent convention of the Central Electric Railway Association, at Indianapolis. Mr. R. C. Taylor of Anderson, Ind., read a paper in which he brought out some good points. In view of the long distances now being covered by electric railways, the cars should first be so lighted that passengers can at all times read with comfort. Headlights and tail lights were also given consideration.

Headlights should be a part of the permanent equipment of the car and should be of the arc type, with large reflectors. These lights should preferably be placed above the motorman's line of vision to give the clearest view of the track at any point within the lamps' range. A good headlight should give a clear view of the track on a clear night of 3,000 feet. Fog, rain and driving snow may cut this down to 500, just the distance in which a car at high speed can be stopped. This range of headlight view will probably call for an expenditure of energy at the lamp terminals of five amperes at 80 volts. Carbons should be arranged to burn at least six days without renewal, and screens of the ordinary type should be provided for the strong lights while passing through cities.

Most interurban cars are being fitted up for single-end operation, and when so arranged, Mr. Taylor said, should be supplied with electric tail lights. These should also be arranged as a permanent part of the car's equipment. Two eight-candlepower lamps behind eight ruby lenses give a very satisfactory set of tail lights. These should be wired up in connection with a storage or dry-cell battery, so that they may burn with a clear light when the trolley is removed or the line current interrupted for any reason. Classification lights equipped with colored lenses may also be fitted up on the front end of the car in the same manner as the two tail lights in the rear and be ready for use at any time it may be necessary to run the car as a classified portion of a train.

There is much room for improvement in interior lighting of cars, Mr. Taylor said. He cited the instance of nine prominent interurban roads with which the number of lights per car vary from 20 to 65 lamps. Their usual method is to connect five incandescent lights in series and put as many circuits in the car as the fancy of the designer may suggest. The arc headlight is then connected across the line in series with enough iron wire resistance to cut down the line voltage to 70 volts across the arc. With this arrangement, assuming a car with seven circuits or 35 lamps, Mr. Taylor gives the energy consumption per car as 4,665 watts—2,700 watts for the arc headlights and resistance and 1,965 watts for the 16-candlepower incandescent lamps. The energy consumption in light in the arc is 315 watts and the energy wasted in heat in the arc headlight 2,385 watts. In other words, there is enough energy wasted through the resistance of the arc to furnish more than sufficient light for the interior of the car.

Assuming that enough incandescent lamps are inserted in the circuit to take the place of the resistance and furnish the interior lights, Mr. Taylor shows a net saving of 1,965 watts per car while the lights are in service. So long as the line voltage remains constant and the resistance of the lamp filaments remain constant, with this arrangement the interior-lighting effect in the car will be quite satisfactory, but, unfortunately, it is very difficult with the very best possible design of feeder arrangement, without involving enormous expense, to maintain anything like a constant voltage over the entire system, or even a fair average. The obvious remedy for this fluctuating line voltage would be to insert in the light circuit some form of regulator or other apparatus to maintain a constant potential on the light circuit, irrespective of the fluctuations on the line. Several suggestions for the accomplishment of this desirable condition have been advanced, but, so far as known, none of them has met with any conspicuous success.

In the event of no satisfactory regulator being produced to meet this service, this matter of constant potential on the lighting circuit is sufficiently important, Mr. Taylor thinks, to warrant the adoption of an independent motor-generator set for car lighting. In the design of a new car this detail could be very nicely cared for in connection with the compressor motor. This motor could be designed to maintain a constant speed at variable voltage and of such capacity as to run the air compressor and lighting circuit. The lighting generator could be mounted on the motor shaft, and no additional bearings or frame would be required. On the compressor gear would be mounted an automatic air-operated clutch. The operation of this machine would then be this: When the lights were burning, the motor and generator would run continuously, the automatic air-operated clutch would throw the compressor part of the device out and in to meet the demands for compressed air. When the lights were not required, the operation of the compressor would be the same as at present, starting and stopping the motor. This device is extremely simple, efficient and of low cost.

The speaker said that with the recently devel-

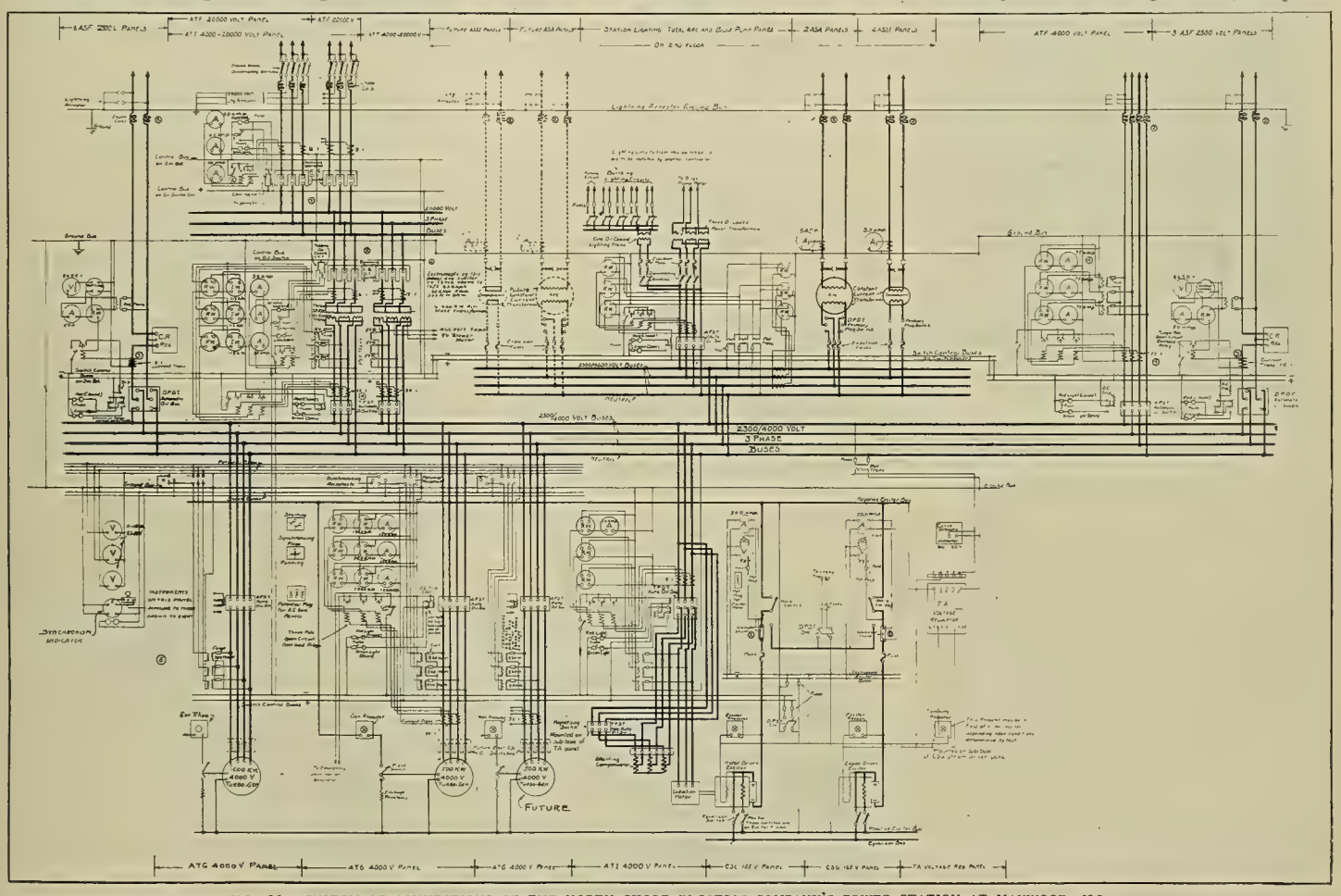


FIG. 13 SYSTEM OF CONNECTIONS OF THE NORTH SHORE ELECTRIC COMPANY'S POWER STATION AT MAYWOOD, ILL.

oped high-efficiency lamps, and with some kind of a system to create a constant potential on the lighting circuit, proper illumination will be easy. Whether the high-efficiency incandescent lamp or a specially designed arc be employed, they should be surrounded with a frosted or opalescent globe, backed up with reflectors, against a white background.

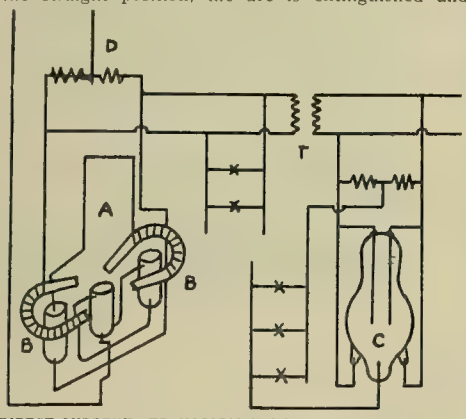
With the car-lighting arrangement as outlined the potential of the lighting circuit may be made that which is most suitable for the headlight, and the interior lights may be designed for that voltage. This will effect the saving of the energy dissipated through the headlight resistance. The interior lamps may be designed of high efficiency, and the total aggregate saving of energy will be the difference between the present practice—4,665 watts—and the suggested arrangement—1,850 watts—or a total net saving of 2,815 watts per car.

Direct-current Transformation by Mercury-vapor Apparatus.

A foreign patent has been secured by E. Weintraub for a static transformer of direct current into direct current of a different voltage. This is carried out by the use of mercury-vapor lamps in the following manner:

It is well known that the vapor lamps can be utilized for transforming alternating current into direct current. According to the inventor, they can be also made to answer for the inverse transformation, so that a system of two vapor lamps, connected in the proper way, will allow of the transformation, by means of apparatus remaining stationary, of a direct current of a certain voltage into a direct current of another voltage.

The action of the apparatus is explained in the accompanying diagram. At (A) is the apparatus which is used for transforming direct current into alternating current. It is composed of a mercury-vapor tube which is provided with three cavities. The central cavity is connected to the negative pole of the current supply and the two others to the positive pole. By slightly inclining the apparatus an arc is made to pass between the cathode and one of the anodes. If the apparatus is restored to the straight position, the arc is extinguished and



DIRECT-CURRENT TRANSFORMATION BY MERCURY-VAPOR APPARATUS.

is established between the cathode and the other anode, and so on, passing from one anode to the other.

This alternate movement of the arc, which Mr. Weintraub explains by an increase in the resistance of the arc, is aided by the action of the electromagnets (B), which blow the arc toward the opposite anode as soon as it is formed. From this movement there results the formation of an alternating current in the circuit shown at the top and to the right of the diagram. The solenoids (D) act as choke coils, and their self-induction has a damping effect upon the sudden change in the direction of the current, and they act so as to give the wave a form which comes near that of a sinusoid. This current is then sent into the transformer (T), which changes the voltage as may be desired, and the secondary circuit of the transformer is connected to the mercury-vapor apparatus (C) of the usual kind, so that the alternating current is transformed into direct current.

A Big Job of Telegraph Line Construction.

The Western Union Telegraph Company has started gangs of workmen from Salt Lake City to string its wires along the route of the Western Pacific toward San Francisco. Five carloads of poles comprising the first shipment have arrived in Salt Lake City from Idaho, and 60 cars of poles are on the way from Michigan. Material enough to build 150 miles of telegraph line has been assembled at Salt Lake City, ready to be started out to the wiremen's camps. The Western Union ordinarily uses 30 poles to the mile, but because of the heavy timber along some of the route and the danger from wind and snowstorms, as many as 40 poles to the mile will be set in some sections. Altogether, there are 929 miles of line to be erected, requiring more than 28,000 telegraph poles.

Korn System of Transmitting Pictures by Electricity.

By A. de Courcy.

The announcement that Professor Korn of the University of Munich, Germany, has succeeded in designing an instrument for the transmission of photographic images over a telegraph wire naturally attracted great attention, especially as many inventors have been working upon the same subject for years past. Up to the present, however, none of them appears to have reached any commercially practicable results in this field, and therefore to Professor Korn, perhaps, belongs the honor of having brought out the first working device of the kind. He uses selenium, of course, as the basis of the instrument, combined with two synchronous motors, moving a corresponding mechanism at each station, as his predecessors have done. A newly designed galvanometer, which acts as an interceptor of the light rays, is also a characteristic of his system, and he has further perfected the device by the use of a compensating method which overcomes the inertia of the selenium to a considerable extent and makes the resulting image much clearer.

In the present description of Professor Korn's new instrument will be found all the data which have as yet been made public as to the method employed, and also a theoretical analysis of the new compensating method. The latter account was presented by the inventor in a paper read before the French Academy of Sciences. Considering the general method of working the transmitting and receiving apparatus at the two stations, the accompanying diagram (Fig. 1) gives the "layout."

To the left is the transmitting station, and it contains a glass cylinder (A) around which is rolled a photographic film having upon it the image desired to be sent. A synchronous motor (M), connected upon the main line, gives the movement to the glass cylinder. The latter is coupled by the proper gearing, so that it is made to take a rotary movement, while it rises by a screw-thread at the same time, after the manner of a phonograph cylinder. Around it is the protecting cover (B), which is made to surround it entirely and screen off all the light. In the side of the cover is a small hole at (E), and through it the lens (D) concentrates the light from a Nernst lamp and reflector (C), so as to form a focus at the photographic film.

The light which passes through the film and glass cylinder passes into a total-reflection prism (F), so that it is sent downward from it upon the selenium cell (G), lying below the cylinder. According to the light or dark parts of the photographic film, corresponding to the image, the beam of light falling upon the selenium cell will have a greater or less intensity, and as the cylinder revolves, each point of the image comes before the hole and acts as a screen, allowing the selenium to receive the illumination which corresponds to each part of the image. These variations of light cause a corresponding variation in the electrical resistance of the selenium cell (G), and as the latter is connected with the line through the battery (H), the electric current variations are sent over the line to the receiving station. While two line wires are represented here, it is understood that one of the wires can be put to ground, using but a single line wire.

Turning to the apparatus at the receiving station, we have a recording device which somewhat resembles the transmitter. It is driven like the latter by a synchronous motor (M′) connected on the line wire. In this device there is a recording cylinder (N) which is given the same movement as the transmitting cylinder by the synchronous motor. A beam of light is caused to fall upon the cylinder through a small opening at (U), so as to make an impression upon a photographic film wrapped around the cylinder. This beam of light

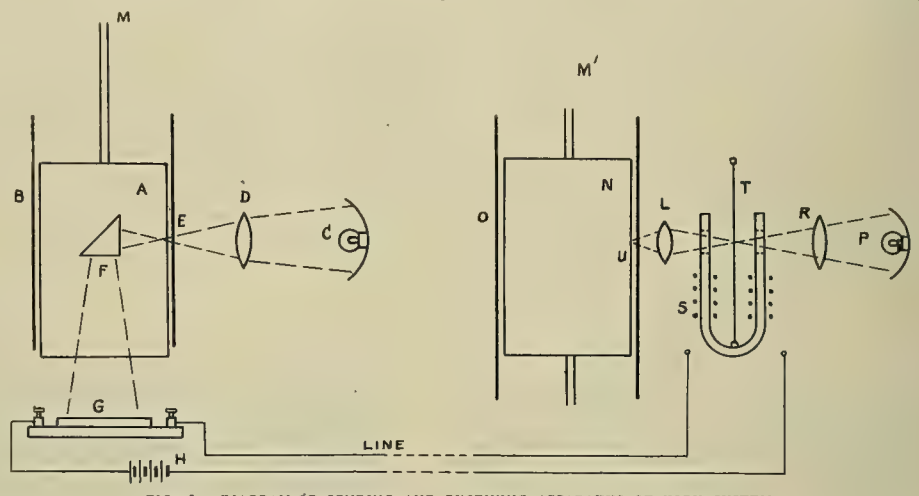


FIG. 1. DIAGRAM OF SENDING AND RECEIVING APPARATUS OF KORN SYSTEM.

is modified at each instant by a specially designed galvanometer (T), which forms one of the features of Professor Korn's apparatus.

The method used in working the galvanometer will be understood, from the fact that it has a bipolar suspension, formed of two fine copper wires. Upon the wires is mounted a very light strip of aluminum, and the latter can be acted upon by the current which passes in the galvanometer so as to cause a deflection when the current passes, and to a greater or less degree. The aluminum vane acts as a shutter and is placed in the path of the light beam which acts upon the receiving drum. Coming from the Nernst lamp (P), the light is concentrated to a focus by the lens (R), and the focus lies in the plane of the aluminum shutter. A second lens (L) again brings the light to a focus upon the receiving drum through the opening at (U), so as to cause an impression upon the photographic surface. Thus, it is evident, that the strength of the light falling upon the receiving film at (U) will be proportional to the amount of light which has been let through the original photograph in the sending drum at (E). The movement of the receiving cylinder across the point of light will cause a line to be traced around it, and this line consists of light and dark places. It is to be noticed that there is no separation between the light and dark points, but these form a continuous band around the cylinder. On the contrary, there

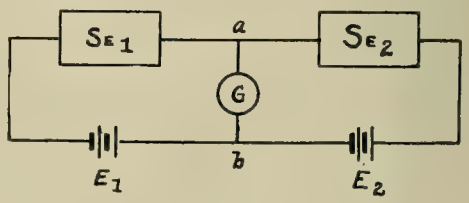


FIG. 2. DIAGRAM OF COMPENSATING METHOD IN KORN SYSTEM.

is a separation between each of the bands on the film, corresponding to each revolution of the drum, so that the resulting image is made up of a series of parallel and vertical (or horizontal) bands, thus somewhat resembling a halftone.

By the use of the present instrument the inventor has already succeeded in transmitting a very clear image over a distance of 25 miles, and the results are very encouraging. During his earlier experiments the image was not nearly as clear as the one he now obtains, owing to the inertia of the selenium, as it is well known that the selenium does not respond instantly to the variations of light, and this fact has always given trouble to

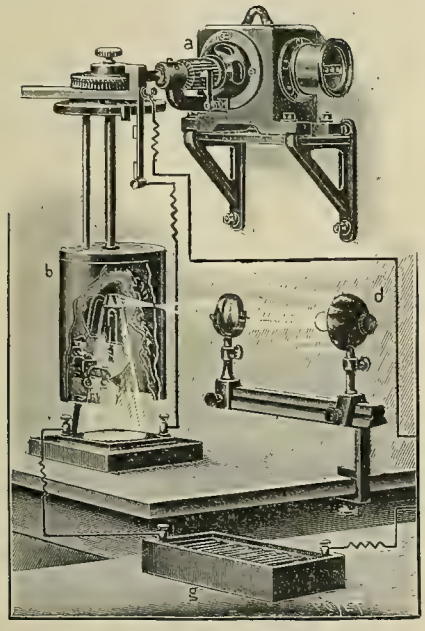


FIG. 3. TRANSMITTING APPARATUS OF KORN SYSTEM.

experimenters. Professor Korn overcomes the difficulty in a very ingenious way by using a second selenium cell at the receiving station, which is placed in series with the first cell. A second galvanometer of the same type as mentioned above allows a beam of light to fall upon the "compensating cell," and the amount of light is made to be proportional to the illumination of the main cell, so that in this way the lag due to the inertia of the main cell is compensated for, and this results in a much better image.

The following is the account of the compensating method which is given by the inventor in the paper referred to above: Let (E_1) and (E_2), Fig. 2, represent two equal batteries of accumulators placed in series, and e the difference of potential at the two poles. (Se_1) and (Se_2) are two selenium cells placed in series in the circuit. In the bridge whose two terminals are situated, respectively, between the two batteries (b) and between the two selenium cells (a) we place a galvanometer (G), which is similar to the form used by Professor Korn in the main part of his instrument. The galvanometer is arranged with reference to the second selenium cell (Se_2), so that this cell is illuminated by a source of light according to the deflections of the galvanometer. Let w_1 and w_2 represent the resistances of the selenium cells, and, supposing all the other resistances to be small in comparison with these, then the deflection of the galvanometer will be $\alpha = c\,e\left(\frac{1}{w_1} - \frac{1}{w_2}\right)$, in which c represents a constant of the galvanometer.

If the resistances of the two selenium cells are the same in the dark, which can be realized by using an extra resistance with one of them, we will have $\alpha = 0$ as long as the cell (Se_1) remains in the dark, and if the galvanometer is arranged so that (Se_2) receives no light except from a deflection of this galvanometer. If we illuminate the cell (Se_1), a current will pass in the bridge and will cause the galvanometer (G) to deflect, thus illuminating (Se_2). It is now desired to choose the constants of the apparatus so that α becomes proportional to the intensity I of the light falling on the cell (Se_1), in spite of the inertia of the selenium, that is, in spite of its property of retaining to some extent the impressions of the previous lighting which it receives. We may make the following supposition, upon the inertia of the selenium, which experiment verifies, for the cases where the change of resistance of the selenium lies within certain limits. We will have:

$$\frac{1}{w_1} = \frac{1}{w_{10}} + c_1 I + C_1 I',$$

in which w_{10}, c_1 and C_1 are constants of the cell, and I a term which depends upon the anterior illuminations. Next follow the three equations:

$$\alpha = c\,e\left(\frac{1}{w_1} - \frac{1}{w_2}\right)$$

$$\frac{1}{w_1} = \frac{1}{w_{10}} + c_1 I + C_1 I'$$

$$\frac{1}{w_2} = \frac{1}{w_{20}} + \gamma\left(c_2\,\alpha + C_2\,\alpha'\right)$$

in which w_{20}, c_2, C_2 are constants of the cell (Se_2), γ a constant, depending upon the arrangement used for regulating the lighting of cell (Se_2) by the deflections α of the galvanometer (G), and α' a term depending upon the previous deflections α. By using an additional resistance in the circuit we can make $w_{10} = w_{20}$.

A first approximation will be obtained by neglecting the terms $C_1 I'$ and $C_2\alpha'$. Then we find

$$\alpha = c\,e\,(c_1 I - \gamma\, c_2 \alpha) \qquad \alpha = \frac{c\,c_1\,e}{1 + \gamma\,c\,c_2\,e} I.$$

We are now to obtain the proportion between α and I also in a second approximation. For this approximation, we no longer neglect the terms I' and α', but we can use the first approximation $\alpha' = \frac{c\,c_1\,e}{1 + \gamma\,c\,c_2\,e} I'$, and we will arrive at the desired result, namely, to eliminate the terms due to the inertia of the selenium, also in the second approximation if $C_1 I' = \gamma C_2 \alpha'$, that is, if we choose the constant γ, so that $C_1(1 + \gamma\,c\,c_2\,e) = \gamma\,c\,c_1\,e\,C_2$. The constant γ depends, as we have seen above, upon the arrangement which allows of lighting (Se_2), according to the deflections of the galvanometer (G), and we can vary γ, for instance, by shifting a lens between the cell (Se_2) and the galvanometer, the latter serving as a shutter between the source of light and the cell (Se_2). In practice we find a good arrangement by a succession of trials. When we approach the right point we find the lag of the galvanometer to be diminished, and the inertia of the selenium is compensated to a certain degree.

The above is merely an elementary theory, which represents the approximate facts, if the change in resistance of the cells remains below a certain limit, but it is clear that we can always improve the compensation by placing between the cell (Se_2) and the galvanometer a shutter graduated so that the intensity of light falling upon (Se_2) is not proportional to the deflection α, but to a certain function of α, which can be found by experiment. However, in his recent experiments in telephotography Dr. Korn uses the method of keeping the proportion. In the transmission of images the compensator has still another advantage, which lies in the fact that the deflection of the galvanometer does not occur at exactly the same speed as the changes in the illumination of the cell (Se_2). A sudden lighting of the cell (Se_1) is felt in the galvanometer before its effect upon (Se_2). This is true for a very short period of time, but, owing to this phenomenon, we find traces of details in the records which did not seem at first possible to give an action in the galvanometer.

FIG. 5. PHOTOGRAPH MADE BY KORN SYSTEM AFTER TRANSMISSION.

For the remaining illustrations I am indebted to La Nature of Paris. With the aid of the diagrams already given, they explain themselves. Referring to the reference letters in Fig. 3, (a) is the motor, (b) the enclosing cylinder of the transmitter, (f) the prism, (d) the Nernst lamp, and (g) the battery. Similarly in Fig. 4, (a) is the motor, (b) the receiving cylinder, (d) and (d") the Nernst lamps, (e), (e') and (e") the galvanometers, (g) the batteries, (m) the governor and (s) the selenium cell. Fig. 5 is a reproduction of a transmitted picture.

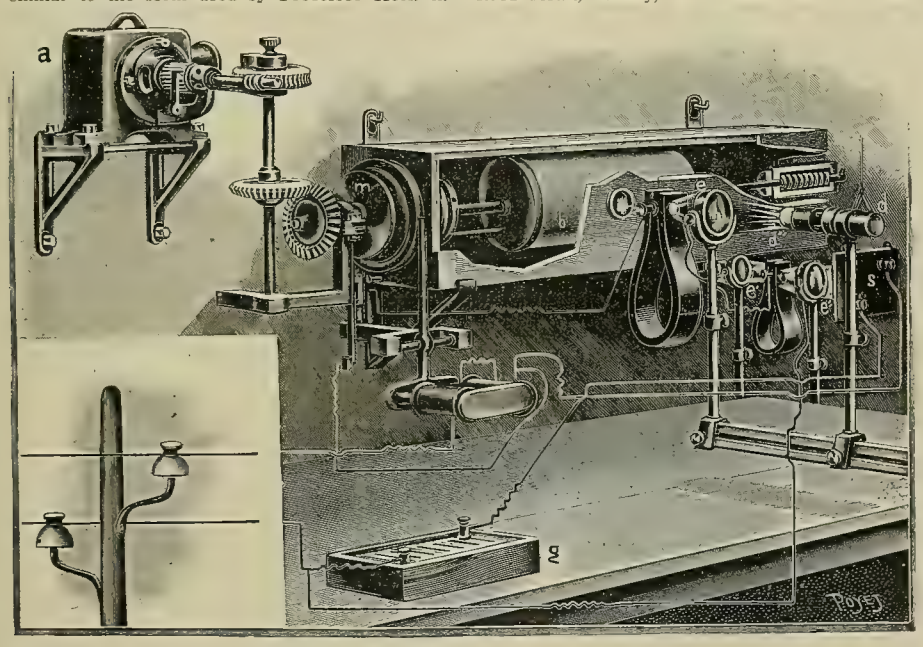


FIG. 4. APPARATUS AT RECEIVING END OF KORN SYSTEM OF TRANSMITTING PICTURES.

City of Mexico Power Projects.

The annual meeting of the Mexican Light and Power Company, held in Montreal last week, was rendered especially interesting by remarks made by Mr. C. H. Cahan, the general attorney of the company at the City of Mexico. Mr. Cahan said that he had at the request of the directors purchased the only remaining lighting company operating in the federal district of Mexico, and this would assure to the power company a practical monopoly The original plan of only developing the powers at Necaxa has been abandoned and it is now intended to develop the waterpowers in the more elevated valley of Laguna. This would give the company an output of 100,000 horsepower as compared with about 50,000 horsepower from the Necaxa plant. The cost of the additional work would be about $3,000,000. In addition, by utilizing other powers, the company can secure an output of 250,000 horsepower, if such an amount is ever needed.

Electricity in Hawaiian Coast Defense.

The defense scheme of Pearl Harbor and Honolulu, Hawaii, as finally submitted, is upon the basis of the existing types of ordinance. The National Coast Defense Board has asked for these items: Submarine mines, $225,390; power plants, $34,469, and an equal amount for the reserves; for searchlights, $95,000; for fire control, which is an elaborate system of electrical communication enabling the commanding officer to control the fire of all the batteries with precision from one point, $320,566.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

Illinois Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

SOME APPREHENSION was caused a few days ago by disquieting reports to the effect that there was serious trouble between the Western Union Telegraph Company and its operators and that possibly a great strike would grow out of the dispute, which was said to relate to wages, conditions of work and the organization of a union. Happily, the Western Electrician is assured, just before going to press, that there is not the slightest danger of an impending strike and that on February 13th the wages of all operators were raised 10 per cent. This increase will add perhaps $1,500,000 a year to the expenses of the company; nevertheless, all concerned are to be congratulated on the outcome of the affair.

MAYWOOD, ILL., a suburb of Chicago, gives evidence in the new station of the North Shore Electric Company of the careful engineering which is now bestowed on the medium-sized electrical generating plant. The installation is fully described and illustrated in this issue, and the account is well worth a careful reading, for it will be found that care and attention has been given to all details of the plant, which may be accepted as a good example of present-day central-station design for plants of moderate size. The steam turbines have the new hydraulic governors, and in all respects the equipment is up to date. The building of this station also illustrates the prevailing tendency toward centralization of power generation, for, supplying alternating current at 10,000 volts, it will supplant, with greater economy, a number of small and widely scattered plants. Thus the concentration of generating units is shown to be proceeding in suburban areas as well as in the larger cities.

ELECTRIC railways have served many purposes; riding on them has, for instance, been gravely recommended as a cure for rheumatism; but it remained for the completion of lines in the Alps to establish the business of quarrying glacier ice for distribution in large cities. Certain of the Swiss communes have been able to grant concessions of their glaciers for this purpose, says the London Times Engineering Supplement, and considerable sums have been expended in constructing ice slides or V-shaped troughs, in which the blocks of ice, often of large size, blasted out of the glacier, are transported to the vicinity of the stations for conveyance in carefully refrigerated cars to Lyons and other large cities remote from the Alps. The method of blasting with black powder so as to avoid the discoloration and soiling of the ice, and the engineering ability displayed in erecting the slides and in providing sufficient friction by means of curves to avoid excessive speed in the downward journey of the ice blocks, are spoken of as examples of considerable ingenuity and skill. Glacier ice is perfectly pure and transparent and has many qualities which are greatly appreciated by consumers.

APROPOS of the new metal-filament lamps, which are attracting great attention in England as everywhere, a correspondent of one of the English electrical journals gave an interesting chapter from personal experience. He installed in one street window of a store 24 16-candlepower carbon-filament lamps and in the other eight 50-candlepower Osram lamps (metallic filament, very likely an alloy of osmium and tungsten). Thus in volume of light, if the ratings were correct, the metal lamps gave better results in the proportion of 400 to 384. The current supply was alternating, the voltage being 100 and the periodicity 60.

After 500 hours' burning it was found that the Osram lamps had consumed about 250 kilowatt-hours, which, at the price charged, 10 cents, amounted to $25. Two lamps gave out in the first 150 hours, so a charge was made for 10 lamps at $1.20 each. Thus the total cost for lamps and current with metallic filaments was $37.

The 24 carbon lamps consumed 750 kilowatt-hours, thus making the cost for current alone $75. Adding $5.76 for the cost of the lamps themselves (ordinary 16-candlepower lamps seem to be figured at 24 cents each in England), the total is $80.76, to be compared with the $37 of the metallic-filament lamps. The difference is thus very marked, being $43.76 in favor of the new lamps. In other words, the use of the Osram lamps cut down the lighting bill in this case 54 per cent., including first cost of lamps. Furthermore, the correspondent says that, with one exception, the metallic lamps seemed as good as new at the end of the test, while the ordinary lamps had all but ended their economical life.

This is of course a remarkable showing, especially as the correspondent declares the quality of light from the Osram lamps was better than from the other lamps. With other similar tests it goes far to justify those who proclaim the end of the carbon-filament lamp. Nevertheless, it is to be remembered that these metallic-filament lamps are in some cases unavailable in small units and that they usually require to be burned in a vertical position. But, after all, these are but minor objections, and it must be admitted that the outlook for that old and faithful friend—the carbon-filament lamp—seems to be a gloomy one.

AIR BRAKES form such an obviously important part of the equipment of the railroad train that one can understand a large measure of enthusiasm in speaking of this apparatus. Nevertheless it is rather surprising to be told that "Perhaps, next to Christianity, the press and the locomotive, the air brake has done more to develop America than any other one thing." This sweeping statement, which leaves out of account the public school, the telegraph, the telephone, agricultural machinery and similar agencies, was made by Mr. Walter V. Turner of Pittsburg, following his paper on "The Development of the Air Brake for Steam and Electric Traction Service," read at a recent meeting of the Boston branch of the American Institute of Electrical Engineers. Mr. Turner went on to say that intercourse between people depends absolutely upon the ability to control the medium of interchange. The air brake makes this control possible. The brake under a single car is much more powerful than the steam locomotive that pulls the train. It takes a locomotive from five to ten minutes, covering a distance of six or seven miles, to attain a speed of 60 miles an hour. "What would you think," asked the speaker, "if it took a brake that length of time and that distance to stop a train? What it takes a locomotive ten minutes and perhaps six miles to accomplish the brake must do in 20 seconds. We are able to stop a train today from a speed of 60 miles an hour in 20 seconds of time. To build a steam locomotive that would accelerate a train in the time and distance that the brake stops it would be impossible; the locomotive itself would have to be twice as heavy as the train in order to accelerate the train as rapidly as the brake retards it. That is not allowing anything at all for the power required to move the engine, so that it resolves itself into a physical impossibility, so far as the steam locomotive is concerned."

But the electric locomotive is different. Mr. Turner said that it was probable that the electric locomotive will be able to accelerate a train to a speed of 60 miles an hour in a minute and a half or less. That means much in the matter of braking, for "in proportion as you accelerate you must perforce be prepared to decelerate." The ability to use high speeds must be measured by the ability to decelerate. Therefore the problem of braking is one for the electrical engineer as it has been one for the steam engineer. The lecturer added that one of the causes of the development of the air brake has been the development of the electric railway. "We tried to adapt the regular steam-road brake to electric service, but with very indifferent success. We quickly found that we were dealing with an altogether different set of factors, and for that reason many things were needed. A few years ago we started out to see what could be done in the development of the electric brake, and found it had about as many possibilities to it as electric science itself."

Apparently Mr. Turner has not a very high opinion of the electric brake but a very exalted opinion of the air brake. Nevertheless his address was most instructive, and it no doubt opened a new line of thought to many of the electrical men present.

Chicago Traction Ordinances Passed Over Mayor Dunne's Veto.

At the Chicago Council meeting this week Mayor Dunne presented his objections to the traction ordinances in a long statement accompanying his veto of the measures which had been passed by the council at the previous meeting by a vote of 56 to 13. After two hours of discussion a vote was taken and the ordinances were passed over the veto by the decisive vote of 57 to 12. It is thus conclusively settled that the ordinances shall be submitted to a vote of the people at the election of April 2d and will become effective if they receive a majority of the votes cast.

Leaders of the council who spoke in favor of the ordinances and who served on the committee which drew them declared that all the objections offered by the mayor had been duly considered in committee, and on all the points provision was made in the measures which will amply protect the city and give its inhabitants good transportation facilities. Furthermore, the essential features were in accordance with the mayor's views outlined in a letter to the chairman of the committee, on which letter the ordinances were based.

One objection the mayor had was that "Under the provision relating to power houses and buildings the companies are permitted to secure power from any source other than the companies own power plants, with the approval of the board of supervising engineers. This provision would permit the companies, subject only to the approval of the board of supervising engineers, to make contracts for any length of time and for any price with the Edison or Commonwealth companies, and if the city took over the systems it might be compelled to assume the burden of such a contract, no matter how remunerative it might be to the power company, or however onerous it might be upon the city, or however desirable it may be for the city to furnish its own power."

The mayor feared also that once the ordinances are in force a consolidation would take place between the companies under the ordinance of the Chicago City Railway Company, which provides that the city may not acquire the plant unless upon the payment of cash to the amount of the total cost of all the properties and the rehabilitation of the same. "The city, being in a position of having only $72,000,000 worth of cash on hand, as at present authorized by the Mueller certificate ordinance, will never be in a position," he said, "to acquire the plants until the City Council shall see fit to pass supplemental ordinances authorizing Mueller certificates to the aggregate of at least $100,000,000."

The mayor held the ordinances defective because the rehabilitation programme was not limited to the amount of the possible issue of Mueller certificates, minus certain charges. But this limitation, it was pointed out, would not give the city a complete, modern street-railway system.

Aldermen who supported the traction ordinances believe that the greatest good to the greatest number will come from the measures, and that the city has made a good bargain financially.

The Real Electrical Fire Hazard.

It is refreshing to find a contribution in the daily papers on the subject of electrical fires written by a man who evidently knows what he is talking about. Such is the following, signed by George G. Pedley, which appeared in a recent issue of the Chicago Daily News.

It is true that in some cases and under certain conditions fires may be caused by electric wires, but under the system of wiring and the high standard of the insulation that is required both by the city authorities and the board of underwriters the risk is very small indeed.

Fires have occurred in many buildings built prior to 1902, before which date the wiring was installed under the "knob and tube" system, that is, the floor joists were bored and a porcelain bushing inserted and the wire pulled through from room to room. In an installation of this kind gas and water pipes had to be crossed. Porcelain bushings were required to be used in crossing, and then securely taped to the wires they were on, but in many instances the bushings were not used.

In the course of time the wire stretched and sagged and then rested on the pipe. If the pipe was dry such a condition might exist indefinitely without any danger, but it was when the pipe started to sweat and the surface of it became moist that the insulation on the wire started to break down. Finally the insulation would rot away until the wire made contact with the pipe. The moment this occurred an enormous amount of current would flow, which usually resulted in the wire melting at the point of contact, thereby causing an arc, or, in other words, a flame large enough to ignite any dry chips or shavings. And there usually is plenty of such debris between the floors, for I have often observed workmen on a new building lift a board in the rough floor and dispose of the fragments by sweeping them down on the plastered ceiling and on the wires.

In 1902 the city ordinances governing the installation of electrical work were changed so that it became necessary to use an iron pipe, or, as it is called, a conduit, on all concealed work running from outlet to outlet.

Contrary to the old system, there is not at the present time an inch of wire put into a flat building, except that used for signaling purposes, until all the plastering is completed.

If the average layman understood the restrictions that the electrical contractor works under and the scope of the inspection department and the thoroughness with which it does its work, I am sure he would be convinced that his fears were groundless.

Hydro-electric Plants and Their Development.

The recent meeting of the Purdue University branch (Lafayette, Ind.) of the American Institute of Electrical Engineers, which was held in the new lecture room of the electrical building, was called to order by Vice-chairman G. B. Walker, who introduced the speaker of the evening, Mr. C. E. Hansell. The subject taken up was "Hydro-electric Plants and Their Development." Mr. Hansell spoke in part as follows:

"The rapid development of hydro-electric plants is comparatively recent. At the Centennial Exposition at Philadelphia in 1876 a single Gramme ring dynamo was to be seen lighting a single arc lamp, and another Gramme ring machine was used to run a small motor stationed a few feet away. The mechanical energy given up by the motor was used to pump a small supply of water. From these small beginnings our magnificent transmission plants have been developed.

"Dating from this exhibition there are three important steps. The first is the Laurenceburg experiments conducted by the Westinghouse company. These experiments were carried out for the purpose of demonstrating the feasibility of electric lighting over what was then deemed a long distance (two miles). The experiments were conducted in 1886. The second was the invention of the polyphase induction motor by Tesla, and the third the invention of the Shellenberger meter. These three events form the basis of our long-distance transmission development. The Niagara power plant (three-phase) was built in 1893. In 1895 there were 75 hydro-electric plants. In 1902 there were 1,390 plants having a combined capacity of 438,472 horsepower, or about 315 horsepower per plant. Most of these plants were located in the western states, largely because better water supply was available."

A discussion of the factors affecting the location, design and operation of hydro-electric plants in general was then taken up. A plant for the Wild Cat River designed for university thesis work last year was used as a basis and the different considerations entering into the selection of site, etc., were dealt with; also the marketing of the power obtained and the cost of power to producer and consumer, allowing a fair rate of profit.

[It is pertinent to remark that the lecturer, in tracing the development of the hydro-electric plant, appears to have overlooked the important Frankfort-Lauffen experimental three-phase transmission of 1891.—Ed. W. E.]

Photometry of Incandescent Gas Lamps.

At a meeting of the New York section of the Illuminating Engineering Society held at the Edison Auditorium, New York city, on February 8th, Mr. Thomas J. Litle, Jr., of Gloucester, N. J., presented a paper on "Photometry of Incandescent Gas Lamps."

It was the purpose of Mr. Litle's paper to deal with incandescent gas photometry from a practical viewpoint and to avoid a theoretical discussion of the various instruments and devices mentioned. He confined his attention almost entirely to gas lighting.

In the discussion Mr. V. R. Lansingh called attention to the photometric laboratory of the Bureau of Standards at Washington, which, he said, was an ordinary room with white walls and ceilings. He wondered when he first visited it what sort of a photometer room it was and what sort of photometry could be done there, for he thought the white walls and ceilings would make a big difference.

Dr. Hyde, however, who is in charge of the laboratory, used a large number of screens to cut off the light, and had made an exhaustive examination to find the effect, if any, of white walls and ceilings on the tests. He had shown that the error due to white walls and ceilings, when the screens were carefully made, was far under one-tenth of one per cent.; in fact it ran into the neighborhood of one one-hundredth of one per cent., so that an ordinary room could be used in the testing, and the effect was much better on the person testing than when a dark room was used; that is, the physiological effect, working in a dark room was sometimes gloomy, and one could work in a light and cheerful room where one could easily have more light by turning on an electric switch, and it was easier to work in such a room if the reflection from the walls and ceilings and the lights in the room were thoroughly screened.

Dr. C. H. Sharp said that unscreened gas lamps, like a good many other sources of light, gave different intensity, according to the directions chosen to measure them. The question of the intensity of the light of incandescent gas lamps in different directions was an important question, as in the case of all other illuminants. Dr. Sharp said that Dr. Nichols of Cornell University about 20 years ago showed that the ordinary Bunsen photometer was a one-sided instrument, or rather the people who used the Bunsen photometers were one-sided and had a tendency to sit persistently on one side or the other of the true value, and then the photometer itself was reversed so as to eliminate differences in it. A white wall photometer room was all right if one could not have a black-wall photometer room.

Lighting Standards and High-voltage Incandescent Lamps.

At a meeting of the Institution of Electrical Engineers of England, held on January 24th, Mr. Clifford C. Paterson read a paper dealing with investigations on light standards and the present condition in England of the high-voltage incandescent lamp.

Mr. Paterson stated that the paper was an account of tests made at the National Physical Laboratory on carbon-filament lamps for the Engineering Standards Committee, and it also gave the results of some investigations on flame standards.

The tests made on high-voltage standard electric lamps were undertaken to ascertain what order of constancy might be expected from the best high-voltage incandescent lamps with a view to using them as photometric standards. It was stated that there was no doubt that high-voltage lamps, although they could not yet be produced with certainty to remain constant for a considerable time, could now be obtained, and some were to be found which were in every way as good as low-voltage standards.

Mr. Paterson emphasized the need for a closer supervision of the incandescent lamps which are supplied in the ordinary course of business to purchasers in England, and pointed out that some of the largest lamp makers are strongly in favor of inspection. It was an anomaly that while the greatest effort was often made to obtain the last one-half per cent. efficiency in the machinery generating the lightning current, generally under severe penalties to the maker, yet an inefficiency of 20 per cent. and even more in the incandescent lamp, the last link in the chain of transformation, was allowed to pass unheeded and unchecked.

The grading of voltages and the enforcement of a rigid incandescent lamp specification had done much for American consumers, and the fact that some English makers were able to turn out a much more uniform product than others showed that improvement was possible if consumers took the necessary steps in the matter. The question of a satisfactory life test for incandescent lamps was difficult but important, and a series of tests carried out at the National Physical Laboratory showed that from the point of view of maintenance of candlepower a 40 per cent. overrunning test on a lamp could not be regarded as a certain guide to its behavior at normal voltage. It was at the same time quite possible that a life test at 2.5 watts per candle would give a result so nearly consistent that nearly all life tests could be run at this figure, considerably curtailing the length of the test.

Dr. J. A. Fleming said that he believed that the large-bulb carbon-filament lamp offered a more perfect means of preserving a standard of light than any flame standard yet made. All that had to be done was to pass through the lamp a known measured current. On the subject of preliminary aging, which was of great importance, it was proposed to specify this, not by a fixed number of hours of running but up to such a time that the candlepower showed no signs of increasing, and if such a certificate were furnished with each lamp by the manufacturer it would be a guarantee against sending out lamps as photometric standards which had not received the necessary preliminary aging.

Important News from Bogota.

A floating newspaper paragraph, apparently originating in Bogota, Colombia, is to the effect that "Prof. Pedro Sandoval, the eminent scientist, believes he has succeeded in transforming the rays of the sun into electrical power, an object which has been sought for 50 years. Professor Sandoval refuses to go into details as to how he converts this energy, but admits that the rays are passed through plates of various density. While it is possible that the electrical current thus produced may be used commercially, the chances are not bright, since the scientist says the amount of current produced is small in proportion to the amount of rays utilized." Evidently this intelligence is to be classified as belonging to the "important-if-true" class.

The headquarters of the American Street and Interurban Railway Association have been moved from 60 Wall Street to the Engineers' Building, 29 West Thirty-ninth Street, New York.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

III.—Elements of Electricity.

Dynamic Electricity

The term dynamic electricity or electrodynamics is applied to electricity flowing in currents, in distinction to static electricity, or electricity at rest. It should be understood, however, that electricity, no matter how produced, is always the same, but various classifications of electricity are sometimes made according to the methods by which it is produced. We have seen that a charge of static electricity passes from one conducting body to another when a suitable path or conductor is provided, and if the electricity were supplied as fast as it flowed away there would be a continuous current of electricity in the conductor. This condition occurs when one end of the conductor is kept constantly positive and the other end negative. This is accomplished in several ways, such as by chemical action, by heat and by induction.

The flow of an electric current through a conductor cannot be accurately explained. There is actually no flow or transfer of matter along the circuit, and the wire carrying a current appears exactly the same as one which does not. Formerly the current was regarded as something traveling in the conductor, and the energy which appeared at any part of a circuit was supposed to be carried through the conductor by the current. This current was assumed to flow out from the positive terminal of the source of current supply, through the circuit and back to its original source at the negative terminal. It is now believed that the electric current passes outside of the conductor, through the surrounding dielectric, rather than being pushed through the conductor like water is forced through a pipe.

The analogy of water flowing through a pipe to current flowing through a conductor is a convenient one to explain the flow of electricity, if the analogy is not carried too far. The flow of water through a pipe connecting two bodies of water at different levels may be compared to the flow of electric current through a wire connecting two sources of electric energy at different potentials. The greater the difference of the two water levels, the greater the pressure of the water in the pipe, and the greater its flow. In the same way the greater the difference of electrical potentials the higher the pressure or voltage of the current, and the greater the flow of electrical energy. If the pipe conducting the water is small, the friction of the current is increased, and the carrying capacity reduced. Similarly, with the conductor; if the wire is of small size, the resistance to the flow of current is increased, and the current-carrying capacity of the wire is correspondingly small.

Primary Batteries.

The method of producing dynamic electricity chemically is by means of batteries, or voltaic cells. Such a cell consists of a glass jar in which a plate of copper and a plate of zinc are immersed in dilute sulphuric acid. If the terminals or electrodes of these two plates are connected by a wire the circuit of the cell will be closed, and the current will flow from the copper through the outside wire to the zinc and through the dilute sulphuric acid back to the copper plate again. The chemical action between the plates and the solution maintains a difference of electrical pressure or potential between the two plates, and the flow of current through the outside circuit tends to neutralize the difference of electrical pressure between the plates.

There are a large number of cells or batteries made up in this same general way, but with different kinds of plates and solutions. The solution is known as the electrolyte. In the Leclanche cell a solution of salammoniac is used in place of sulphuric acid, and one of the plates consists of a zinc rod. The other plate consists of carbon which is contained in a porous cup. The Daniell cell has one copper plate in the shape of a cup which contains a saturated solution of copper sulphate; a porous cup, containing dilute sulphuric acid and a rod of zinc, is placed inside the copper element. The Grove cell consists of a hollow cylinder of zinc in dilute sulphuric acid, and a porous cup containing strong nitric acid and a piece of platinum is placed inside the cylinder. The Bunsen cell is similar to the Grove cell, except that the platinum is replaced by carbon. The dry cell which is at present in such general use is provided with a zinc and a carbon electrode, the zinc generally forming the jar of the cell. The electrolyte, instead of being a liquid as in the cells previously mentioned, is a substance which will retain its moisture for a long time. The different parts, after being properly packed together, are sealed on top with some substance which prevents evaporation of the moisture within. The dry cell should perhaps more properly be called a damp cell, for as soon as it actually becomes dry, it ceases to produce a current.

The cells mentioned are only a few of a very large number in use at present, but they serve to illustrate the general method of producing a current of electricity by chemical action. In all of these cells the essential elements consist of a plate which may be oxidized, a liquid which acts chemically upon this plate, and an inactive plate. When a connection between the plates is made through an outside circuit, this chemical action takes place and the current flows. If the outside circuit is broken, the chemical action ceases, as well as the current. When the solution loses its strength, or the metal of the active plate is used up, there can be, of course, no further chemical action.

A cell is said to be polarized when bubbles of hydrogen gas cover the surface of one of the electrodes to such an extent that the solution in which it is immersed comes in contact with only a small portion of its surface. This coating of gas, as it spreads over the surface of the electrode, decreases the chemical action further and further, and in the same proportion the battery decreases in strength.

It is to avoid this polarization that cells using two fluids have been introduced, one of the fluids being some substance which unites chemically with the hydrogen and avoids its adhering to the surface of the plates. The gravity cell is a good example of the two-fluid cell, one of the liquids being heavier than the other. The heavier liquid remains at the bottom of the cell and the lighter one lies on top of it. In this case the copper plate lies on the bottom of the cell and is surrounded by crystals of copper sulphate, and the zinc plate is located at the upper part of the cell in dilute solution of sulphuric acid. The copper sulphate being heavier remains at the bottom, although some slight mixture of the two solutions takes place. The difference in the specific gravity of the two solutions, however, enables a porous cup for holding one of the solutions to be dispensed with, and this greatly reduces the internal resistance of the cell.

The part of the circuit inside of the battery, through the plates and the electrolyte, is known as the internal circuit, and the wire or other conductor through which the current from the cell passes, is known as the external circuit. Cells of the character described are usually used where only small amounts of current are required for a comparatively short time. To obtain best results, the external circuit should have a high resistance, so that only a comparatively small current will pass through it; and to keep the electrical pressure or voltage of the cell up to its highest value the internal resistance of the cell should be made as small as possible. The resistance of the electrolyte is considerably greater than of the wire conductor, and to keep this resistance as low as possible, the plates may be placed close together, and may be made of as large an area as possible. The gases which adhere to the plates cause considerable additional internal resistance, as gases are very poor conductors of electricity.

Thermo-electricity.

The second method of establishing a current of electricity, namely, by means of heat, is very inefficient, and has few, if any, practical applications. Electricity direct from coal has been a favorite theme for inventors for many years past, but up to the present no substantial progress has been achieved in this direction. It has long been known that certain minerals, when heated, acquire electrical properties. One of these is tourmaline. It is not, however, the absolute temperature, but the change of temperature which produces this effect. If it is kept for a sufficient length of time at a constant temperature, no electrical manifestations are exhibited, but if it is changed into a warmer or a cooler atmosphere, it will exhibit positive or negative electricity.

Electricity is also produced by differences of temperature at the joint of dissimilar metals. If a bar of antimony and a bar of bismuth are soldered together at one end and their free ends are connected by a conductor, a current will pass through this circuit when heat is applied to the joint, so that the temperature at this point is raised above that of the rest of the circuit. In this case the current will flow from the bismuth to the antimony; and if the joint be cooled below the temperature of the rest of the circuit, a current will also be produced, but in the opposite direction. This combination of the two dissimilar metals is called a thermo-electric couple, and current will pass through it in either direction, according as the point is hotter or colder than the rest of the metal. The action of a thermo-electric couple is a very complicated one, and the difference of potential is small, and consequently the amount of current produced by such a couple is extremely small. A number of such couples may be connected together in series to produce a thermo-electric battery.

Induction.

The third method of producing an electric current is by induction, and this is the method which principally concerns the electrical engineer. A most important step in the knowledge of electricity was made when it was discovered that a wire carrying an electric current acted like a magnet, and caused a magnetic needle to be deflected. This discovery showed that the electric current could act through space, and that its action upon the magnetic needle was similar to that of a magnet. From this it was apparent that some relation existed between magnetism and electricity.

When an electric current passes through a cylindrical coil of wire with circular convolutions (a solenoid), the coil becomes similar in its action to a magnet, and has north and south poles, which are situated at the ends of the cylinder upon which the coils may be supposed to be wound. The polarity of the solenoid depends upon the direction of the current, or on the direction of the winding. Therefore, the polarity of any solenoid may be reversed by reversing the current. There is a magnetic field surrounding such a coil similar to that of a bar magnet, and if such a coil is suspended so that it can turn freely, it will assume a north and south position, similar to a compass needle. Attraction and repulsion will be exhibited between two solenoids in exactly the same way as between two magnets, and they also have the ability to magnetize iron and attract small pieces of iron or iron filings, like a steel magnet.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

BOOK TABLE.

The Treatment of Storage Batteries. By R. W. Vicarey. London, England: The Electric Accumulator. 1907. Pp. (8¾ by 11 inches), 60. Price (in England), 2s. 6d.

The author states that, having been associated with the manufacture of accumulators for more than 16 years and having inspected a great number of installations of various makes and types, he has been surprised at the alarming number of cases where the persons in charge have been entirely ignorant of the management or treatment of their batteries.

The book, as a whole, applies to all types or makes of lead, sulphuric lead, cells, except where specially stated to refer to either the Planté or Faure types of plates. The 28 branches of the subject dealt with are treated in a concise manner, diagrams being employed to assist the reader in grasping the subjects fully.

An alphabetically arranged glossary of technical terms is a feature of the work.

Annual Report of the Board of Regents of the Smithsonian Institution. Washington: Government Printing Office. 1906. Pp. (5¾ by 8⅞ inches), 576.

The book, which is bound in cloth, uniform with previous reports, gives the operations, expenditures and condition of the Smithsonian Institution for the year ended June 30, 1905, and the last report prepared by the late secretary, S. P. Langley. An appendix is included which comprises a selection of miscellaneous memoirs of interest to collaborators and correspondents of the institution, teachers and others engaged in the promotion of knowledge.

Among the reprinted articles, many of them illustrated, are: "New Measurements of the Distance of the Sun," "Photographing Lightning with a Moving Camera," "The Tantalum Lamp," "Some Refinements of Mechanical Science," "Progress in Radiography," "History of Photography," "The

Genesis of the Diamond," "Gold in Science and in Industry," "Submarine Navigation," "Liberia," "Geographical Results of the Tibet Mission," "The Development of Rhodesia," "The Ethics of Japan," "Plague in India," "Luminosity in Plants," "Notes on the Victoria Lyre Bird," "Physical Conditions in the Genesis of Species," "Parental Care Among Fresh-water Fishes," "Relations Between the United States and Germany," etc.

QUESTIONS AND ANSWERS.

Insurance Requirements for Motors on Trolley Circuits.

T. D. M., Toledo, Ohio: On page 459 of your issue of December 8th I note an article entitled "Insurance Requirements for Motors on Trolley Circuits." Will you kindly advise me whether these requirements have been adopted or indorsed by the National Board of Fire Underwriters, or, if not, what is the authority issuing them?

ANSWER.

While the insurance requirements for motors on trolley circuits are not indorsed by the National Board of Fire Underwriters, in a strict sense, the Western Electrician is informed that they are tacitly accepted as proper. The National Electrical Code, section 34, simply states that "lighting and power from railway wires must not be permitted, under any pretense, in the same circuit with trolley wires with a ground return, except in electric-railway cars, electric-car houses and their power stations; nor shall the same dynamo be used for both purposes."

The specifications for installation of motors on trolley circuits are prepared by electrical experts connected with the various insurance inspection bureaus, and, while they vary slightly, are in the main alike as to their requirements. The latest rules covering such installations, and which, it is believed, are being used by the majority of electrical inspection bureaus, are as follows:

Enclosure surrounding motor should be fire-resisting in construction and completely cut off from building.

Room to be constructed of brick, concrete or hollow tile, with not less than four-inch walls.

Floors to be of brick, cement or earth.

Roof to be of brick, concrete or tile; arched construction; all weight to be borne by side walls.

Openings to be protected by standard tin-clad or iron fire doors.

Power to be communicated to outside by means of a shaft, enclosed in an iron pipe, sealed at ends.

All switches, cut-outs, wires and controlling apparatus to be located inside of fire-resisting room.

Wires to enter building through approved iron armored conduit; same to be continuous from outside of building, to inside of motor room. Conduit, where terminating on outside of building, to be equipped with a gooseneck turned downward and sealed to keep out all moisture.

End of conduit to be provided with standard bushings.

Approved double-braid wire to be used inside of conduit, or where same is subjected to moisture, approved lead-sheathed wire to be used. Approved lightning arresters to be provided on overhead lines, same to be installed outside of building. Return of negative wire to be carried back and tapped direct to rail.

All wiring and apparatus to be installed in accordance with the rules and requirements of the National Electrical Code.

Irish International Exhibition.

Ireland's forthcoming international exhibition, which will be open from May to October, 1907, will be the biggest undertaking of its kind ever organized by Irishmen. Work on the exhibit buildings has gone on so rapidly that they will be finished before the day set for opening, May 1st. Machinery Hall is already completed.

Among the foreign countries France is preparing a French section which will equal that at the exposition at Liege; Russia has appointed an agent to make necessary arrangements for a large exhibit; Italy, Canada and Australia and other countries will be well represented.

Exhibits will be classified in 19 sections, including manufactures and textiles; civil engineering and transportation; electricity; motors; gas lighting, heating and cooking; agricultural implements and chemical industries. In the transportation and machinery section many notable firms and companies will be represented. The exhibition site at Herbert Park, Dublin, is said to be particularly well adapted to the purposes of the exposition.

Ethics of Trade Secrets.

Frederick P. Fish of Boston, formerly one of the most prominent patent lawyers of the country and now president of the American Telephone and Telegraph Company, delivered an address on January 8th before the American Society of Mechanical Engineers in New York on "The Ethics of Trade Secrets." This is a subject on which Mr. Fish is an authority. Some idea of the trend of his remarks may be given by the following extract:

"It is to me somewhat significant that the legislatures of England and America, which have many times dealt with the patent law, have never directly touched the subject of trade secrets. They seem to have recognized the fairness and justice of the common-law rules on the subject, and that the only course which would commend itself to a sound public sentiment was to make the patent laws so attractive as to induce the owners of patentable trade secrets to publish them in consideration of the patent grant. In this they have to a large extent succeeded. There are an innumerable number of patents and a comparatively small number of trade secrets. It is only in a few special classes of subject matter that the patent is not a more attractive reward for the new contribution to industrial progress than is the limited protection given by the law to a trade secret. There are few situations in which the secret can be kept at all, even if everyone exercises the utmost possible good faith. It is impossible in the case of a product, whether chemical or mechanical, and more than difficult in the case of tools and machinery. It is only with processes which are practiced in a factory and which are not disclosed by a study of the product, that there is any substantial chance of maintaining secrecy. To a far less extent, tools and machines which are not generally distributed have some chance of being kept secret.

"If a man elects in those few cases not to publish but to take his chances, can there be any real objection to his pursuing that course? It is certainly inconvenient and annoying to some extent. It is a real personal hardship that a workman or engineer who has learned the secret under such conditions that he must respect it, cannot utilize it in his subsequent work. It undoubtedly holds back the progress of the useful arts to some extent that the whole world is not free to practice it and to improve upon it. But this, in theory, is equally true as to things that are patented, during the long term of 17 years in which no improvement on the thing patented can be rightfully used except by the patentee or those claiming under him. It would be true of any monopoly given the inventor or devisor of a new thing as a reward. But the progress of the useful arts is, I believe, enormously promoted by the patent system. I doubt if it is interfered with to any appreciable extent by the requirement of good faith in those who have in confidence become acquainted with trade secrets.

"On the other hand, I believe that sound business generally and the comparatively few arts in which such secrets are of any importance are definitely promoted by the fact that the law aids in preventing disclosures based upon bad faith."

Elastic Substance Similar to Rubber.

A United States patent, No. 842,839, has been granted to Lucien Roland of Paris, France, on an elastic substance analogous to caoutchouc, and the method of manufacturing same. The substance comprises a mixture of gelatine and glycerine in a liquid state with an aqueous solution of chromates or chromic acid, the quantity of glycerine exceeding by about one-tenth in weight that of the gelatine, while the quantity of chromates is equal to about five-hundredths of this quantity of gelatine. The weight of water employed for dissolving these chromates is finally equal to about two times the weight of the latter, a little more or a little less, according as the proportion of glycerine in the mixture is more or less strong, this water remaining enclosed in the substance under the form of water of constitution.

The process of manufacturing the substance consists in mixing glycerine, gelatine and chromic acid or chromates with a quantity of water in the proportions specified, then allowing the mixture to to set while retaining the water of hydration in combination whereby is formed a solid hydrated compound devoid of free water and insoluble in water.

Proposed Niagara Show.

The citizens of Niagara Falls, N. Y., are considering plans for an electrical exposition to be held in the summer of 1908. The Board of Trade and the several power companies have taken hold of the project. Committees have been appointed and steps will be taken to incorporate an exposition company. The Canadian city of Niagara Falls will be asked to co-operate so that comprehensive plans may be carried out for the electrical illumination of the entire district surrounding the falls, including the gorge and whirlpool.

Annual Report of Western Electric Company.

The annual meeting of the stockholders of the Western Electric Company was held in Chicago on February 7th.

The company's sales for the fiscal year ended November 30, 1906, were $69,245,531, as compared with $44,145,753 in the previous year, an increase of 56.9 per cent. This unusual increase in the volume of business occurred in part from the large expenditures of the Bell telephone companies for new construction.

The company was able to currently borrow the considerable amounts required to provide working capital for the increased business. A portion of the indebtedness thus incurred will be retired during 1907. No addition to the present outstanding capital stock of $15,000,000 is now contemplated for the immediate future.

The principal additions to plant during 1906 were two additions to the cable plant at Hawthorne; the construction at Hawthorne of a switchboard and woodworking factory, now nearing completion; warehouses at Atlanta, Pittsburg and San Francisco, and additional machinery for the Chicago and New York factories.

In the early part of the year the board of directors established a pension fund of $400,000 for the benefit of superannuated or disabled employes. To this $150,000 has been added for the year 1906. There are now 13 pensioners on the roll.

In December, 1906, there were in the company's employment 26,938 people, as compared with 19,704 in December, 1905.

Owing to the high prices of metals, especially copper and lead, and the high rates prevailing for money for new investments, customers are not planning to do as much construction work in the coming year as they have done during the last year. This tendency is likely to result in a smaller business for the company in 1907 than it obtained in 1906.

Retiring directors were re-elected.

New York Illuminating Engineers Elect Officers.

The New York section of the Illuminating Engineering Society held its regular meeting at the Edison Auditorium, New York city, on February 8th, when the officers for the ensuing year were elected. At the request of Chairman A. E. Forstall the nominating committee presented its report and the following-named officers were elected: Chairman, A. E. Forstall; managers, M. K. Ayer and T. R. Beale; secretary, Preston S. Millar.

A paper on "Photometry of Incandescent Gas Lamps" was presented by Thomas J. Litle, Jr. W. C. Morris, V. R. Lansingh, Victor A. Rettich, Dr. C. H. Sharp, W. A. Lawrence, Guy Williams, P. S. Millar, F. J. McGuire and A. E. Forstall took part in the discussion.

The chairman, Mr. Forstall, made the announcement that the next meeting would be held on March 8th and that the proceedings would take the form of a symposium on the subject of "Lighting of Large Office Interiors." Two or three short papers on the lighting of such interiors by electricity will be read, as also will be a paper or two on lighting by means of gas.

New Automatic Train Stop.

An automatic train-control device for the prevention of wrecks has been invented by John E. Stiedelmeyer of Indianapolis. In a general way, the device consists of a steel "shoe" on a truck of the engine and a similar "shoe" on the rear car of the train, with a third rail between the rails on which the trains operate. These third rails are electrically connected, and the appliance is so constructed that the trains are automatically stopped in case of an accident, or may be stopped by a telegraph operator pressing a button. The invention is operated upon much the same principle as the block system, except that it works automatically by electricity, and is designed to control not only locomotives, but all trains or power-propelled cars running on fixed tracks. It is so arranged in the tracks that when two trains are approaching on the same track, two catches fly up when each train gets in the danger zone, and striking an attachment on the engine, automatically shuts off the steam and applies the air brakes, thus, it is expected, stopping both trains and averting a collision. The device can be placed on the track at intervals of half, three-quarters, or a mile.

Words of Appreciation.

In concluding its comment on the recent New Years number of this journal, Electricity of London has this to say: "The Western Electrician is to be commended upon the very complete table of estimates for the year, which is now quite a feature of the New Years number of my excellent contemporary. It would be interesting to see a similar list prepared for this country."

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER IX

Commercial Applications of the New Method of Telegraphy.

When the telephone was invented many people imagined they could set the date of abandonment of all telegraph lines, but a quarter of a century after the establishment of telephonic service those familiar with the conditions of electrical communication have good reason to believe that telegraphy will not be supplanted by the telephone.

When the announcement was made of Mr. Marconi's achievements in wireless telegraphy another generation of the uninformed could plainly see the relegation of all wires to the scrap heap.

Wireless telegraphy has greatly broadened the field of instantaneous communication, and in all probability it will continue to develop new territory, and such development will act as a very considerable feeder to existing wire lines.

The following list shows the number of wireless stations established and working, in the principal countries at the present writing (November, 1906):

Denmark, four; Germany, 100; United States, 92; France, seven, Great Britain and Ireland, 48; Holland, 10; Spain, six; Italy, 20; Russia, 10; Turkey, six; Canada, 10; Mexico, two; Panama, two; China, 10; Hawaii, seven; together with a lesser number in various smaller countries. In all there are over 400 stations in operation throughout the world.

Nearly all the large Atlantic steamships are equipped with wireless apparatus, it being common experience for vessels to be in constant communication with shore or ship stations during the entire passage of the Atlantic, and the revenue therefrom is growing rapidly. The wireless-telegraph

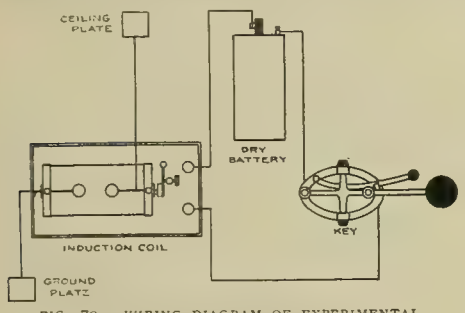


FIG. 79. WIRING DIAGRAM OF EXPERIMENTAL TRANSMITTER.

companies operating ship stations have working agreements with the big land-line companies, and the exchange of traffic has assumed profitable proportions.

It is probable that an application of wireless telegraphy to be made in the near future will be that of bridging over storm districts. There are certain well-known storm paths in America which seem to be periodically visited by high winds and sleetstorms, which destroy wire lines, no matter how stoutly constructed. General commercial operations have grown to be almost entirely dependent upon instantaneous communication over long distances, and interruption to such service, even for a day, means the loss of many thousands of dollars to those who depend upon continuous service. Wireless installations for emergency service over these storm paths would be worth the while if used only three days in a year.

One possible accomplishment which will give a great impetus to wireless work, will be satisfactory, constant, and reliable transatlantic and transpacific service. By this is meant continuous service night and day without interruption, in both directions, and a system capable of taking care of a large volume of traffic.

In January, 1903, Marconi transmitted aerograms from England to America without relay. In March, 1903, the Marconi company undertook to furnish news service from America to England, but the service was suspended after a short trial. More immediate and greater financial returns awaited the Marconi people in less extensive and less expensive fields, and transatlantic service was for the time abandoned.

The De Forest company in April, 1906, succeeded in transmitting satisfactory signals directly from Manhattan Beach to Bantry Bay, Ireland.

Professor Fessenden has also exchanged reliable signals between his Brant Rock (Mass.) station and a station at Machrihanish, Ireland. These, however, were only tests for experimental purposes, and were made under the most favorable conditions. Nevertheless, the fact that signals may be sent over such long distances is full of hope for the future of the art.

CHAPTER X.

How to Construct Experimental Apparatus for the Demonstration of Different Methods of Wireless Signaling.

Whether for pastime or profit, the subject of wireless signaling forms a very interesting study. The only satisfactory way to gain a complete knowledge of the phenomena concerned is to construct and experiment with the various electrical devices employed in the art. The construction of an experimental set of instruments is a comparatively simple matter; of course, it is necessary that the student have a fair knowledge of electricity and of mechanics. Some of the required parts may be purchased more cheaply from dealers than they can be constructed by the amateur, and when purchased the apparatus will be more durable and have a more workmanlike finish. It is essential that the instruments used be properly constructed, especially in regard to adjustment of moving parts, and insulation of coil windings.

For the transmitter we shall require an induction coil capable of giving a one-half-inch spark between the secondary winding terminals. Such a coil may be purchased from a dealer in electrical supplies for seven or eight dollars. The coil should be procured from a reliable dealer, however, so that the insulation may be depended upon.

Many students prefer to construct the induction coil themselves, but this course can be recommended only where the amateur has the assistance and advice of those who have had experience in coil building, as the first attempt frequently results in failure, or, at least after the coil has been completed, it is found that the length of spark obtainable is not up to expectations.

Coils of the size referred to are not generally fitted with secondary terminal knobs when purchased from dealers, so it will be necessary to purchase from some brassworker a pair of brass balls one-half inch in diameter and fitted with small brass rods, which must be securely soldered into holes bored into the spheres.

It is well to remember that the rods attached to the balls (or oscillators) must be of a gauge that will snugly fit into the binding posts mounted on top of each end of the coil.

The coil purchased should be fitted with an automatic primary-current interrupter mounted on one end of the base-box, and also, there should be a small-capacity Fizeau condenser in the base box. This condenser is connected across the contact points of the interrupter for the purpose of reducing the amount of sparking at the contacts, and the charge thus taken up by the condenser is availed of to assist the action of the battery connected in the primary circuit.

In addition to the coil it will be necessary to purchase:

An ordinary Morse telegraph key	$1.50
Three hundred-ohm Morse relay	4.00
Morse sounder, four-ohm	1.00
Six dry cells battery	1.00
Small electric bell	25

Anything else that is required may easily be constructed by the student from materials readily procurable.

In Fig. 78 is shown a wiring diagram of the experimental transmitter. It may be found necessary to use two, or even three, dry cells instead of one, as shown in the diagram.

For experimental purposes, indoors, a piece of No. 9 copper wire 10 or 12 feet long and looped at the top, the diameter of the loop being about two feet, will serve for the aerial wire in place of using a copper plate. Also, for indoor working, the ground connection may be dispensed with, but it is well to connect the ground terminal of the coil to a copper plate or area of wire gauze lying on the floor. The Germans call this latter arrangement a "counterpoise."

The brass-ball terminals of the coil should be so adjusted that the sparks passing between them will be thick and continuous when the Morse key is closed, rather than long and intermittent.

This simple transmitter is devoid of any refinements in the way of tuning devices, but such refinements may be added as the knowledge of the student advances.

With the above-described transmitter it is possible to actuate any of the wave detectors described in the chapter on the latter subject.

Fig. 79 shows the circuits of a type of experimental receiver using a filings coherer, each instrument being shown in its proper position on a base-board. The "tapper" shown is the decoherer and consists simply of a small electric bell with the gong removed, so that the hammer may have

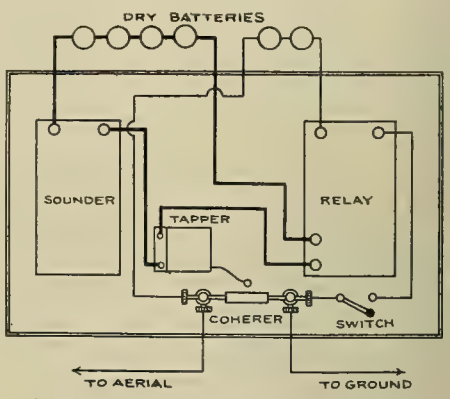


FIG. 79. CIRCUITS OF EXPERIMENTAL RECEIVER USING FILINGS COHERER.

free play to tap the coherer at the right moment.

The filings coherer may be made up as illustrated in Fig. 80. All that is required is a piece of thick glass tubing an inch or so in length, with an internal diameter of one-eighth inch, two double connector binding posts, two stiff metal wires for inserting into the glass tube, and a small base-board. The tube wires should snugly fit the glass tube; if the wires obtainable are too large they may be filed down to the required diameter. It is well, also, to fit the outer ends of these wires with milled heads, to facilitate adjustment of the wires after being inserted in the tube. The ends of the wires which are inserted in the tube should be filed smooth and flat. Inside the tube, and between the ends of the two wires, should be placed a minute quantity of nickel filings, which may be made by filing a nickel five-cent coin with a clean file.

Fig. 81 shows the receiving set complete mounted on a base-board. It will be observed that the dismantled electric bell (decoherer) is placed on its side, so that the tapper will operate against the under side of the coherer tube, tending to shake up the filings.

After the student has familiarized himself with the operation of the coherer type of wave detector he should proceed to construct one of the electrolytic, or "wet" wave detectors. A very simple and yet efficient receptor may be made in the following manner:

Procure a piece of hardwood, one inch thick, four inches wide, and 10 inches in length; saw into two pieces, making one six inches long, the

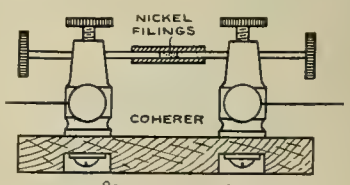


FIG. 80. FILINGS COHERER.

other four inches; mount the two as shown in Fig. 82. In front of the upright piece, and on the base-board, place a small glass or earthenware vessel, two or three inches in height; this vessel should be glued to the base-board. If no other more suitable vessel is at hand, a very neat and convenient detector may be made by using one of the small white earthenware pots in which imported cheese is generally packed, and which sell for 10 or 15 cents at any grocery store, the cheese being disposed of according to liking.

On top of the upright piece are fastened two small strips of stiff brass, which extend out over the top, and to the center, of the vessel. These are for the purpose of supporting the electrodes which dip into the acid to be placed in the cup. The supports may be fastened to the top of the board by means of screw connectors, the connect-

Note. This series of articles was begun in the issue of December 1, 1906. It is now complete in ten chapters. In reference to the nomenclature in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

ors being used to hold the wires which connect the detector with the receiving circuits.

One of the electrodes to be fastened to the brass strips consists of a three-inch length of zinc, which may be procured by buying an ordinary LeClanche zinc for 15 cents at any electrical shop, and then cut or filed off to the required length.

The other electrode should be made of a very fine platinum wire, the finer the more efficient will be the detector. There are certain methods of making up these thin platinum electrodes, but for the purposes of the amateur, with whom expense frequently matters much, a fairly satisfactory platinum terminal may be made by breaking an old exhausted incandescent lamp, and removing the glass nipple which extends down into the lamp from the base, and into which is sealed two small platinum wires. If care is used in breaking the lamp, the nipple may be removed intact. The best way to break the lamp is to wrap it up in a newspaper and tap it with a hammer until the globe collapses.

After having secured a suitable nipple, which means one in which the copper leading-in wires are solidly connected with the short pieces of platinum passing through the glass, an extension wire may be soldered to one of the copper leading-in wires, so that the wire will be long enough to securely fasten the nipple to the support on top of the upright board. Both platinum wires should be filed off close to the glass, so that the smallest possible area of platinum is exposed to the action of the acid. As only one of the platinum points is made use of, the other may be disregarded.

If the upright portion of the frame is securely screwed to the base, a very substantial receiver will be the result.

The electrolyte to be placed in the vessel consists of dilute sulphuric acid, about 10 per cent. strength. The zinc rod should be well amalgamated by coating with mercury, and should be kept well amalgamated at all times.

Fig. 83 shows the manner in which the detector is connected in the receiving circuit. The absence of a battery means that the detector itself is a source of current sufficiently strong for the purpose of detecting electric waves. In the diagram, (A) is the aerial connection, (D) the detector, (G) ground or "counterpoise" connection and (T) telephone receiver. The telephone receiver used should be wound to at least 500 ohms resistance, as the ordinary 70-ohm receiver used in telephony is not sufficiently responsive to give readable signals. These 500-ohm receivers are now carried in stock by the principal telephone-supply houses.

In Fig. 84 is shown complete wiring diagram of an experimental station recently fitted up by the writer, showing transmitting and receiving circuits so arranged that when the switch (A) is set as shown in the drawing the receiver circuits are connected with the aerial wire, and when the switch is pulled over, so that the movable arms cover the other two points, the transmitter is connected with the aerial. Thus a single movement of the switch (A) throws either the sender or receiver into connection with the aerial wire.

In the diagram, (M) is the aerial wire, (T) tuning coil, (A) switch, (D) detector, (R) telephone receiver, (E) potentiometer or resistance rheostat, (B) battery, (P) primary and (S) secondary of induction coil, (C) Leyden-jar condenser, and (G) ground connection.

Wireless telegraphy, like all other pursuits worthy the consideration of the studious, requires patience, care and constant practice; and the more thought and attention that are given it, the more gratifying and satisfactory will be the results.

APPENDIX.

Telegraphic Alphabets.

LETTERS.

	BAIN.	CONTINENTAL.	MORSE.
A	· —	·	· —
B	— · · ·	— · · ·	— · · ·
C	— · — ·	— · — ·	— · — ·
D	— · ·	— · ·	— · ·
E	·	·	·
F	· · — ·	· · — ·	· · — ·
G	— · — ·	— ·	— — ·
H	· · · ·	· · · ·	· · · ·
I	· ·	· ·	· ·
J	· — — —	· — — —	· — — —
K	— · —	— · —	— · —
L	· — · ·	· — · ·	· — · ·
M	— —	— —	— —
N	— ·	— ·	— ·
O	— — —	— — —	— — —
P	· — — ·	· — — ·	· — — ·
Q	— — · —	— — · —	— — · —
R	· — ·	· — ·	· — ·
S	· · ·	· · ·	· · ·
T	—	—	—
U	· · —	· · —	· · —
V	· · · —	· · · —	· · · —
W	· — —	· — —	· — —
X	— · · —	— · · —	— · · —
Y	— · — —	— · — —	— · — —
Z	— — · ·	— — · ·	— — · ·
&	· — · · ·	· — · · ·	· — · · ·

FIGURES.

	BAIN.	CONTINENTAL.	MORSE.
1	· — — — —	· — — — —	· — — — —
2	· · — — —	· · — — —	· · — — —
3	· · · — —	· · · — —	· · · — —
4	· · · · —	· · · · —	· · · · —
5	· · · · ·	· · · · ·	· · · · ·
6	— · · · ·	— · · · ·	— · · · ·
7	— — · · ·	— — · · ·	— — · · ·
8	— — — · ·	— — — · ·	— — — · ·
9	— — — — ·	— — — — ·	— — — — ·
0	— — — — —	— — — — —	— — — — —

PUNCTUATION MARKS.

	PHILLIPS.	CONTINENTAL.	MORSE.
Period (.)	· — · — · —	· · · · · ·	· · — · — ·
Colon (:)	— — — · · ·	— — — · · ·	— — — ·
Semi-colon (;)	· · · · ·	· — · — · —	· — · — ·
Comma (,)	· — · —	· — · — · —	· — · —
Interrogation (?)	· · — — ·	· · — — · ·	· · — — ·
Exclamation (!)	— — — ·	— — · · — —	— — — ·
Paragraph (¶)	— — — — ·		— — · — ·
Parenthesis ( )	· · · · · — ·	· · · · · — ·	· · · · · — ·
Hyphen (-)	· · · · · ·	— · · · · ·	—
Pound sterling (£)	· · · · · — · ·	— · — · ·	
Underline	· · — · — · —	· · — — · —	
Quotation mark (" ")	· · — · · — · —	· — · · · · — ·	
(Do) in quotation	· · — · · — · · — ·	· · — · · — ·	
Apostrophe (')		· — · — · —	
Fraction	·		
Dash (—)	· · — · ·		
Shilling	· · — —		
Dollars ($)	· · · — · · ·		
Pence	· ·		
Capitalized letter	· · · · — · ·		
(:) followed by quotation	· · — · · · — ·		
Cents	· · · ·		
Decimal point	— · — · —		
Brackets [ ]	· · · · · · · · · · · ·		

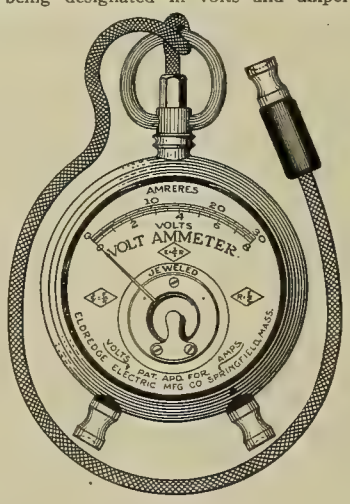
[*The end.*]

A Pocket Volt-ammeter.

The "Advance" pocket volt-ammeter, manufactured by the Eldredge Electric Manufacturing Company of Springfield, Mass., possesses certain characteristics worthy of mention. The instrument has a standard range of 0-8 volts and 0-30 amperes. It indicates in either direction of the current, the reading being obtained instantly regardless of the polarity of the battery terminals.

An important feature of the indicating vane and needle is a zero-adjustment, whereby the needle can quickly be set at zero should it be thrown out of such position.

In testing single cells, for either voltage or amperage, it is not necessary to use the cord, it being more convenient to make contact by the proper insulated spur at the bottom of the case (these spurs being designated in volts and amperes) to one terminal and side of the case to the other terminal.



POCKET VOLT-AMMETER.

The scales, which are uniform, are each calibrated individually by hand, by standard instruments, which are always kept in check. The controlling spring, which is made of fine non-magnetic phosphor-bronze, insures continued accuracy, owing to the extreme constancy of the metal.

The Deiterick-Murdock syndicate, which recently purchased the Northern Indiana Railway Company, will construct a large power house at South Bend, Ind.

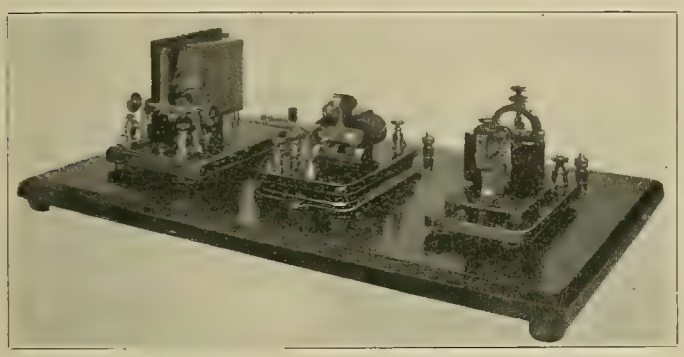


FIG. 81. WIRELESS RECEIVING SET COMPLETE.

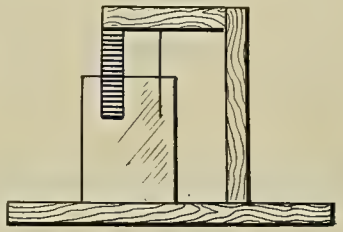


FIG. 82. HOME-MADE ELECTROLYTIC DETECTOR.

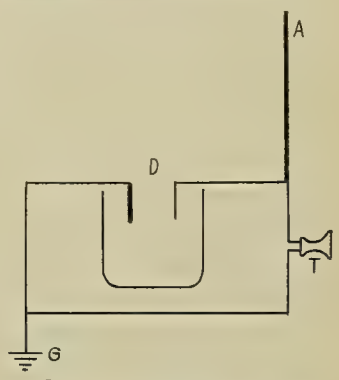


FIG. 83. ELECTROLYTIC DETECTOR CONNECTED IN RECEIVING CIRCUIT.

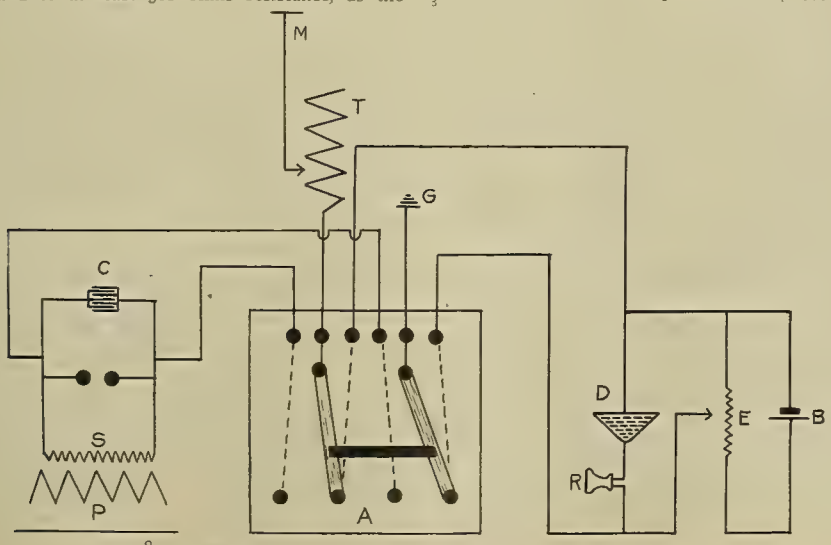


FIG. 84. COMPLETE WIRING DIAGRAM OF EXPERIMENTAL WIRELESS STATION.

Storage Batteries and Their Electrolytes.[1]

By R. W. Vicarey.

Summary—The author deals with the lead accumulator from the manufacturing point of view, as apart from laboratory experiments. Stress is laid upon troubles due to ammonia when nitrogen plays a part in the formation, and experiences due to nitrogen compounds are related. Finally, the author says that he has discovered a new irreducible sulphate of lead, and discusses the effect of certain impurities on current density in formation.

Until very recently the manufacture of the storage-battery plate was carried out in most works by rule of thumb. As soon as the original inventor of the process had completed his laboratory experiments and handed them over to be reproduced on a large scale in practice troubles and unforeseen irregularities began. But the keen competition has brought about a state of great uniformity so that a comparison of price lists of the principal makers shows that there is very little to choose between them.

As regards the lead cell, it is needless to point out how troublesome to manipulate lead is in electrochemical work. Until very recently it had not even been possible to deposit it satisfactorily, although after all these years there seems to be hope of this at least being accomplished. Unfortunately, the use of such things as lead salts, sulphuric acid and other materials must in time introduce impurities. But still greater uncertainties are due to the carelessness of employes; the following are personal experiences: A carpenter repairing an acid tank will drop a brass screw into the acid and leave it to tell its own tale; a laborer will carry acid in iron pails or will empty one acid into a tank of different acid; a wireman will file, solder or repair cable leads over cells or acid tanks.

The ideal accumulator works should be erected on carefully chosen ground away from all manufacturing centers, i. e., as far in the open country as railway facilities for transport of goods, in and out, will permit.

It will be gathered from my previous paper that ammonia plays a very important part in accumulator practice by causing irregularities. Nitrogen, combined with either oxygen or hydrogen, must always be looked upon as a subtle enemy. Now, several processes of manufacture, both chemical and electrochemical, make use of nitrogen in the preliminary treatment of the plates, in the shape of nitric acid, nitrate salts, nitric peroxide, and the nitrogen invariably remains in the plates to be dealt with subsequently, usually in a sulphuric acid bath of various densities.

Nitrogen appears to be capable of repeated and unlimited oxidation and reduction; for instance, if we have a sulphuric acid solution and add to it known quantities of nitrates or nitric acid under certain conditions the current may reduce the whole of the nitrogen compound present to ammonia, which, of course, combines with the sulphuric acid to form ammonium sulphate. On the other hand, under different conditions the nitrogen may be oxidized to nitrite, and subsequently to nitric acid. Thus ammonia appears at the negative or spongy plate and the nitric acid or nitrates at the positive or peroxide plate.

The most striking effect appears to be in the case of ammonia, a serious loss of original capacity in the negatives; and in the case of the nitrates an excessive growth of the positives. It may be thought by some that both effects would appear simultaneously, seeing that the nitrogen is capable of undergoing alternately oxidation and reduction. It unfortunately does not so happen in practice for some reason not yet ascertained.

It might be urged, why use nitrogen compounds at all, seeing the possible dangers its non-elimination can lead to. But it must be remembered that this element is the best agent we have for assisting in the oxidizing process of the positives; and that it has also the very attractive property of causing the plates to acquire a good rich color, besides effecting economy in production.

Makers use nitrogen in some form or other in their processes, in view of the advantages gained, and are justified in doing so, but it is absolutely imperative that they adopt means by which they can ensure its total elimination before the plates are considered finished and out of their control.

It will be of interest to give some of the peculiar experiences to be met with in works, and directly traceable to nitrogen, although accelerated more or less by other impurities. I know an extreme case in which instead of giving a six hours' discharge at normal rate the cells gave out in 20 minutes. This, which appeared on the first test after the formation process, was repeated at intervals with many batches of newly made plates, and after much experimental work was capable of being attributed to the presence of nitrogen compounds. Another common experience again attributed to nitrogen is that of an unusual fall in specific gravity during discharge, with failure to rise correspondingly in the succeeding charge.

In works that deliberately use nitrogen compounds the following experiences are met with in addition to those cited above: (1) A very excessive shedding of PbO_2 appearing periodically; (2) an abnormal heating of the forming electrolyte—that is to say, if the average forming temperature is 25 to 30° C., it may suddenly run up to even 100° C.; (3) heavy deposits of spongy lead, generally on one side of the negative plate or dummies, sometimes on both, such deposit being sufficient to cause short-circuits; (4) abnormal growth or expansion of the positives during formation. Now I have come across plates measuring 13 inches by 14 inches which have grown in one formation as much as 1⅛ inches high and nearly one inch long, the duration of such formation being a little under 40 hours at a current density of 0.003 ampere per square centimeter of developed surface. Some of these plates instead of being melted down were put up for experimental testing, and in three such cells, each containing seven plates, discharged at a high rate (1½ hours), the positives grew vertically 3¼ inches in five weeks without breaking, bursting or even buckling, while in three other cells discharged at a low rate (i. e., nine hours), the growth was only 1⅝ inches vertically in the same time, and the plates buckled and broke. The formation of a very troublesome and obstinate sulphate of lead often gives serious trouble. This particular sulphate is not capable of either oxidation or reduction; that is to say, when making Planté plates, if this sulphate once develops during the first oxidizing process it resists all attempts to decompose it in subsequent reversals.

I have analyzed some samples of this sulphate and found them to agree with analyses made by an independent chemist. The compound may be termed a hemibasic sulphate $2PbSO_4PbO$, whose molecular weight is 829, and which contains 74.9 per cent. of lead, 80.7 per cent. of lead oxide and 19.3 per cent. of SO_3.

The most common of other impurities may be said to be iron, which accelerates the deleterious action of nitrogen compounds to an alarming degree. Unfortunately iron appears in small quantities in very nearly all natural waters, in almost all samples of sulphuric acid, in all samples of lead oxides used for pastes, in a large majority of samples of rain water, and in most so-called distilled waters taken from the steam boiler in use on the generating plant.

Although there are many impurities other than iron and nitrogen having deleterious effects on storage batteries, it is principally my intention to deal in this paper with only these two most common impurities. We will proceed to consider their effect on current density of formations, a matter that has not nearly sufficiently been experimented upon by makers. Different electrolytic reactions take place side by side on the prepared surfaces of the electrodes, and in proportion to the current density adopted the process may be either an oxidizing or a reducing one. Oxidation is most facilitated by concentrated solutions and low current density at the positive, while reduction is facilitated by concentrated solutions and low current density at the negative. High current density and dilute solutions do not assist either oxidation or reduction at the respective electrodes, for it is possible that the substance which is reduced at the negative may be oxidized at the positive, and the substance which is oxidized at the positive may be reduced at the negative, and when this happens the two active opposing currents neutralize each other, with the result that no work is done internally.

Now, I find by practice and repeated experiments that both ammonia and iron have several oxidizing values, and by experimenting with pure sulphuric acid of specific gravity 1.200, and varying percentages of iron sulphate, that the electrolytic reactions are seriously affected thereby. In one experiment made, four voltameters were arranged in series, using strips of pure platinum as electrodes, and the electrolyte containing 0.001, 0.01, 0.1 and 1.0 per cent. of iron and ammonia, respectively.

In view of the very different behaviors and nature of products when concentration of electrolyte and current density are varied, I would suggest the following simple experiment: Take pure metallic lead plates and immerse in baths containing sulphuric acid of, say, 1.100 specific gravity, and varying percentages of nitric acid or some nitrogen salt. If a series of such experimental cells be subjected to a fixed current density for a fixed number of hours and the positive plates carefully watched, very different behavior will be noticed in the different cells, some cases producing a copious supply of peroxide of lead, such peroxide precipitated as fast as it is formed; others producing no precipitate but very nearly the same quantity of peroxide of lead, strongly adherent; other cases producing peroxide, very much intermixed with a sulphate of lead; and, finally, if the percentage of nitric acid be high (say about two per cent.), nothing being produced but white sulphate of lead with scarcely a trace of peroxide intermixed. This experiment should be also carried out by using a series of cells of the same concentration throughout, but a different current density for each, when the results obtained will be practically the same. It is evident that there is in every case a current density most suitable for every existing condition.

In the early days of the Epstein type of plate, which, I believe, is still being manufactured with success, ammonia and ammonium salts in combination with potassium, sodium, aluminum and calcium salts were used very plentifully in the process of manufacture. But in 1891 it was accidentally discovered that better plates were obtained by avoiding the use of such salts in the forming bath, and no doubt many similar cases experienced could be quoted.

But when, as I shall show later, one can find actual proofs of batteries having been started with electrolytes containing only small percentages of ammonia and iron, and subsequently doubling and even trebling the quantities present in less than the first year's working, then it is time that manufacturers should do their utmost to bring the responsibility of failure upon the shoulders of the right person, and to do this they must first adopt such methods in their own works that there will be no possibility of failures being ascribed to failure on their own part to eliminate all dangerous impurities.

Discussion.

The discussion was opened by Mr. H. L. Joly, who said he thought that such a paper should be a crystallized embodiment of careful experiment and theory, but the present paper appeared to him a colloidal mass of hints, generalities and unfinished research. Taking the paper page by page he found that the author bewailed the ignorance and carelessness of battery makers, and quoted figures intended to show the uniformity apparently prevailing in the accumulator trade. Mr. Joly thought that for many years nearly every accumulator factory boasted of a Reichsanstalt of its own, and that the uniformity was apparent only in the failures of the "inventions," issued from the laboratories, to reach a healthy commercial stage. Price varied, for certain cells of a given capacity in a standard container and given weight, between 6½d. and 1s. 3d. The reference to careless workmen showed forcibly the need to educate the men, and if they were refractory to intellectual training to keep over them a foreman with keen eyes and who would not hesitate to dismiss the offenders. Overforming has often caused greater trouble than under formation. The advice to remove to the country for pure air and simple life was a counsel of perfection; works could not be erected near heaven and benefit by cheap rates of transport, besides which everybody was now removing to the country to escape rates rather than impurities in the atmosphere. The author saw in ammonia the greatest incubus that ever beset accumulator manufacture, and yet, as he says, the question has not yet been thoroughly investigated. Why, therefore, not refrain from considering the case against ammonia as proved before placing on record indisputable scientific evidence thereof? Nitrogen formed a large part of our atmosphere, and it happened to be useful in many respects. Its compounds were easily detected, and with care their introduction in cells could be prevented. The author had quoted some erratic results which he attributed to nitrogen compounds, but he expected us to receive this statement without giving us any details as to the cells, their history, etc., and we could not discuss his opinion any more than accept it implicitly if he meant that such trouble was due to spontaneous absorption of atmospheric impurities by the electrolyte. Coming now to the vital question of sulphate, Mr. Joly said that he had examined microscopically many plates for the presence of sulphate or sulphates, and he thought it a difficult matter to collect enough from one plate for satisfactory analysis; collecting from various plates would introduce varying conditions, and if the author's theory was correct could hardly be accepted. He would much like to see the actual crystals of this so-called hemibasic salt and to hear more, not about the trouble it caused, but about its physical characteristics, density, crystallography, solubility, etc. He thought that this salt might be a mixture of ordinary $PbSO_4$ and Kuhn's sulphate $PbSO_4PbO$, which was originally obtained by digesting $PbSO_4$ with ammonia, and wondered whether through some lapse of memory the author had not inadvertently mixed up his experimental sulphates. Regarding the voltameter tests: The gas analysis study of the oxygen efficiency of the accumulator had already been done by Dr. Rokotnitz, with lead electrodes, not platinum, and as nobody would dream of using platinum as an auxiliary electrode on accumulator research, he thought figures obtained by the Rokotnitz method would be more valuable than those given here by the author. The tendency now was to abandon the delicate mercury electrode, and even cadmium, to use the spongy lead test plate, much more consistent in the results, and capable of immediate interpretation by ordinary battery workers without scientific training. It was therefore a pity that the author, as a man of practical achievements, should have used platinum, and moreover, given such scant

[1] Abstract of a paper read before the Faraday Society, December 11, 1906. From London Electrician.

information about his voltametric measurements. Had he used lead plates the analysis of the gases evolved would have proved of some interest and perhaps helped to further the author's theory. Perfect purity would be a luxury, but we could hardly picture a trust of accumulator makers selling certified pure acid and water and keeping a watch on the atmosphere of their client's battery rooms to facilitate their fulfillment of maintenance contracts.

Indiana Telephone Items.

George H. Rush, formerly of Lafayette, has succeeded J. E. Morris as manager of Bell telephone interests in Shelbyville.

The first quarterly meeting of the year of the Fifth District of the Indiana Independent Telephone Association was held in Columbus on February 7th. There were 16 companies represented and one new company admitted. This district includes the counties of Bartholomew, Brown, Dearborn, Jackson, Jefferson, Jennings, Ohio, Ripley and Switzerland. The interest manifested during this meeting was so great as to greatly encourage the members. This district is perhaps more bitterly contested by the Bell company than any other in the state. It was regarded doubtful if an Independent company could survive in the district, but all doubts have been removed, and nearly a score of prosperous Independent companies are now doing business. The principal feature of the meeting was the reading of a paper on "Financing Telephone Property," by Charles S. Norton of Indianapolis. The election of officers for the district association resulted as follows: President, W. H. McPherson of Brownstown; secretary, W. B. Reed of Seymour.

A. J. Parsons, manager of the South Bend exchange of the Central Union Telephone Company, has been promoted to division sub-license agent for Illinois, and will have his headquarters in Springfield. The successor of Mr. Parsons will be E. D. Blume, service inspector in the district superintendent's office.

The City Council of Mt. Vernon has repealed the franchise of the Cumberland Telephone and Telegraph Company, granted in February, 1899, and running 15 years, and the city now asserts that the company is operating without authority. Before a new franchise is granted, the city demands more favorable conditions to subscribers, cheaper toll rates, free telephones and a short-term franchise.

The telephone lines south of Fort Wayne have been put out of commission, it is said, by the trolley wire of the Fort Wayne and Springfield interurban railway. This new line uses single-phase alternating current of such high voltage as to make it impossible to operate telephone wires of the central-energy system in close proximity. The telephone wires are from 10 to 30 feet away; still the effect is too great for good service. The telephone company will be forced, apparently, to rebuild its line to Decatur and change the rural lines to the local-battery system. This the telephone company has decided to do, but it expects to collect the expense of making the change from the traction company, which will, of course, be the basis for extensive litigation. S.

Telephone News from the Northwest.

Business men of Bowdon, N. D., contemplate forming a company for the establishment of a telephone exchange.

The Mesaba Telephone Company will install a new switchboard for its exchange at Eveleth, Minn.

The Northwestern Telephone Exchange Company will install an addition to its switchboard at Grand Forks, N. D., adding about 300 to its capacity.

The Advance Telephone Company has filed articles of incorporation at Ida Grove, Iowa.

A Farmers' Mutual Telephone Company is to be organized at Williams, Iowa.

The Mosher Mutual Telephone Company has been incorporated at Dexter, Iowa, with George Elliot as the leading stockholder.

The Independent Telephone Company has posted a $25,000 forfeit at Omaha, Neb., to insure the construction of the proposed new system in that city. The new automatic exchange which will be installed will have a capacity for 8,000 telephones.

The Independent Telephone Company has leased a building at Sterling, Neb., and proposes to install a new telephone system.

The telephone exchange at Milton, N. B., has been sold to Frank Delling.

The Dundas (Minn.) Rural Telephone Company has filed articles of incorporation with a capital of $10,000. E. T. Mackey is president and A. G. Chase of Faribault secretary-treasurer. R.

Illinois Telephone Men at Springfield.

The annual meeting of the seventh district of the Illinois Independent Telephone Association was held in Springfield last week. B. F. Wasson of Clinton read a paper on "The Evolution of the Telephone," which furnished material for a long discussion. C. B. Cheadle of Joliet, who is secretary of the state association, gave an interesting address.

W. H. Ramsey of Alton was elected president and F. W. Kelly of Springfield was elected secretary. An executive committee of five was elected as follows: L. C. Schwendtfeger, Lincoln; C. S. Haskins, Decatur; J. H. Hackett, Jacksonville; E. D. Boynton, Pleasant Plains, and W. D. McBride of Taylorville.

The district comprises Sangamon and 14 adjoining counties and the companies represented are giving service to over 30,000 subscribers.

There are 1,200 Independent telephone companies in the state. The state meeting will be held some time in May.

GENERAL TELEPHONE NEWS.

The Norwalk (Iowa) Telephone Company has sold its entire system to the Southern Iowa Telephone Company.

The Northwestern Telephone Company of Jamestown, N. D., is arranging to extend its lines to Ypsilanti, Montpelier and other neighboring towns.

At a recent meeting of the executive members of the Memphis (Tenn.) Telephone Company it was decided to issue $800,000 in bonds for enlarging the plant and expanding business. Harvy Myers is president of the company.

The next annual convention of the International Independent Telephone Association will be held in Chicago on June 4th, 5th and 6th. Meetings will be held in the Auditorium Hotel, which will be the headquarters. Manufacturers and supply dealers will make exhibits.

The following telephone companies have recently been incorporated: The Bristol Mutual Telephone Company of Farlin, Iowa, capital stock $2,500; Sinclaireville (N. Y.) Independent Telephone Company, $5,000; Blue Grove (Tex.) Independent Telephone Company, $3,000; Bedford Rural Telephone Company of Bedford City, Va.

A mutual telephone company will be established in Laporte City, Iowa, and vicinity. Articles of incorporation have been filed with a capital stock of $25,000. The object of the company is to procure franchises from cities and towns for telephone purposes and to operate telephone lines in Iowa in connection with other systems. O. A. Wallace is president and A. A. Sloan, secretary.

H. W. Knopp of Davenport, Wash., has sold the telephone line from that place to Fruitland, Wash., and the Deer Trail Mine, via Miles, Wash., to M. R. Nichols, who is taking up the wire to use in an independent farmers' line south of Davenport. The line between Miles and Latt, along the Spokane River, has been purchased by A. E. Lewis and C. L. De Tilbon and will be known as the Spokane River Telephone Line. It is connected with the Farm and City Telephone system at Miles.

The new directory of the Pacific States Telegraph and Telephone Company in Spokane will contain 11,500 names, an increase of 1,000 since August, 1906. This indicates that there are nearly twice as many telephones in use in Spokane, according to the population, as in any other large city in the Northwest, according to figures recently compiled. There is an average of 19.22 telephones for each 100 of population in Spokane. Figures in other cities are: Seattle, 10.10; Tacoma, 10.86; Portland, 10.90.

A number of telephone companies which will furnish long-distance connection with Independent telephone lines have recently been incorporated. The companies which, it is said, will enter the merger are the Chicago, Milwaukee and Northern Long-distance Company, the Chicago, Indiana and Eastern Telephone Company, and the Chicago, St. Louis and Western Long-distance Telephone Company. The general offices of the company will be located in Chicago. The incorporators are Gregory, Poppenhusen and McNab, Chicago lawyers.

The annual convention of the Ohio Independent Telephone Association will be held at Columbus, Ohio, on March 28th. Frank L. Beam is president and Ralph Reamer, secretary, both of Columbus. In a statistical report dated October 30, 1906, the association reports 270,720 Independent telephones in service on that date as against 141,111 operated by competing interests. Compared with competitors the number of Independent exchanges was 835 against 275, and the number of toll stations 1,663 against 839. The number of stockholders in the Independent systems is reported as 24,650.

The following-named telephone companies have recently been incorporated: Farmers' Telephone Company, Aurora, Neb., capital stock, $10,000; Pattonsburg (Mo.) Home Telephone Company, $25,000; Hamilton (Mo.) Telephone Company, $30,000; Tillman County Telephone Company of Frederick, Okla., $20,000; Dublin (Texas) Farmers' Rural Telephone Exchange, $20,000; Corsicana (Texas) Telephone Company, capital stock increased from $100,000 to $200,000; Orient-Santa Fe Telephone Company of Hamlin, Texas, $25,000; Mill Creek Telephone Company of Seguin, Texas; New State Telephone Company of Cooperton, Okla., $25,000.

CORRESPONDENCE.

Continental Europe.

Paris, January 27.—Electric-railway and tramway projects are active in Switzerland at present, and among the railroad projects I may mention that the demand for a concession for the Splügen railroad line, applied for by the Grisons Canton, has now come before the federal Parliament, where the matter will be discussed at one of the coming sessions. The projected electric-railway has its starting point at the station of Coire, and the total length of the line running through the tunnel to the Italian side is somewhat over 50 miles. It joins the already existing Lecco-Sondrio-Chiavenna electric railway, which has been in operation for some years past. The highest grade on the new road will be 2.6 per cent. and the least radius of curve 970 feet. As to the Splügen tunnel, it will have a total length of 15 miles, and is about equally divided between Swiss and Italian territory, according to the engineers' plans. Single track will be used upon all the line, and the cost is estimated at about $25,000,000. About eight years will be needed to complete the work.

It was decided some time ago to transform a part of the Arth-Righi railroad to the rack-and-pinion system, and at present the work of construction is going on upon this section, which extends from Goldau to Klösterli. Current for operating this part of the line is to be secured from the electric plant of Altorf. Next spring will, no doubt, see the trains in operation upon the rack-and-pinion section of the road. While speaking of matters in Switzerland, one of the recent projects relates to a large hydraulic plant which the Federal Railway Department is to erect upon the Rhone, and with this end in view negotiations have been made with the State Council of the Valais Canton, as it is desired to utilize the power of the Rhone upon the portion lying between the Fischerbach and the Saltine. According to recent reports, it appears that the matter will be arranged to the satisfaction of all parties and nothing will hinder the hydraulic work from taking shape.

Another railroad project of interest relates to the electric lines in the Fribourg Canton. A large company formed at Neuchatel has applied to the State Council of this canton, which controls all the hydraulic power in the region, so as to secure the needed power when the time comes for changing over from the steam to the electric system upon the railroads of the Jura in the region of Neuchatel. The company has secured the promise of at least 3,000 horsepower from the council.

In Spain, bids have been asked from the leading companies relating to an electric-tramway line to be erected in the town of Vigo. The project relates to the construction of the line and its operation for a period of 60 years.

It is stated that a project is on foot for the erection of a large electric station at Constantinople. Marshal Zeki-Pacha, the chief of the artillery, is making arrangements with several of the large European firms with this end in view. Zeki-Pacha has already obtained the concession for the lighting and electric traction in the towns of Top-Hané, Bechiktach, and in the suburbs of Yldiz. There seems no doubt that in the near future all the large cities of the empire will be supplied with current on a large scale.

Captain Ferrié of the French government has been carrying out experiments with radio-telegraphy upon the Eiffel Tower, and for some time past he succeeded in exchanging messages with some of the stations in the south of France, lying upon the Mediterranean. Quite accidentally it was found not long ago that messages could be sent to the North African coast from the Paris station. While Captain Ferrié was signaling to Port Vendrez, near Marseilles, the post established at Bizerta, near Tunis, was able to receive the message at the same time, even though it was not specially equipped for the purpose. This result is quite encouraging, and the experiments will be made on a larger scale in the future.

The Aire River in France is to be called upon to furnish a large amount of hydraulic power, according to a recent project, for a series of overhead lines which will take in the cities of Macon, Bourg and Villefranche. Two different stations will be erected; one of these, at Cize, will be the largest, and is to give 3,000 horsepower. A second plant at La Leschère will supply about 1,500 horsepower. A. DE C.

Great Britain.

London, January 30.—The embittered feeling which is being shown by both political parties in London in connection with the electrical undertakings of the County Council is alike unparalleled and regrettable. As I mentioned last week, one of the opposition papers has charged the highways committee with deliberately awarding contracts to its friends in connection with the tramways at inflated prices. This has resulted in the members of the committee in question issuing writs for libel against the newspaper, the proprietors of which have accepted service. In the course of a long speech on municipal trading generally, Mr. John Burns, who,

in addition to being a member of the County Council, is also president of the Local Government Board, took sides with the County Council. The result was an application to the courts to commit Mr. Burns to prison for contempt of court, it being argued that his speech was calculated to prejudice the trial of the pending action between the members of the highways committee and the Standard newspaper. The application failed, as it should have done, but it emphasizes the length to which opponents to municipal trading in England are prepared to go to arrest the progress of that socialism which has gained hold of municipalities here.

Apropos of this may be mentioned the fact that all the electric power bills dealing with London have passed the preliminary examination stage. To what extent the past opposition to these measures has depleted the coffers of the existing electric-light companies it is difficult to say, but there is no secret made of the fact that dividends are being reduced as a direct result. But this does not come about through decreased business; rather I should imagine as a little foresight in anticipation of still greater expense in the future either by way of reduced prices through competition or further opposition to competing power bills.

The report of the Metropolitan Railway Company, now fully worked by electric traction, shows an even worse position of affairs than was the case last year. The dividend has dropped to one-half per cent., as mentioned last week. The abolition of second-class fares, and severe competition from motor omnibuses are the causes to which the directors attribute the loss. This latter is becoming daily more and more serious, and it is a factor quite outside Mr. Yerkes' calculations when he took the question of locomotion in London into consideration. A suggestion has now been made that first-class carriages shall be abolished and only one class run. In time it is bound to come to this, for tramways now run as long distances as the suburban railways in London, and no question of a differentiation of classes in connection with them has ever been suggested. At present the Metropolitan ordinary shares are lower than they have been since 1887, and the Metropolitan District ordinary stock quotation is the lowest on record.

In connection with the proposed tunnel between England and France, a mysterious correspondent in a daily paper states that the aim of the promoters is once they get the bill passed by Parliament to agitate for the construction of a direct electric railway between London and Paris instead of allowing the through communication to be in two hands, as is the object at present. As the present bill is being introduced practically with the collaboration of the two railway companies concerned on either side of the channel, it is urged that the ultimate intention is to oust these from possession. In the bill powers are taken to work the trains in the tunnel by electric traction.

Some novelties in the design of the coaches for the single-phase line of the London, Brighton and South Coast Railways Company's suburban railway system from London Bridge to Victoria may be looked for. As far as I can understand the new coaches will not follow the corridor type of car so commonly adopted on electric railways in London, but will constitute something of a reversion to the old method of compartment coaches. It is quite interesting to note how opinion seems to be rapidly changing in the matter of the correct type of car for both tramways and railways. I have several times mentioned the fact that the corridor type of railway car is viewed more or less with disfavor by quite a number of railway men. In connection with tramways more than one manager is coming round to the view that smaller cars, and more numerous, offer the most elastic method of dealing with a heavy traffic. In London the single-deck cars running on the Aldwych subway have the favorable opinion of at least one of the chief officials of the London County Council in preference to the double deck. A report just issued by Mr. James Dalrymple, the general manager of the Glasgow tramways—and who has made a close study of American tramway methods—urges the corporation to retain the single-truck type of car in preference to the double truck. The former are shorter cars and are more easily handled in a dense traffic. These opinions are noteworthy amidst the very general adoption of double-truck double-deck cars in England.

An interesting tramway improvement is the invention of a truck that will run from one gauge to another without trouble. Messrs. Spencer and Hamilton (the tramway managers at Bradford and Leeds, respectively) are responsible for this, and in view of the very numerous gauges that exist over here there should be a wide field for such a piece of apparatus if it will stand the wear and tear of continual operation. I believe that only one trial truck has yet been constructed and no description of it is yet available.

The Edinburgh corporation is advertising for tenders for large continuous current dynamos for turbine driving in the electricity works, and also some exhaust steam turbines of considerable size. As comparatively little has been done in either direction so far, the results of the tenders should be watched for with interest.

No less than 59 miles of new electric tramways are included in the London County Council's programme for 1907-1908. Six miles on the west and two miles on the east will be on the overhead system and the remainder on the conduit system. G.

Dominion of Canada.

Ottawa, February 9.—The Hannawa Falls Power Company of the state of New York wants Prescott and Brockville, Ont., to combine on a power-supply scheme, and the company will then make a proposition to deliver power on the Canadian side of the boundary.

Mr. Cecil Doutre, commissioner and superintendent of government stations, has perfected arrangements for establishing the wireless-telegraph system between Prince Edward Island and the mainland until the broken cable is restored. A temporary Marconi station is being built at Pictou, N. S., to connect with the government wireless station at Cape Bear, P. E. I.

The boom in gold mining at Michipicoten, Ont., will be brought about by the development of the waterpower of the Michipicoten River. Gold was found in paying quantities there a few years ago, but not much mining has been done on account of there being no economical way of operating machinery. Mr. D. B. Detweller of Berlin, Ont., has constructed a power plant at the Michipicoten Falls at a cost of $150,000 and will be ready to deliver power in July next. Power will be supplied on a 24-hour-per-day system at $40 per horsepower per year.

At the annual meeting of the Toronto Street Railway Company Mr. William Mackenzie was re-elected president, and all the other directors were also re-elected. The report showed that the gross earnings of the year were $3,109,739 and that 76,109,932 passengers were carried. The operating expenses were $1,646,513; bond interest and fixed charges were $227,199. Payment to the city of Toronto for percentages amounted to $348,963; pavement charges, $80,965, and dividends at the rate of 6 per cent. on the ordinary stock, $460,241, leaving a surplus of $355,854; of the surplus $100,000 was added to the contingent fund and $255,854 to the profit and loss account, which now stands at $1,070,653. W.

Winnipeg, February 9.—The question of a government-owned telephone system was discussed by the Winnipeg Board of Control. After the matter had been fully gone into it was decided to ask the Manitoba government to take no steps in the matter until after April, 1908. Alderman Cox has the matter in hand.

The private bills committee of the Manitoba Parliament refused to grant a charter to the proposed Winnipeg and Lakes Electric Railroad on the ground that it would tie up the country too much against possible competitors. The company did not give sufficient assurance that it was going to build a suburban road, having promised the same construction several years ago, but had never made a start on the work.

At the last meeting of the Calgary City Council it was decided to construct a municipal street-railway system 12 miles in length and to equip it with 12 cars. City Engineer Thorold or Mayor Cameron may be addressed.

The town of Strathcona, Alberta, is figuring on a fire-alarm system to be installed there this summer. As a start 12 boxes will be installed. Mayor Mills may be addressed.

The Winnipeg Electric Company has issued its report for the last year and shows gross receipts of $727,726 against $551,650.60 for 1905. For the year 1906 the company paid the city of Winnipeg $36,386 for its franchise, being 5 per cent. of the gross receipts, and $2,380 for taxes on 119 cars at $20 a car. Since 1902 the gross receipts have risen from $199,728.80 to $727,726, and the number of cars from 42 to 119.

The Winnipeg Electric Company has built and put into service a new style of car, the principal difference being heated vestibules for motorman and conductor. The car was built in the Winnipeg shops of the company and several others of similar type are now under construction.

The Winnipeg power committee announces tenders will be called at the end of the present month for a quantity of electrical equipment for the Winnipeg power plant. It is understood that tenders will remain open for a sufficient time to allow British firms to bid. R. R.

New England.

Boston, February 9.—The Massachusetts Gas and Electric Light Commission has held a hearing on the Cambridge Electric Light Company's petition for authority to issue additional stock amounting to $60,000, the proceeds to be used for putting its wires underground on the main streets. Permission was asked to allow the stock to be issued at about 160, although this is below the market price.

The Wilmington and Whittingham Traction Company has been incorporated for the purpose of building an electric railway between Shelburne Falls, Mass., and Wilmington, Vt. It has a capital of $50,000 and is the outgrowth of a syndicate's purchase of the Shelburne Falls and Colrain Street Railway.

The Citizens' Street Railway Company, the Haverhill and Amesbury Street Railway Company, the Salisbury Beach Improvement Company and the Salisbury Land Company have been consolidated under the name of the Merrimac Valley Electric Company. This company will have an electric-railway line from Haverhill, Mass., to the sea with extensive beach property. James F. Shaw is president of the new company and George A. Butman is treasurer.

Owing to the great demand for its products the Wright Wire Company of Palmer, Mass., has decided to increase the capacity of its mill some 4,000 tons per year.

The Connecticut General Assembly is considering a bill regulating the increase of the capital stock of public service corporations. It provides that new issues shall be offered to shareholders in proportion to their holdings at not less than the market value of the securities at the time the increase is made. Shares not taken by stockholders may be sold at auction for not less than their par value or otherwise at not less than their market value. The issue of scrip dividends is forbidden. The act will apply to electric-railway, electric-light and power, telegraph and telephone companies among others.

The Rockland, South Thomaston and Owl's Head Railway, now in the hands of receivers, will be sold at auction March 8th. The road connects the Maine towns mentioned in the title.

The Employes' Mutual Benefit Association of the Institute of Technology had a dinner at the Technology Union in Boston on January 31st. Prof. G. V. Wendell of the physics department gave a talk on his experiences at the University of Leipsic, Germany, and Joseph Blachstein, instructor in modern languages, spoke about German universities. The new officers are as follows: President, Edward Edwards; vice-president, F. W. Perkins; treasurer, W. F. Wilton; secretary, F. G. Hartwell.

The Consolidated Lighting Company has bought control of the J. S. Viles Lighting and Power Company, by which it has acquired the plant at Middlesex Narrows, Vt., and all the lighting and power contracts in Montpelier, Middlesex, Barre, Williamstown, East Barre, South Barre, Graniteville and Waterbury, Vt. The Consolidated company now owns 6,000 water horsepower and 3,500 steam horsepower. The price paid for control of the Vilas Company was $300,000.

The opposition to the elevated railway through the west end of Boston has apparently been overcome, as the Boston Elevated Railway Company has taken the land necessary to construct the line between the North Station and the Charles River dam.

The Consolidated Railway Company's engineers have begun the survey of an electric railway between Adams, Mass., and the summit of Greylock Mountain. A cog rail will be used up the mountain.

The New Hampshire Legislature is considering a bill incorporating the Spaulding-Jones Power Company, with a capital of $1,000,000. The company proposes to dam the Merrimac River and to develop water, steam and electric power. Leon C. and Roland H. Spaulding of Rochester, N. H., Huntley N. Spaulding of Boston, Mass., Ira W. Jones of Lebanon, Me., and Stephen A. Frost of Fremont, N. H., are the incorporators.

The Electric Cable Company is preparing to double the capacity of its plant in Bridgeport, Conn., at a cost of $15,000.

The Trumbull Electric Company has awarded the contract for the erection of an additional factory in Plainville, Conn. The building will be brick, four stories high, 150 feet long and 50 feet wide. B.

New York.

New York City, February 9.—Many scientific men, especially electricians, were eager listeners to telharmonic music at the annual dinner of the alumni of the Worcester Polytechnic Institute in the Hotel Normandie on the evening of February 2d. Seated in the banquet hall they enjoyed the music sent over the wire to them from Telharmonic Hall. A striking novelty was introduced by means of the biograph. A guest called for a musical selection. As the strains filled the room the picture showed Karl W. Schultz at the keyboard in Telharmonic Hall. The Entertainment Club, which was holding a dinner at the Waldorf-Astoria at the same time, was also entertained with music from the same source.

According to a statement given out by Controller Metz, satisfactory progress is now being made on Manhattan Bridge No. 3. The superstructure of the bridge, for which the contract was let to the Ryan-Parker Construction Company in June, 1906, will be finished in about three years. There has been expended for work completed and for property acquired $6,349,255. The sum of $7,420,547 has been engaged by outstanding contracts. The total of the two sums, $13,769,802, covers prac-

tically the entire cost of the bridge. Completed the bridge will be 9,330 feet long, with a maximum grade of 2.8 per cent., or 0.45 less than the Brooklyn Bridge. The Brooklyn Bridge cost $21,000,000.

The annual inspection of the Brooklyn Rapid Transit system by the Brooklyn League is set for February 14th.

On account of the enormous expense entailed, the plan to use only steel fireproof cars in the subway has been practically abandoned, and the steel-truck asbestos-lined cars now in use by the Brooklyn Rapid Transit Company will be substituted.

It is stated officially by the New Haven road that, beginning next June, the passenger service between Stamford and New York will be equipped electrically. During the present year the important bridges between New York and Boston will be rebuilt for the heavier train loads on the system.

On Saturday, February 2d, the American Institute of Electrical Engineers, having completed its arrangements for moving, vacated the old quarters on Liberty Street and moved bag and baggage into its new home in the Engineers' Building. The officers of the society take considerable pride in the orderly manner in which the Institute's effects, including library and furnishings, were transplanted without the slightest hitch and installed in their proper places ready for business on Monday morning.

John C. Sheehan of the Manhattan Transit Company announces that the Long Acre Electric Light and Power Company has entered into a contract with the Wilkinson Turbine Company to supply the electrical power to operate the lines for which the Supreme Court has compelled the Electrical Subway Company to provide space in the subway. The company is making every effort to begin active operations without delay.

At a hearing which took place on February 7th over 400 Fifth Avenue and Broadway merchants protested against the proposed method of construction for the Lexington Avenue subway. It was contended that an open excavation would be detrimental to the business interests of the shopping district. It was urged that the new subway be made a deep tunnel and constructed by the boring process. The Rapid Transit Commissioners took the matter under consideration, and their decision will be made known at the next meeting on February 14th.

Counsel for the New York City Railway Company has turned over to Controller Metz a check for $133,000 to be applied on its debt to the city for unpaid car-license fees. D. E. P.

Southeastern States.

Charlotte, N. C., February 9.—The town of Lumberton, N. C., is offering for sale $5,000 worth of lighting bonds. R. C. Lawrence is town attorney.

Alderman Key of Atlanta has introduced an ordinance to prohibit any electric railway from charging more than one-cent fare from passengers who are not provided with a seat. The promise of the Georgia Railway and Electric Company to put on more cars on congested lines has resulted in the withdrawal of the ordinance for the present at least.

A bill has passed the lower house of the South Carolina Legislature to permit municipalities to sell water and light to residents living in the suburbs of such municipalities. The bill is not mandatory, however.

A resolution has been introduced in the City Council of Richmond, Va., to authorize a $1,000,000 bond election for public utilities, including the erection of a municipal lighting plant. The resolution is now in the hands of the finance committee.

The Tidewater Power Company, with $750,000 behind it, will ask the present session of the Legislature of North Carolina for the right to incorporate to transmit power from Bluitt's Falls to Wilmington, N. C. The new company will be a subsidiary one to the Rockingham Power Company, which is developing the Bluitt Falls. The Tidewater company has a tentative contract to receive 10,000 horsepower for 40 years from the Rockingham company. Twenty times as much power may be brought to Wilmington as is at present used there. The Rockingham company has a capital paid in of $4,800,000, with authority to increase to $8,000,000, and among those interested in the Rockingham company are E. A. Smith and F. Z. Mitchell of New York, M. F. H. Gouveneur of Wilmington, and Boston and Washington capitalists.

In a recent interview at Memphis J. K. Newman of the firm of Isidore Newman & Son denied that there would be a pooling of the earnings of the electric-railway properties in Memphis, Birmingham, Little Rock and other Southern cities in the American Cities Railways and Lighting Company, against the prospective organization of which suit has been instituted in Memphis. The American company will not change the corporate existence of the companies named one iota, according to Mr. Newman. "The American company is merely a grouping of the stockholders of the other companies for mutual protection. In the disbursements of dividends of the various companies these will go to the American Cities company." The latter is to have a capitalization practically equal to that of the component companies, $7,000,000 preferred and $12,000,000 common stock, held by about 4,000 individuals.

The town of Waynesboro, Ga., has sold $60,000 water and electric bonds to the Robinson-Humphrey Company of Atlanta, and has taken over the city lighting plant. D. H. L.

Michigan.

Grand Rapids, February 9.—"Jerry" Boynton, who has built many railroads—on paper—and of late has turned his atention to electric roads, has applied to the council of Grand Rapids for a franchise for an electric road through the city for the line from Alpena to Grand Rapids and Grand Haven and south to Battle Creek. Mr. Boynton says he wants to make this, his last project, his greatest. The company of which Mr. Boynton is president is known as the Grand Rapids Electric Railway Company. The franchise asked would give the company right-of-way on streets not occupied by the Grand Rapids Railway, but coming into competition with the latter company, and it is supposed that this is a part of the projected new city system of which some of the aldermen have been talking.

Detroit's municipal government, too, is taking an unusual interest in traction matters. The new mayor, William B. Thompson, is drafting an ordinance which will require a new schedule throughout the city and will require a big increase in the number of cars. The mayor is even considering the advisability of drafting a no-seat-no-fare clause into the ordinance.

The Board of Works of Wyandotte has recommended to the council that the present electric-lighting plant be modernized and equipped with the necessary machinery to produce all the current required and that an election be held to authorize the issue of $20,000 in bonds to provide for the improvements.

It is now stated that Alex Jacobi will remain with the St. Clair-Edison Electric Company, which has taken over the plant of the Mount Clemens company, as secretary-treasurer. John C. Hoetger, long with the Rapid Railway, has been appointed superintendent.

The Detroit Gas and Electric Fixture Company, capitalized at $15,000, has filed articles of association. Of the capital stock $10,000 is subscribed and paid in property. The shares are held as follows: William Ryan, Chicago, 75; Charles A. Coppock, Detroit, 20; Fred G. Lafferty, Detroit, 5 shares. B.

Indiana.

Indianapolis, February 9.—The promotion of traction lines in this state continues, and the indications point to a big year's work.

The bill introduced in the Legislature to discontinue the voting of subsidy aid to railroad companies failed of passage. In consequence subsidy elections will soon be held in several townships.

A conspiracy among several street-car conductors in Indianapolis to defraud the company has been broken up by the sentencing of two of them to the reformatory. The plan was to neglect to cancel a large number of tickets each day and turn them over to a third person to sell. The Criminal Court held it to be embezzlement under the statute. The court said, by virtue of his employment a street-car conductor is bound to return to the company even a ticket found by him on the floor of his car or on the street.

The city of Columbus is boasting of the cheapest street lighting of any city in the country. It is asserted that during 1906 the city paid only $31.03 for current for each of its street lamps. The city owns its own waterworks and electric-light plant, and there are 137 street lamps in the city. The city clerk figures that the cost of maintaining each for the year was the small amount named above.

The first meeting of the newly elected executive committee of the Central Electric Railway Association will be held in Indianapolis on February 13th. President A. H. Nichol will preside. It is said that one of the important matters to be dealt with is the reported falling off in the amount of interchangeable mileage handled during the last two months. Until November a notable increase, with a single exception, has been recorded since the first of 1906. The falling off has been more noticeable in Ohio than in Indiana. S. S.

Illinois.

Peoria, February 9.—The Gillespie Electric Light, Heat and Power Company and Benld Electric Light, Power and Telephone Company of Gillespie have consolidated under the name of United Electric Light and Power Company, with a capital of $30,000.

The Mount Carmel Gas and Electric Company of Mount Carmel has certified to an increase of capital stock from $150,000 to $250,000.

The village of Peoria Heights has signed a contract with the Peoria Gas and Electric Company of this city to light the village for five years. Arc lights are to be furnished at a rate of $67.50 per lamp per year.

Train dispatchers and telegraph operators on the Big Four have been granted an increase in pay, as have also the men on the Illinois Central Railroad.

As was expected, the Peoria and Pekin Terminal Railway Company was purchased by the Peoria Railway Terminal Company. The property was bid in for the bondholders at $600,000 and a deposit of $50,000 in stock was made to insure good faith. By this arrangement the original bondholders of the terminal company who formed the Peoria Terminal Railway Company have secured possession of the road. It is proposed to rebuild the line and make many needed improvements at once.

A number of the residents along the proposed electric-railway line from Mackinaw to Lincoln, together with William Evans and D. H. Sawyer of the Springfield and Northeastern Traction Company, held a conference with L. E. Fischer of the McKinley syndicate regarding the route of the proposed road. This road will connect at Mackinaw with the Peoria-Bloomington line and give Peoria direct connection to St. Louis via Lincoln and Springfield.

The electric limited service between Springfield and St. Louis has been doubled by the addition of four cars, giving service every two hours. The new cars are to be known as the Capital City Limited cars. The new sleepers between the same points are to be started Sunday, leaving each point at midnight and arriving early in the morning at St. Louis and Springfield.

Thieves cut down some of the new copper trolley wire that had never been used and only recently erected by the Illinois Traction Company on the Bloomington line in East Peoria this week. They were seen and scared away before they had secured more than 200 feet. V. N.

Northwestern States.

Minneapolis, February 9.—The Union Electric Company of Dubuque, Iowa, will probably extend its lines to neighboring mines to furnish power for operating them.

The Albia (Iowa) Electric Light and Power Company has sold its plant to Ross, Kimberly & Gant.

The La Crosse and Winona Traction Company has filed articles of incorporation with C. M. Morse of Winona, Minn., as president and S. H. Somsen, secretary. It is proposed to build a line from Winona, Minn., to La Crosse, Wis., and furnish both cities with power. The capital is $50,000.

The Charles City Water Power Company has applied for a power and light franchise at Charles City, Iowa.

The Mesabe Traction Company has begun surveying for its trolley line on the iron range in St. Louis County, Minn., connecting Virginia and Hibbing.

R. S. Feurtado of Chicago has submitted his estimate to the City Council of Fergus Falls, Minn., for a concrete dam and power house. He figures the cost at $49,600.

The Aitkin Power and Light Company has applied for a franchise at Aitkin, Minn.

The Marengo Interurban Railway Company has been incorporated. The purpose of the corporation is to build a trolley line from Marengo to Millersburg, Iowa.

The City Council of Eau Claire, Wis., has ordered a survey for a power dam to be made at Shawtown. R.

Pacific Slope.

San Francisco, February 7.—There has been much complaint in the manufacturing district south of Market Street owing to the lack of alternating-current motors which have been barred out with a few exceptions by the Pacific Gas and Electric Company since the fire. Great fluctuations on the voltage on power circuits have been complained of as well as numerous interruptions of the service for varying periods of time. Direct-current motors have often varied greatly from the required speed. Within a year two competing light and power systems will be giving service and alternating-current motors can then be installed.

The Standard Electrical Works has moved from the Atlas Building to a new two-story brick building at 60 Natoma Street, where the company's store and offices will be located until about April 1st, when the business will be moved to permanent quarters in the new Drexler Building at 125 New Montgomery Street, near Mission.

According to J. B. Rogers, chief engineer of the Ocean Shore Railway Company, the road will be completed as a single-track electric line from San Francisco to Santa Cruz by October next. About 20 miles of trackage is now in use, extending northward from Santa Cruz.

City Electrician Babcock in his annual report to the Board of Police and Fire Commissioners of Oakland, Cal., has recommended radical changes in

the location of the central station for the fire-alarm and police-telegraph system, which is now located in the third floor of the Fifteenth Street engine house. At the time of the earthquake on April 18th last the building nearly collapsed. In spite of the crippled condition of the system, he said, five alarms were received and sent out during the first four hours after the "shake," but he insists that the apparatus should be installed on the ground floor of a new building.

The Nevada Power, Mining and Milling Company, which transmits electric power from Bishop Creek, Cal., to Tonopah and other mining towns in Nevada, is making arrangements to increase the capacity of its generating plant. Additional machinery of 4,000 horsepower has just been installed and the management intends to increase this by 8,000 horsepower before long.

Sealed bids will be received by the mayor and City Council of Pasadena, Cal., at the city clerk's office until 10:30 a. m., February 26th, to furnish one 300-kilowatt steam-engine or steam-turbine, electric-lighting plant, completely erected, ready for operation, within a building to be furnished by the city. This plant shall be so arranged as to be an extension of the 200-kilowatt plant now in course of construction by the city.

Sealed bids will be received up to 2 p. m., February 28th, for the installation of electrical work at the United States Immigration Station on Angel Island. Particulars as to the conditions and limitations governing the bidders can be obtained upon application to the office of Walter J. Mathews, 969 Broadway, Oakland, Cal.

The Navy Department's new wireless-telegraph station at North Head, Wash., near the mouth of the Columbia River, is now in successful operation. Wireless communication has been established with San Diego, Cal., 1,600 miles south, as well as with the navy yards at Mare Island, Cal., and Bremerton, Wash.

The San Francisco Coke and Gas Company's stockholders will hold a special meeting on March 25th to vote upon the question of increasing the bonded indebtedness from $2,500,000 to $7,500,000. President Leopold Michels is authority for the statement that the directors recommended such action to enable the company to extend its mains, enlarge the gas plant and also to install a plant to generate and distribute electricity throughout San Francisco. He also said that the proposed increase in the capitalization of the company and its bonded indebtedness had nothing to do with any merger proposition in the light and power field.

W. R. Hewitt, chief of the Department of Electricity, recently filed with the San Francisco Board of Supervisors an estimate of $590,000 to cover the cost of construction and equipment of a building and repairs of works under his jurisdiction. Mr. Hewitt asked that the school lot on the north side of Grove Street between Larkin and Polk be assigned to his department. He estimated that it would cost $200,000 for the building, which will include general offices, machine shop, necessary switchboard machinery, motor-generators, battery room and underground testing plant. The police central station will cost $25,000 additional. The rehabilitation of the underground system in the burned district, the fire and police boxes and other equipment will require $275,000 more, while the repair of the overhead system will cost $50,000. He also asked for $40,000 for a stable, including horses and wagons for use of the department.

The John A. Roebling's Sons Company, wire and wire rope manufacturer of New York, will erect a five-story building on the northeast corner of Folsom and Hawthorne streets on a lot recently purchased for $60,000. The cost of the building, which the company will use for its offices and warehouse, is estimated at nearly $250,000. The new structure will be fireproofed throughout by the Roebling system.

The Lake County Electric Power Company has been granted a franchise to install an electric-light and power system within the town limits of Lakeport, Cal. The company will take its electric power from the plant of the Snow Mountain Power and Water Company, which is in course of construction on Eel River.

The Stanislaus Electric Power Company, through the Union Construction Company, a subsidiary concern, recently closed contracts with the Risdon Iron Works of San Francisco for the entire hydraulic equipment for its new plant near Vallecito, Cal., with the exception of the waterwheels and connections. The contract with the Union Construction Company calls for two riveted steel-pressure pipe lines, each approximately 3,800 feet in length, each line being 48 and 38 inches inside diameter. The Risdon company has the contract for the riveted steel header and connections connecting the two pressure pipe lines to the waterwheel units. It has also the contract for the mine pipe line on the opposite side of the river, leading from the power house to the top of the hill, for supplying mines with water from the power plant. The total length of the mine pipe is approximately 5,300 feet. The pipe lines will operate under a head of 1,500 feet of water. The diameters of the mine pipe line are 31 and 37 inches. The thicknesses of the riveted steel pipes in the pressure pipe lines and the pipe line and header vary from one-quarter to one inch.

A.

PERSONAL.

C. R. Jackson, an electrician of Indianapolis, Ind., died at Dwight, Ill., on February 11th from the effects of an electric shock, it is reported.

J. E. McGillivray, district manager of the Pacific States Telephone Company, with headquarters at Walla Walla, Wash., has resigned and will leave for the East. He will be succeeded by F. J. McGougan, formerly of Spokane.

Archibald T. Naugle of the Naugle Pole and Tie Company of Chicago was severely shaken up one evening last week when on trying to avoid being struck by a street car at Washington and Dearborn streets, he was knocked down by a bus.

John W. Lieb, Jr., vice-president of the New York Edison Company and of the American Society of Engineers, will deliver an illustrated lecture on "Vesuvius and Pompeii" before the latter organization on the evening of March 12th.

Thomas A. Edison was 60 years old on February 11th. His friends hope that he will live to be a hundred. According to the newspapers, he said that it was time for him to "knock off" work with electricity and play for a while. But as Mr. Edison's play is his work and his work his play, his friends do not imagine that his activity as an inventor will suffer a serious eclipse.

Hugh G. Neary has resigned his position as superintendent of the municipal electric-light plant at Troy, N. Y., to take the position of general superintendent of the American Construction Company of Albany, N. Y. When Mr. Neary assumed control of the plant in 1901 it was in debt over $5,000, but in less than two years the debt had been removed.

John F. Doyle, engineer of the North Shore Electric Company's plant at Waukegan, Ill., was instantly killed in the plant a few days ago from an electric shock. Mr. Doyle was standing on a box at the rear of the main switchboard. It is thought his hand touched a live wire and in jumping back the box tipped and he fell to the floor in such a position that his head touched an angle bar on the switchboard, causing a ground through his body of the 2,300-volt circuit. He was killed instantly, but there were no marks or burns on his person.

Frank P. Allen, Jr., manager of the General Engineering and Construction Company of Seattle and Portland, has been appointed director of works of the Alaska-Yukon-Pacific Exposition, which will be held at Seattle, Wash., during the summer of 1909. Mr. Allen gained his exposition experience at the Lewis and Clark Exposition at Portland in 1905, where he had charge of the structural work. After taking a course in civil engineering at the University of Michigan, he spent six years in Chicago specializing on structural work for bridges, railroads and large buildings.

ELECTRIC LIGHTING.

J. Shaw will install an electric-light plant in Chesaw, Wash.

A new electric-light plant will be installed at Deer River, Minn.

Nebraska City, Neb., will install an electric-light plant to cost $15,000.

The Argenta (Ark.) Light and Power Company will install a new light and power plant in that city.

The Pinckneyville (Ill.) Light, Ice and Power Company has incorporated with a capital stock of $20,000.

The Callicoon Electric Light, Heat and Power Company of Callicoon, N. Y., has been incorporated for $25,000.

Friend, Neb., will vote on the proposition of installing an electric-light plant. A. H. Frantz can give particulars.

About $80,000 will be expended by the government for constructing an electric-light system at Jefferson Barracks, Mo.

The electric-light plant at Thief River Falls, Minn., will be enlarged to double its size. The cost is estimated at $20,000.

The Buffalo (Iowa) council has granted a franchise to the Tile and Brick Company to establish an electric-light plant in that village.

The Artesia (N. M.) Ice and Light Company has been incorporated with a capital stock of $35,000 and will install a new light plant in that city.

The Compress Ice and Light Company of Gibsland, La., has been incorporated with a capital stock of $40,000 and will install a new plant in that city.

The Manufacturers' Electric Company has been formed at Reading, Pa., for the purpose of competing with the lighting company at present doing business in that city.

Tenders have been received by the city of Northport, Mich., for the construction of an electric-light system to cost about $10,000. W. R. Caldwell of Traverse City is the engineer.

An appropriation of $350,000 has been made for the purchase of new machinery and for making improvements to the electric-light plant and waterworks in the city of Morristown, Tenn.

The Independent Power Lighting Company of Davenport, Iowa, has received a franchise from the City Council. The capital stock of the company is $625,000. C. J. Von Maur is president.

The village of Duncombe, Iowa, is considering the idea of establishing an electric-lighting system, and at the last meeting of the council the matter was taken up and a committee appointed to ascertain the probable cost of the improvement.

The decision of the electric-lighting concerns of Jamestown, N. Y., to sell power in the future by meter, has caused quite a sensation among merchants and others using electricity. One firm has already begun to generate its own electric power.

Among the corporations recently authorized to do business in Pennsylvania are the Strasburg Electric Light, Heat and Power Company, Strasburg, Lancaster County, with $5,000 capital, and the East Stroudsburg Light, Heat and Power Company, East Stroudsburg, Monroe County.

With further reference to the street-railway, electric-plant and waterworks plans for Vladivostok, Siberia, concerning which details were recently printed in the Western Electrician, Vice-consul Nicholas Gray writes from Vladivostok that the business is still open to all the foreign capitalists, and if Americans desire to compete for it a representative should be sent immediately to Vladivostok to enter into negotiations direct with the city.

The Missouri Lead and Zinc Company of Joplin, Mo., will shortly begin the erection of a new steel addition to its power house. A new 1,000-horsepower engine and dynamo will be installed, and the remaining machinery for the new building is now on the ground. The company is closely associated with the Joplin Light, Power and Water Company, and the installing of this new machinery will enable it to increase its lighting facilities to a great degree.

ELECTRIC RAILWAYS.

The City Council of Opelika, Ala., has granted an electric street-railway franchise to H. L. McKee of Troy for 30 years.

The council of Virginia, Minn., has granted a franchise to the Mesaba Traction Company to use the city streets for an electric road.

The Toledo and Indiana Traction Company of Kendallville, Ind., has been incorporated with a capital of $100,000, to construct, maintain and operate street and interurban railways.

Robert W. Hunt & Co. have been appointed consulting engineers to the receivers of the Union Traction Company, Chicago, and placed in direct charge of the lowering of the car tunnels under the Chicago River.

A proposition is now being considered by a number of Dubuque (Iowa) people who have secured mining leases near the lines of the Union Electric Company, to install electric power in all of their mining operations.

C. S. Chestnut of Redlands, Cal., who recently secured a franchise to build an electric road from Redlands to Yucaipo, has incorporated a company with a capital stock of $1,000,000 for the purpose of constructing the road.

The Toledo (Ohio) and Fremont Construction Company has been incorporated with a capital stock of $10,000 to build a branch line of the Toledo and Port Clinton electric railroad from Oak Harbor to Fremont.

The New York, New Haven and Hartford Railway Company has decided to construct a power plant for the electrification of the main line, in the south end of the freight yard, convenient to the coal station at Bridgeport, Conn.

The Atlantic (Iowa), Northern and Southern Railroad Company has been incorporated with a capital stock of $500,000. The company hopes to build an electric road north from Atlantic to Kimbleton and Manning and south to Villisca.

The Rapid Transit Company of Philadelphia, Pa., has installed in its new power house at Delaware Avenue and Laurel Street a 6,000-kilowatt generator which is destined to help the company out of the difficulty of providing adequate power for its lines.

The Wisconsin Electric Railway Company, recently incorporated at Madison to operate in Milwaukee, it was said, has changed its name to the

Southern Wisconsin Traction and Light Company. It is now understood that the corporation will not operate in or near Milwaukee.

The Pennsylvania Railroad Company has under consideration a plan to substitute electricity for steam in its suburban station and feeding lines in Philadelphia. Whether the plan will be adopted will depend upon the report of a commission which recently returned from Europe.

The Rock River (Ill.) Traction Company, which now has $250,000 worth of bonds on the market, has issued a statement in which it is asserted that the section of road between Geneseo and Carbon Cliff will be the first to be built, and it is expected to have this in operation by April 1, 1908.

G. J. Sampson of Glasgow, Ky., is interested in a plan to build an electric railway from Bowling Green to Louisville, Ky. He is also interested in the Kentucky Central Traction Company, which will be incorporated March 1st. The road will be 27 miles in length and is estimated to cost $300,000.

The Minster, Loramie and Southern Railroad Company has been organized for the purpose of constructing and operating a traction line from Minster to Versailles, Ohio. The road will connect with the Western Ohio at Minster and the Southern traction lines operating in Darke County.

The Schoepf-Morgan syndicate will build a power house to cost $200,000, either at Lima, Ohio, or Bellefontaine, during the present year. The plant will probably be built at the latter place, in order to furnish power for the Lima-Bellefontaine-Columbus line to be built early in the spring, as well as to aid in operating the Lima and Toledo, now running cars as far north as Leipsic.

Consul James E. Dunning of Milan, Italy, reports that an electric railway 80 miles long, requiring a power plant of 30,000 horsepower, is to be built in Northern Italy from a seaport to an inland river port. Further details will be furnished by the consul at Milan. The name of the concern can be obtained by applying to the Bureau of Manufactures, Washington, D. C., and referring to file No. 686.

The bill has passed the United States Senate authorizing the Washington, Spa Spring and Gretta Railroad Company to extend its street railway into the District of Columbia, by either trolley or underground electric system. The company is also granted the right to construct telephone and telegraph lines in connection with its road. The work is to be completed within two years.

A newspaper dispatch says that a gigantic tri-state interurban plan is being worked out by the Murdocks of Indianapolis and Congressman McKinley of Champaign, Ill., by which Missouri, Kansas and Oklahoma will be connected with interurban lines north of St. Louis. The proposition involves millions of dollars, and the enterprise is said to be backed by unlimited Canadian capital.

Articles of incorporation have been filed in Ligonier, Ind., by the Wawasee, Ligonier, Topeka and LaGrange Railway Company, with a capital stock of $50,000. The purpose of the company is to build an interurban line connecting and operating in LaGrange and Wawasee, through Kimmell, Cromwell, Topeka and Ligonier, and to furnish light and power for commercial purposes. The headquarters of the road will be at Ligonier.

The consolidation of the traction interests operating between Erie and Buffalo, N. Y., which has been in progress for a year or more, has been practically completed. In all, there are now five traction enterprises merged in the Buffalo and Lake Erie Traction Company, and the latter has plans under way for the building of the links necessary to make the chain between Buffalo and Erie complete. The holding company is capitalized at $6,750,000.

Active steps are now being taken to construct an electric railway to the summit of the Matterhorn in the Swiss Alps. The line will be divided into two sections, the first being an electric railway from Zermatt to the Schwarzsee, at the height of 8,228 feet, and from thence by a tunnel under the Hörnli to the Matterhornhütte at an altitude of 10,013 feet. The second section will consist of a double-track electric-rope railway, passing through a nearly vertical tunnel, inclining only a few degrees out of the vertical, to the summit station on the north side of the Matterhorn, at a height of 14,682 feet, only 65 feet below the top of the mountain.

POWER TRANSMISSION.

George P. Baldwin will erect a new power plant on the Spearfish Creek, at Spearfish Falls, S. D., to cost about $500,000.

The Hudson River Water Power Company of Glens Falls, N. Y., has purchased a site in Hadley, N. Y., for the purpose of developing waterpower.

The Northern Light and Power Company of Red Bluff, Cal., will build two power plants on South Cow Creek, five miles apart, and of a capacity of generating 7,000 horsepower.

It is reported that the Green River Hydro-electric Company of Bowling Green, Ky., will shortly ask bids for the construction and equipment of its projected hydro-electric plant. H. von Schon of Detroit, Mich., is the consulting engineer.

A company has been incorporated at Johnson Falls, Wis., for the purpose of erecting a new power plant on the Peshtigo River at Johnson Falls. The capital is $600,000. C. O. Frank and J. A. Powers of Oshkosh are the incorporators.

The Tallapoosa Development Company has been incorporated at Montgomery, Ala., for $50,000 for the purpose of developing and utilizing the waterpower of the Tallapoosa River, to promote new industrial enterprises at Montgomery and other points.

A company has been organized to develop 100,000 horsepower on the Savannah River for the use of cotton mills and other industries in Western South Carolina and a portion of Georgia, the transmission lines in complete circuit covering about 200 miles. The entire development covers a distance of about 40 miles on the river. The capitalization of the undertaking will be approximately $8,250,000.

It is expected that the Susquehanna River Power Company will soon be in a position to begin the construction at Conowingo, Md., of its proposed waterpower electrical plant on the Susquehanna River. Its plans involve the construction of a dam estimated to develop from 50,000 to 70,000 horsepower for transmission by electricity for lighting and power purposes within a radius of many miles.

The lower part of Grandfather Rapids waterpower on the Wisconsin River, controlled by Wausau (Wis.) capitalists, it is said, will be developed in the spring. It will produce 10,000 horsepower. The men back of the movement are said to be the owners of the Wausau Street Railway Company, which expects to build an interurban line to Merrill and other points. It will cost $300,000 to build the dam.

In connection with the power plant on the Cumberland River near Corbin, Ky., there will be established a large electro-chemical reduction plant, the principal output probably to be aluminum. It is anticipated that the initial capacity of the hydro-electric plant will be 20,000 horsepower, most of this to be used by the reduction plant and the balance to be transmitted to industries in the Louisville district.

It is said that the Economical Power and Construction Company of Albany, N. Y., intends to construct plants in Buffalo, Rochester, Syracuse, Utica, Schenectady, Troy, Albany, Yonkers and New York city. This development is inferred as foreshadowing possible power distribution from Niagara Falls. The president and secretary of the company are, respectively, William K. McFarland and Burt L. Jones.

It is proposed to carry out on the Upper Rhine in Germany a project for utilizing the waterpower of that river for generating electricity in order to supply power to manufacturers of Upper Alsace and the Grand Duchy of Baden. The work will be carried on on similar lines to that followed by the power companies which have been utilizing the falls of Niagara for electrical power plants. The scheme includes two power houses, the first to generate 32,000 horsepower and the second 30,000 horsepower. The turbines will be capable of developing over 3,000 horsepower.

PUBLICATIONS.

The Allis-Chalmers Company is sending out a reprint of Bulletin No. 1038 on the subject of "Alternating-current Generators." This is mainly a "picture book," and the illustrations constitute its chief interest. The parts of machines are shown and there are some good pictures showing various plants equipped with these alternators.

Directions for erecting Gates elevators are contained in an instruction book just issued by the Allis-Chalmers Company of Milwaukee. The matter contained is plainly put, and, with the aid of excellent illustrations, will be found of general interest to the users of the elevator type of conveyors.

Bright, as befitting its name, is the February number of "Lux," published by the Nernst Lamp Company of Pittsburg. "That Brownsville Affair," "Thirty Hours of Sunlight in Thirty-one Days," "Electrical Economy," "Electricity as a Guide," and "Some Sis Hopkinsisms"—these are the titles of some of the articles.

The Cutter Company of Philadelphia, in its calendar for 1907, describes a number of electrical circuit-breakers manufactured by the company, among which are a single-pole I-T-E circuit-breaker with direct-acting time-limit attachment, type "W" circuit-breakers, single-pole overload "Midget Senior" type, single-pole, "Dal-ite" L-L type, "N-X" type double-pole dublarm circuit-breaker and a three-pole type "W" circuit-breaker. The halftone illustrations shown are of unusual excellence.

The Ajax Line Material Company, 12-14 South Jefferson Street, Chicago, has recently issued a catalogue descriptive of the company's products, consisting of specialties for electrical construction work. Among the lines described and illustrated are Ajax universal, swivel, socket, safety and clamp pulleys, Ajax rainproof rope, galvanized strand, Ajax pole lock, Ayer self-locking windlass, Ajax swinging insulator, Ajax bell alarm, Ajax universal, hooded, antique and forward poletops, Ajax pulleyed fixture, Ajax toggle bolt, etc.

The insulating varnish department of the Standard Varnish Works of New York city has recently issued another edition of "The Insulator," which contains several articles, among them being: "Protecting the Electromagnets of Telegraph and Telephone Instruments," by Thomas W. Wylie, chief of the Signal Corps, Department of Colorado, U. S. Army; "The Preservation of Underground Cables," by P. J. McGunigle; "The Vacuum Process of Impregnating Field and Armature Coils," a reprint. "The Standard Idea," the booklet says, "is a special electrical varnish for each and every special electrical need."

The Simplex Manual, issued by the Simplex Electrical Company of Boston, Mass., contains besides a description of the various Simplex insulated wires and cables, a number of tables which make the book a very convenient work of reference, valuable to all interested in the data of electrical wires and cables. Much information is given relating to the dimensions of copper wire, resistance of pure copper wire, diameters by different wire gauges, weights of copper wire, rubber-covered cables, lead-covered cables and wires, approximate diameters of cabled conductors, logarithms of numbers, equivalents of electrical units and specific gravity of metals, etc.

SOCIETIES AND SCHOOLS.

The dedication of the new Engineers' Building in New York city will be held on April 16th and 17th.

At the meeting of the American Institute of Electrical Engineers in New York on March 1st J. LeR. Hayden will present a paper on "Alternating-current Electrolysis," and A. A. Knudson one on "Electrolytic Corrosion of Iron and Steel in Concrete."

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at 32 Nassau Street, New York city, on March 27th and 28th, beginning at 10 a. m. All interested in the National Electrical Code are cordially invited to be present. C. M. Goddard of 55 Kilby Street, Boston, is secretary.

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MISCELLANEOUS.

The following is a floating newspaper paragraph: "A new alloy, which serves electricians as a substitute for platinum, consists of 16½ ounces of silver, 4½ pounds of nickel, one-half ounce of bismuth and 53 pennyweights of gold. The cost is about one-thirtieth of that of platinum."

Prof. D. C. Jackson of the University of Wisconsin is preparing plans for a cement plant to be erected near Portage at a cost of $400,000 by the Wisconsin Portland Cement Company of Portage. The plant will be operated with electric power brought from the dam in the Wisconsin River at Kilbourne.

Henry Strong, owner of the property at 165-187 Fifth Avenue, Chicago, has filed suit against the Union Elevated company and the four elevated companies using the loop to recover $125,000 damages. He asserts that the running of the elevated trains has injured his property and made it undesirable for renting purposes.

The Board of Trade of Atlantic City, N. J., has recommended to the City Council the removal of all overhead wires in that city. The Atlantic City Electric Light Company wants the city to construct the conduits, a work that will cost about $300,000, and the city may build a trunk conduit and lease it to the corporation.

The city of Edinburgh, Scotland, has abandoned the proposition of introducing electric street railways and will install a cable system instead on the Gilmore Place section of the street-railway system. The reason for the rejection of the electric system is said to be on account of the "unsightliness" of the overhead wires, residents of the "Athens of the

North," as Edinburgh is frequently termed, being possessed of pronounced esthetic propensities. The decision on the part of the Edinburgh authorities is somewhat unique, as the advantages of electric traction have been universally demonstrated.

A 10-horsepower electric motor has been installed to furnish power for hauling ice from Collins Lake, near Schenectady, N. Y., to the ice houses located on the Scotia Dyke, some distance from the lake. When the houses were first built animal power was used to do the hauling, and this was replaced by steam, which was in turn set aside for electricity. The ice is hauled along the long slide that connects the houses with the lake, at such a rapid rate that the old force used to store away the cakes had to be nearly doubled.

An addition has recently been built to the power house at Fort Madison, Iowa, from which is furnished the power to run the machinery in the Santa Fe shops. In the new part two heavy Ideal engines and two large dynamos are to generate power for operating the transfer table at the machine and locomotive shop and the turntables, and also to furnish light for the shops and yards. On the transfer table locomotives of the largest type are moved from point to point in the shop, the electric power being much more convenient than steam.

Acting on information that employes of the Department of Electricity of the city of Chicago were performing outside labor when they should have been engaged on city work, the Civil Service Commission made an investigation. Eight electricians admitted that, in connection with their city duties, they worked at different theaters, but declared that the extra work was performed after hours. "Our investigation did not show that the men had neglected their duties," said Commissioner Powell, "but we do not approve of city employes engaging in outside work."

A new portable apparatus has just been constructed at Cardiff, Wales, for the purpose of lighting miners' safety lamps in any part of the colliery. The invention is based upon results obtained from experiments with low-tension high-frequency currents made by Dr. J. C. Bowie of Cardiff. The appliance is capable of lighting 20 lamps per minute, but if intended for use in the lamp-room several lamps may be lighted simultaneously. A main feature of the apparatus is that it is impossible for any electric discharge to pass from it into the atmosphere of the mine.

Anent the recent letter of recommendation that the law shall be so amended that the government may be forced to pay for patents which it may have taken from government employes and used, a bill has been introduced to direct the secretary of commerce and labor to investigate and report to Congress what existing patents have been granted to officers or employes of the government upon inventions, discoveries or processes of manufacture or production upon articles used by the government of the United States and how and to what extent such patents enhance the cost or otherwise interfere with the use by the government of articles or processes so patented.

TRADE NEWS.

J. C. Steele & Son of Statesville, N. C., are in the market for electric equipment. Four motors will be purchased and other electrical machinery.

The Oppenheimer Electric Company of Augusta, Maine, has been capitalized at $500,000 for the purpose of manufacturing electrical machinery. J. Berry of Augusta is president and treasurer.

The Chicago office of Evans, Almirall & Co., engineers and contractors, has been moved from 1057-8 Monadnock Building, to 1208-9-10, same building. Mr. Benj. Kauffman is Chicago agent.

Bids will be received up to February 25th for installing a conduit and wiring system in the United States postoffice at Superior, Wis. James K. Taylor, Treasury Department, Washington, D. C., is the supervising architect.

A South African engineering firm with branches at several cities desires agencies for various American mining and electrical machinery. Information may be had by addressing the Bureau of Manufactures, Washington, D. C., and referring to file No. 682.

The Standard Electric and Chemical Company of Chicago has been organized with a capital stock of $10,000 for the purpose of manufacturing and dealing in electrical and chemical specialties. The incorporators are George E. Dierssen, George E. Fuller and Herbert Green.

The Sachs Company is the name by which the Arknot Company of Hartford, Conn., will in future be known. The change has been made, according to an announcement, in order to more closely identify the company with its products, the Sachs fuse and non-arcing appliances for any voltage. Joseph Sachs, well known in the electrical trade, is president of the company.

Recently the various branch managers and department managers of the H. W. Johns-Manville Company held their annual convention at the headquarters of the company, 100 William Street, New York. This company has a reputation as probably the largest manufacturer of asbestos, magnesia and certain electrical products in the United States, if not in the world, having factories at Brooklyn, Milwaukee, West Milwaukee and Hartford, Conn., and branch offices and warerooms in Milwaukee, Chicago, St. Louis and many other cities. Representatives from the various branches and factories were present and the meeting was not only profitable but interesting to everyone present. As a fitting finale, the convention wound up with a banquet at the Waldorf-Astoria on Friday evening, February 1st.

BUSINESS.

A carload of air brakes recently left the West Allis Works of the Allis-Chalmers Company, Milwaukee, eastward bound for foreign shipment. The air-brake department of the company has up to the present time been actively engaged in supplying the regular demands of domestic trade. The present shipment to a foreign country therefore marks a step forward for this additional line of production of the company. Air brakes are being used to a greater extent every year. The wonderful impetus of the last few years given to the building and operation of interurban and electric railways everywhere has greatly increased the demand in this country and abroad for brakes of this description. Many of the electric railways using power brakes of any kind are equipped with Christensen brakes, now manufactured by the Allis-Chalmers Company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 5, 1907.

842,849. Electric Heater. Arthur N. Anderson, Niagara Falls, N. Y. Application filed May 31, 1905.

The invention relates to an electric heater, particularly an electric flatiron, in which the resistance coil sections are connected in series, so as to form a zig-zag-shaped conductor. An electric insulating and heat-conducting filling is arranged in the shell or casing so as to surround the coil sections completely.

842,852. Electrical Contact Apparatus. James C. Boyd, New York, N. Y. Application filed December 16, 1905.

This device relates to apparatus intended automatically to shift the contact shoe in a third-rail system from one conducting rail to another by the movement of the car.

842,861. Auxiliary Fire-alarm Box. Frederick W. Cole, Newton, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, New York, N. Y. Application filed October 11, 1905.

Details for operating an auxiliary circuit in a fire-alarm system are described.

842,867. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed July 14, 1906.

A battery construction comprising a metal envelope having an auxiliary bottom of non-conducting material, a tube within the envelope, and a conduit exterior to and connected through the bottom with the tube, is described.

842,875. X-ray Tube. Mylius Ehrhardt, Berlin, Germany. Application filed October 18, 1904.

In a Röntgen tube of the kind described, the combination relates to an anticathode, a lead-glass tube inclosing this anticathode, a lateral opening provided in the tube and situated between the anticathode and the end opening of the tube, and a plate also located within the tube and situated about opposite to the lateral opening.

842,910. Wireless Communication. Greenleaf W. Pickard, Amesbury, Mass. Application filed November 30, 1906.

Of several claims the second is given: In systems of wireless communication means for shielding the wave-intercepter from static discharges, which means consists of a conductor having connected with it a plurality of impedance coils and non-inductive resistances. (See cut on next page.)

842,911. Electric Bell. Henry E. Reeve, Brooklyn, N. Y. Application filed October 4, 1905.

Features are a base, an electromagnet, a binding post and a contact post carried by the base, two independently adjustable contact screws carried by the contact post, a vibrator arm and two contact strips carried thereby for engagement with the contact screws.

842,918. Type-printing Telegraph. Edwin J. Steljes, London, England. Application filed April 17, 1905.

In combination in a typewriting transmitter with a key to a known Wheatstone transmitter pierced with a hole at its end, there are a connecting rod engaging the hole, a rock shaft, a crank upon the rock shaft operating the connecting rod and another crank upon the rock shaft and a vertical rod having a button thereon and actuating the transmitter crank.

842,930. Railway Switch. Thomas K. Wilson, Chillicothe, Ohio. Application filed November 18, 1905.

Electrically operated auxiliary locking mechanism is provided for the operating lever whereby the lever is maintained in "set" position without regard to the operation of the train-operated means for releasing the lock of the switch.

842,941. Insulator. Walter G. Clark, New York, N. Y. Application filed January 29, 1906.

A wire-carrying insulator elongated in the direction of the wire strain, is combined with a bracing means extending into the insulator on the general line of the elongation.

842,942. Wire Insulator. Walter G. Clark, New York, N. Y. Application filed January 29, 1906.

Combined with an insulator having an overhanging upper edge are wire clamps adapted to be secured to a wire, and to engage the insulator beneath the overhang.

842,945. Battery Element. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed February 1, 1906.

The element is described as a molded and baked carbon primary battery plate having a corrugated body provided with edge and interior bracing members, the interior bracing members being diagonally disposed to the corrugations.

842,950. Battery Cell. Hugo Gernsback, New York, N. Y., assignor to the Royal Battery Company, New York, N. Y. Application filed June 28, 1906.

The device consists of a number of battery cells secured together by a spacing member, a rod between the cells and having ends projecting beyond the cells, and a flexible handle secured to the ends of the rod, the rods being adapted to engage the spacing member for carrying the cells, and to be lowered between the cells to secure the handle close to the cells.

842,951. Ventilation of Electric Motors. George Gibbs, New York, N. Y. Application filed October 25, 1906.

In a system of ventilation for electric railway motors there is a combination of a truck having one or more motors and having a swivel connection with the car, the swivel connection having an air passage through the same, with a blower, an air conduit conducting air from the blower to the upper end of the air passage, and one or more pipes connecting the lower end of the air passage with the motor or motors.

842,954. Electric Sign. George Howe, New York, N. Y., assignor to the Metropolitan Engineering Company, New York. Application filed March 16, 1906.

A metal sheet having an integral character or letter formed by striking up the metal of the sheet is provided with openings in the struck-up portion to receive the sockets of electric incandescent lamps.

842,957. Electric Car and Locomotive. Coloman de Kandó, Budapest, Austria-Hungary, assignor to the Westinghouse Machine Company, Pittsburg, Pa. Application filed May 12, 1904.

In an electric vehicle are combined a frame, a motor, the rotating element of which is journaled in bearings carried by the stationary element, flexible means for supporting the motor, a crank shaft driven by the rotating element, and a bearing in the vehicle frame for receiving driving thrusts communicated through the crank shaft.

842,963. Dynamo-electric Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 9, 1905.

The invention consists essentially of a dynamo-electric machine, in which are a polyphase armature winding, a field magnet, a winding for each pole of the magnet comprising a number of equal sections, one-half of which are reversely wound relatively to the other half, similar sections of all the pole windings being connected in a group and all the groups being connected in series in a closed circuit, a many-part commutator connected to the points of connection between the several groups and having segments, varying progressively in width in accordance with a sine function, a polyphase arrangement of brushes bearing on the commutator, and connections for supplying to the brushes polyphase currents derived from the armature. (See cut on next page.)

842,966. Method of Operating Electric Motors, Generators and Other Apparatus. Ralph D. Mershon, New York, N. Y. Application filed February 1, 1904.

In electrical apparatus, in which magnetic poles are produced, and which is adapted for change of the number of poles therein, there is a method of varying the speed or frequency and obtaining a speed or frequency equivalent to an odd or non-integral number of poles. It consists in producing the poles with angular distances, between adjacent poles of opposite sign, corresponding to the desired speed or frequency, and where a continuation of such production of poles around the circumference of the excited element causes overlapping or interference of poles, dropping out one or more poles at such point. (See cut on next page.)

842,971. Winding Mechanism for Self-winding Electric Clocks. Henry W. Porter, Forestville, Conn., assignor to the New Haven Clock Company, New Haven, Conn. Application filed September 4, 1906.

Details are described.

842,978. Multipolar Service Switch. Howard R. Sargent, Schenectady, N. Y., assignor to the

General Electric Company, Schenectady, N. Y. Application filed September 3, 1901.

A device connected with the movable part is adapted to engage the carrier for clamping a fuse support in relation to the movable part and also may be released to leave the fuse support in connection with the metallic contacts.

843,005. Automatic Electric Time Switch. Leslie C. Dorland, Poughkeepsie, N. Y. Application filed June 8, 1906.

The opening and closing of the door of the casing operates the device.

843,033. Fluid-pressure Regulator. Walter J. Richards, Milwaukee, Wis. Application filed April 7, 1904.

In a fluid-pressure system are described a controller for the motor compressor, a shunt circuit around the main switch, a primary switch sensitive to the pressure of the fluid-pressure system adapted to close the shunt circuit, a motor-starting switch having its operating magnet included in the shunt circuit, and various other devices, one intended to short-circuit the main-switch magnet.

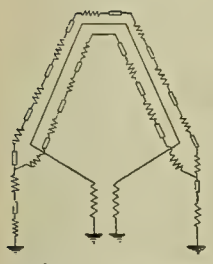
843,039. Train-dispatching System. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed July 9, 1906.

In a signaling system for electric railways, the semaphore is operated and controlled by electromagnetic means.

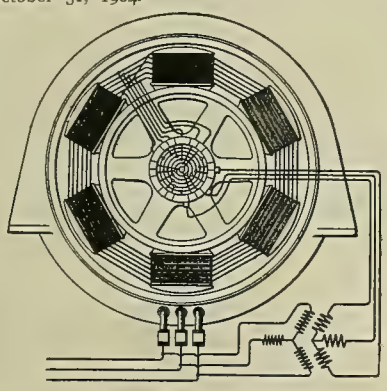
843,053. Telephone Switch. Klas Weman, Buffalo, N. Y. Application filed July 13, 1906.

In the switch there are combined a casing, comprising a shallow channel, having an extension provided with an upwardly curving end, a set of contact springs secured to the base of the channel, a tension spring secured to and projecting upwardly from the base, a lever connected with the tension spring and adapted to operate the contact springs, and an adjusting screw associated with the curved end of the extension, the adjusting screw being provided to limit the upward motion of the lever.

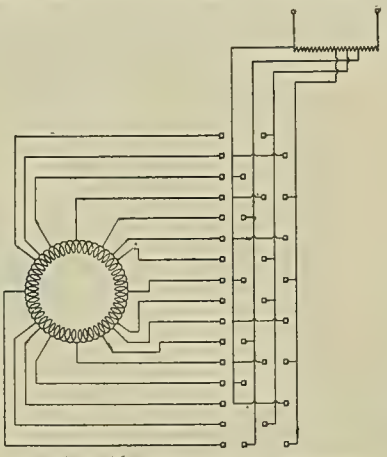
843,054. Incandescent Electric Lamp. Willis R. Whitney, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 31, 1904.



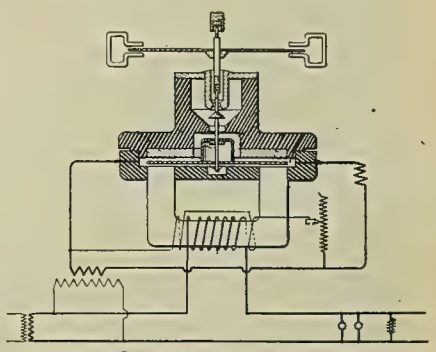
NO. 842,910.—WIRELESS COMMUNICATION.



NO. 842,963.—DYNAMO ELECTRIC MACHINE.



NO. 842,966.—OPERATION OF ELECTRICAL APPARATUS.



NO. 843,155.—ALTERNATING-CURRENT WATT-HOUR METER.

Combined with a lamp bulb having a re-entrant tubular portion, are tubular extensions thereof terminating within the lamp bulb, metal caps having a coefficient of expansion greater than that of the material of the lamp bulb and tightly clasping the ends of these tubular extensions and in intimate contact with the glass, and electrical connections on either side of each of the caps.

843,058. Fire Alarm. Gustaf A. Anderson, Kansas City, Kan., and Harvard O. Harpster, Kansas City, Mo. Application filed January 30, 1906.

There are electromagnetically operated means for releasing the detent from the locking means, and electromagnetically operated means for holding the detent in position for clearing the arm of the striker support.

843,070. Switch-operating Mechanism. Theodore E. Button, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 11, 1904.

The apparatus consists of an electric switch provided with an actuating spring, a lever having one end adapted to engage the spring, a motor crank connected to the center of the lever, and other means for actuating the switch.

843,078. Telephone System. Richard M. Eaton, Philadelphia, Pa., assignor to the Keystone Telephone Company, Philadelphia, Pa. Application filed March 30, 1904.

Combined with a line circuit in the telephone system are a number of stations common to the line circuit, a local-instrument circuit at each station, comprising a receiver, an induction coil, and a shunt to ground, an automatic switch coil at each station, operatively related to distinct switch members respectively connected to the opposite sides of the line circuit, and a manual switch at each station, arranged to connect its local-instrument circuit in a bridge across the line circuit and contemporaneously operate the automatic switches at the other stations, whereby the selected station is operatively connected with the line circuit, and the remaining stations are contemporaneously excluded from connection with the line circuit.

843,155. Motor-meter for Alternating Currents and Method of Operating the Same. Robert C. Lanphier, Springfield, Ill., assignor to the Sangamo Electric Company, Springfield, Ill. Application filed April 27, 1906.

In a motor watt-hour meter for alternating currents there are a chamber adapted to contain a conducting fluid, an armature rotatable therein, and a field magnet adapted to act upon the armature to cause rotation of an energizing winding for the magnet carrying current proportional to the load upon the meter, and a transformer having its primary winding in derivation to the load circuit and its secondary winding connected to terminals adapted to direct its currents across the armature. (See cut.)

843,182. Circuit-closing Mechanism for Indicators on Cars. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed May 17, 1905.

The trolley pole of the moving car, by striking a stationary projection, operates electrically the street or other indicator on the car.

843,186. Telephone Dictating Machine or Apparatus. Kelley M. Turner, New York, N. Y., and William F. H. Germer, Hoboken, N. J., Germer being assignor to Turner. Application filed April 30, 1906.

In the apparatus described, there are a manager's instrument having a transmitter inset therein, a loud earpiece also inset in the manager's instrument, a telephone receiver flexibly connected to the instrument and having a switch, by which either the receiver or the earpiece is included in the talking circuit, a receiving or stenographer's station also in the talking circuit, and an additional talking circuit, including the transmitter and a receiver at the stenographer's station.

843,189. Measuring Instrument. George M. Willis, Chicago, Ill. Application filed February 12, 1904.

In the instrument described, there are combined with an indicating needle, means for causing electric sparks to pass through the record sheet of the instrument and to the needle, and means for causing marking material to be carried by the electric discharge and imprinted on the record sheet in places corresponding to the positions of the indicating needle on its indicating scale.

843,245. Telephone Trunking System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 8, 1902.

Apparatus is described whereby, under certain conditions, the relay may be de-energized by the removal of the connection between the cord circuit and the trunk.

843,258. Insulator Clamp. Walter G. Clark, Seattle, Wash., assignor to the Clark Electric and Manufacturing Company of New York. Application filed June 12, 1905.

Combined with an insulator provided with a transverse groove and conducting wire therein, is a clamp adapted to be secured in the groove and comprising co-operating members interlocking one with the other and adapted to hold the wire in the groove in the insulator.

843,259. Insulator. Walter G. Clark, Seattle, Wash., assignor to the Clark Electric and Manufacturing Company, New York. Application filed July 20, 1905.

The insulator is formed with a groove in its top for the wire, a widened cavity or passage way at the central portion of the insulator extending to the top of the insulator for the insertion of a wire-holding clamp, and recesses or undercut portions at each side of the widened cavity, with projecting shoulders above the recesses for receiving and retaining lugs on the clamp to hold it in place.

843,261. Electric Tram Car. George J. Conaty, Smethwick, England. Application filed July 6, 1906.

A four-wheel electric tram car or truck, with two pairs of bearing boxes held against lateral and longitudinal movement, two radially moving axles having their ends supported to have longitudinal movement in the bearing boxes, and an electric motor for driving each axle. The arrangement is such that the motors have the same radial movement as the axles.

843,266. Synchronizer. William H. Freedman, Burlington, Vt. Application filed June 13, 1903.

It comprises a magnetic ring wound to produce a rotating field, a magnetic bar mounted in the plane of and concentrically with the ring and also having the magnetic windings, and means for connecting ring and bar respectively to the two currents to be synchronized.

843,267. Frequency Meter. William H. Freedman, Burlington, Vt. Application filed September 18, 1903.

The instrument which is used for alternating-current circuits includes a fixed and movable element, which carry rotating magnetic fields, interacting on each other, both elements having energizing coils, and means for connecting the circuits of the coils in parallel to the terminals of the circuit to be measured, the constants of the circuits differing from one another.

843,270. Circuit-catching Device and Electrical System for Use in Conjunction with the Same. Albert H. Graves, Chicago, Ill. Application filed May 8, 1903.

The apparatus is designed to be used in a telephone system. It combines with an electric circuit, a source of current supply connected with the circuit, a condenser and a circuit-catcher magnet interposed in the circuit, a resistance and key-controlled circuit connections whereby the resistance may be interposed between the source of current supply and the condenser and cut out of the circuit at will.

843,276. Automatic Electric Switch. William F. Irish, East Orange, N. J. Application filed July 16, 1904.

In the switch are two levers mounted upon adjacent centers and having a loose engagement with each other, a spring joining the remote ends of the levers, switch contacts controlled by one of the levers and operating devices connected to the other lever.

843,281. Lamp Socket for Incandescent Lamps. Charles M. Keier and Edwin W. Keier, Toledo, Ohio. Application filed July 11, 1904.

In the device described are a pair of porcelain blocks oppositely recessed to form a chamber, a pair of coiled springs in the chamber, a contact plate supporting the springs, a pair of contact pieces adapted to contact with the plate, an external key extending into the chamber, and means upon the key for actuating the plate.

843,283. Electric Signal. Charles L. Krum, Chicago, Ill. Application filed January 10, 1903.

Details are described.

843,286. Power-transmission Mechanism. Robert H. Little, Chicago, Ill., assignor to Talbot & Holst, Chicago, Ill. Application filed December 11, 1905.

With an electric motor are combined a load-actuating element to be driven thereby, a switching mechanism controlling the circuit of the motor and effecting intermittent operation of the motor and the element controlled thereby, the mechanism including a circuit opening and closing switch element, a releasing device permitting the switch to close and a clutching mechanism engaging the switch element to open the circuit, and a traveling weight governed by the motor and thrust thereby into engagement with the releasing device to close circuit through the motor.

843,287. Electric Motor. Andrew T. MacCoy, Dover, Mass. Application filed March 15, 1905.

The motor comprises a series of field-magnet poles of alternate polarity, a rotatable armature having a non-rotatable coil, means rotatable independently of the armature for changing the direction of the current delivered to the coil, and positive means for preventing reverse rotation of the armature, against which means the armature is held when a constant current passes through the coil.

843,296. Telephone Relay or Repeater. Albert L. Parcelle, Boston, Mass. Application filed October 12, 1900.

The relay or repeater comprises a receiver circuit having a confined mass of granular material of variable conductivity, a two-part magnet, one section of which is permanent and the other of which is electrically magnetized, the sections having their poles oppositely disposed and movable one toward the other, the granular material being placed between the poles and being compressible thereby, and a transmitter circuit connected with the electrically magnetized section of the magnet.

843,305. Trolley Wheel. Adam A. Schneider, Camden, N. J. Application filed April 30, 1906.

The disks of the wheel are non-rotatably mounted on the shaft.

843,310. Incandescent-lamp Socket. George B. Thomas and Gilbert W. Goodridge, Bridgeport, Conn., assignors to the Bryant Electric Company, Bridgeport, Conn. Application filed July 5, 1906.

In incandescent-lamp sockets are provided a cap and shell and means for fastening the same together, the means consisting of straps punched from one part, tongues punched from the other part and interlocking with the straps on rotation of the parts when together, and a projection borne by one of the tongues to act as a catch in connection with one of the holes formed by the punching of the straps.

843,312. Magnetic Work Holder. Walter N. Vance, Chicago, Ill. Application filed September 20, 1906.

Combined with the machine bed of magnetic metal, and the magnetic work-holder, designed to hold a piece of work of magnetic-metal work to the bed, is a supplementary lift, made of magnetic metal in shape and form to correspond to the magnetic metal of the holding magnet, and having non-magnetic parts so arranged that, when the lift is placed between the magnet and the bed, or attracted part, the lines of magnetic force will be compelled to pass through the said bed or attracted part.

843,316. Attaching Means for Electric Lamps. Earl G. Wilson, Morrow, and William B. Goodwin, Columbus, Ohio. Application filed December 4, 1905.

Details are described.

843,317. Electromechanical Apparatus for Shaving or Slicing Beef. Frank H. Wurzbacher, Washington, D. C. Application filed September 15, 1905.

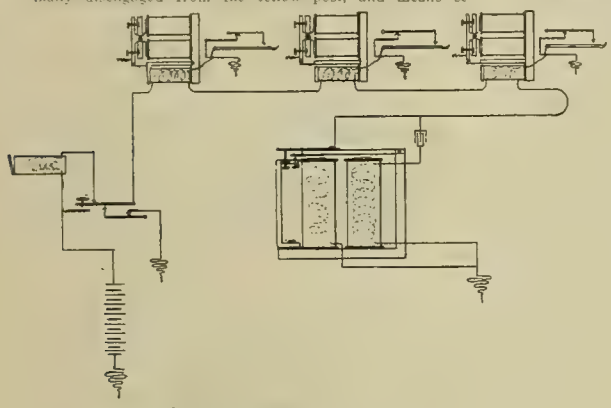
Details are described.

843,321. Electroplating Apparatus. Herman R. Boissier, Great Neck, N. Y. Application filed November 25, 1905.

Combined with a tank having means for conducting a current thereto, are a movable receptacle for the articles to be plated, located within the tank, and an eccentrically mounted rotary electrode, located adjacent to the receptacle, but exteriorly thereof.

843,327. Automatic Circuit-closer. Leandre Charbonneau, Woonsocket, R. I. Application filed November 21, 1906.

The device comprises a number of independent suitably mounted current-conducting binding posts, adapted to be located in an electric circuit, and also adapted to be secured to the respective terminals of a main conductor, a substantially horizontal self-dropping, current-conducting contact member in continuous engagement with one of the posts and extending through but normally disengaged from the fellow post, and means secured to the movable contact member capable of being fused at a comparatively low degree of heat, so as to release the latter from its normal position, and close the circuit by gravity action, the action being irrespective of the plane in which the posts are located with respect to the movable member.



NO. 843,270.—CIRCUIT-CATCHING DEVICE.

843,329. Intercommunicating Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 15, 1903.

In the intercommunicating system described are combined with a single source of current, for both talking and signaling, three conductors for each sub-station, consisting of an individual metallic circuit and an individual signaling wire extending throughout the system, and means at each sub-station for calling and talking with any other party connected with the system.

843,352. Process of Making Insulators. Louis McCarthy, Boston, Mass. Application filed March 8, 1906.

The process comprises the forming of an interior layer of insulation in a coupling, which consists in inserting a collar in each end of the coupling to form a shoulder on the insulation, manually inserting the insulating material in a plastic state and subjecting the same to pressure by means of a tapered mandrel.

843,354. Electrode for Therapeutic Use, etc. Everett T. Nealey, Bangor, Maine. Application filed May 14, 1906.

An electrode of the kind described, comprises a porous terminal and a hollow support of insulating material, containing a liquid conductor.

843,362. Attachment for Mouthpieces of Telephone Transmitters. William C. Plank, Las Flores, Mexico. Application filed August 1, 1906.

The attachment includes a series of concentric linings of antiseptic paper, a number of ears projecting from the outer lining, a projection extending from all the linings, and a series of perforations in alinement with one edge of the projections.

843,373. Trolley. John Struth and Conard Holzapfel, Primrose, Pa. Application filed June 23, 1906.

Various details of the trolley harp are described.

843,414. Optical Reading Device for Electrical Measuring Instruments. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds & Northrup Company, Philadelphia, Pa. Application filed March 27, 1906.

Mirrors and a telescope are arranged in such a manner that the scale of the instrument may be read easily.

843,415. Electrical Synchronism. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds & Northrup Company, Philadelphia, Pa. Application filed October 18, 1906.

Combined with one or more coils arranged to develop a periodically varying electric current, are a circuit, including the coils and a synchronizing ohmic resistance, which decreases as the current through it increases, means to vary the load of the resistance on the coils at unvarying intervals, once for each electric impulse developed by the coils or multiple thereof, the natural frequency of which intervals is less than the natural frequency of the electric current, the latter being damped down to synchronism with the period of the load varying means by the load of the resistance.

843,418. Single-rail Electric Overhead Railway with Suspended Vehicle. Hippolyte Romanoff, St. Petersburg, Russia. Application filed June 1, 1905.

Mechanical details are described.

843,425. Incandescent-lamp Socket. Frederick Wunderlich, Swissvale, Pa. Application filed November 28, 1906.

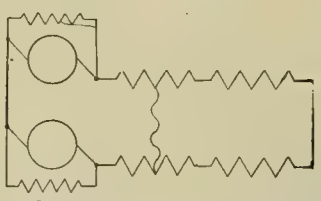
Combined with a socket having a threaded shell, in an incandescent bulb lock, are a spring secured to the shell and protruding therein, a threaded sleeve adapted to engage in the shell and having a beveled groove to receive the end of the spring, and an outer casing detachably secured to the socket and bearing upon the spring.

843,441. Electric Insole. Henry O. Can Dee, Syracuse, N. Y. Application filed February 7, 1906.

The inventor describes a voltaic couple applied to the metal base-plate of an insole.

843,445. Trolley-controlling Device. Jonathan Dale, Kinston, N. C., and Harvey Le Roy Dale, Newport News, Va. Application filed July 9, 1906.

The device includes a spring-actuated drum for initially controlling the trolley-pole-manipulating line.



NO. 843,489.—PARALLEL RUNNING OF DYNAMOS.

843,473. Switching Device. John N. Makley, Edward F. Manett and Frank M. Dannelly, Dallas, Texas, assignors to the Standard Electric Company, Dallas, Texas. Application filed July 17, 1906.

In the switch-thrower described there are a contact-making device interposed in the main circuit and insulated therefrom, a circuit-changer having a core magnet provided with a movable armature, and in electrical connection with the contact-making device and the circuit of the main line, switches for the electrical connection, a series of contact plates arranged in the circuit-changer, a motor having electrical connection with the contact plates, and other features.

843,489. Parallel Running of Dynamo Machines. Charles A. Parsons and George G. Stoney, Newcastle-upon-Tyne, England, Stoney being assignor to Parsons. Application filed July 25, 1905.

Combined are two or more of continuous-current dynamo machines having series coils compensating for armature reaction and compounding the machine, the coils being divided into two parts, one of which compensates for armature reaction, while the other gives the compounding, reverse compounding turns, and an equalizing wire cross-connecting certain points within the compensating windings of the two machines. (See cut.)

843,508. Printing Telegraph. James D. White, London, England. Application filed July 3, 1906.

The apparatus comprises rotary adjustable printing type, a series of electromechanical devices, each giving a different throw to the printing type, a main-line circuit, a series of selective branch circuits, all connected to the main line and each connected to and operating its own electromechanical type-moving mechanism, each of the selective branch circuits comprising a local-battery circuit with two paths, one of which paths passes through the electromechanical type-moving device, and an electrically differentiating device in the branch circuit acted upon by differentiated impulses of the main line, and adapted to throw each local branch circuit through either of its two paths to operate or not operate the electromechanical type-moving mechanism.

843,515. Process for Electrically Welding the Longitudinal Joints in Tubular Objects. Emil Bier, London, England. Application filed September 10, 1906.

Longitudinal joints of tubular objects, such as boiler shells, tubes, pipes, etc., are electrically welded by means of induced current produced within the tubular objects, the longitudinal edges of the objects being formed to obtuse angles and pressed against each other during the welding process.

843,520. Electric Tram System. Orrin J. Davy, Washington, D. C., assignor to the Industrial Motor Company, Washington, D. C. Application filed November 5, 1906.

In the system described are a carrier, a seat located upon the carrier, a swinging back attached to the seat, a swinging trolley attached to the carrier, a means connecting the trolley with the seat back, to cause the same to swing simultaneously, and at all times incline in the same general direction with relation to the seat, and a spring attached at one end to the seat back, and at the other end to the trolley.

843,533. Induction Vapor or Gas Electric Lamp. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed April 18, 1900.

A vapor or gas device has an inclosing chamber, a primary exciting coil, the vapor or gas constituting a secondary circuit for the primary, and having such quality as to be traversed by induced electric currents and absorb practically all the energy from an oscillatory circuit in the first oscillation, and means for transmitting rapidly varying electric currents through the primary, thereby rendering the secondary luminous.

843,534. Method of Producing Electric Light. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y., Original application filed April 18, 1900. Divided and this application filed September 28, 1900.

The method of producing light from the energy of a varying electrical current consists in opposing to the flow of the current through a circuit a counter electromotive force approximately equal to the applied electromotive force, and subjecting an inclosed gas or vapor to the inductive influence of the circuit, thereby modifying the counter electromotive force in proportion to the energy consumed by the current traversing the gas or vapor.

843,541. Inductor Magneto Alternator. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company, New York, N. Y. Application filed December 11, 1905.

This inductor magneto alternator comprises a permanent magnet formed of a permanently magnetized ring wound from a continuous hardened-steel ribbon, laminated polar projections adjacent to the consequent poles of the magnet, the poles being bifurcated, stationary windings surrounding two of the diametrically opposite bifurcations and an inductor rotor adapted to modify by its rotation the distribution of the magnetic flux through the oppositely disposed bifurcations, whereby the reluctance of the magnetic circuit comprising the permanent magnet, the bifurcated polar projections, the inductor rotor, and the air gaps existing between the rotor and the polar projections is kept down to a fairly constant value.

843,549. Receptacle for Elements. Heinrich P. R. L. Pörscke and Gustav A. Wedekind, Hamburg, Germany, Pörscke being assignor to Wedekind. Application filed July 25, 1904.

The battery-container electrode has walls of cast-iron bulging outwardly to co-operate with the opposite electrode, a number of dovetailed holding projections formed on the inside of the bulging walls and hardened coherent copper oxid material on the walls, engaging the projections, forming a substantially flush surface.

843,550. Electric Signaling System. Frank W. Prentice, Chicago, Ill. Application filed March 24, 1906.

In a railway cab and block-signaling system there are a series of blocks, generators of Hertzian waves for respective blocks normally operative to propagate oscillations along an adjacent block, when the respective blocks are safe, track circuits controlling the respective generators and operative to stop the generators when the corresponding blocks are at danger, and means on a car or train to indicate the presence or absence of oscillations from the generator of the block being approached.

843,553. Fuse Box. Charles A. Rolfe, Rochester, N. Y., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed April 19, 1905.

In the fuse-box, combined with the casing, are a block of insulating material, devices for removably securing the block to the bottom of the casing, the block being provided with a longitudinally extending slot or groove, and a cross slot or groove, a fuse-holding device adapted to fit in the longitudinally extending slot or groove and provided with a projection adapted to fit in the cross slot.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 11, 1907:

420,954 and 420,955. Electro-mechanical Movement. Samuel E. Nutting, Chicago, Ill.
420,964. Electric Vote Indicator and Recorder for Legislative Bodies. William H. Robinson, Rochester, N. Y.
420,975. Storage Battery. Charles Sorley, New York, N. Y.
420,984. Lightning Arrester. George G. Beyne, Fremont, Neb.
421,006. Telephone Transmitter and Receiver. Hosea W. Libbey, Boston, Mass.
421,011. Attachment for Telephones. George F. Newland, Detroit, Mich.
421,053. Thermo-electric Resistance Regulator. Samuel E. Nutting, Chicago, Ill.
421,088. Conduit for Electric Cables. William P. Tyler, Boston, Mass.
421,090. Starting Switch for Electric Motors. William A. Anthony, Manchester, Conn.
421,169. Electric Battery. Ernest M. G. Hewett, Newton, Mass.
421,177. Safety Device for Electric Circuits. Hermann Lemp, Lynn, Mass.
421,185. Electric Soldering Iron. Willard M. Miner, Plainfield, N. J.
421,193. Transmission of Power by Electricity. Edwin W. Rice, Jr., Lynn, Mass.
421,195. Motor for Electric Regulating Apparatus. Friedrich Ross and Asmus Franzen, Vienna, Austria-Hungary.
421,207. Cut-out for Incandescent Lamps. Elihu Thomson, Lynn, Mass.
421,208. System of Distribution for Alternating Currents. Elihu Thomson, Lynn, Mass.
421,214. Telegraphic Sounder. George W. White, Huntsville, Ala.
421,239. Railway Electric Signal. Paul D. Cable, St. Louis, Mo.
421,240. Thermal Cut-out. Philip Cardew, Chatham, County of Kent, England.
421,304. Trolley for Electric Railways. Frank B. Rae, Detroit, Mich.
421,305. Overhead Trolley for Electric Railways. Frank B. Rae, Detroit, Mich.
421,320. Collecting Contact for Electric Machines. Albert Schmid and Edward C. Means, Allegheny, Pa.
421,340. Electric Compound Push. John F. Wollensak, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XL. CHICAGO, FEBRUARY 23, 1907 No. 8

Operating Features of the Chicago Freight Tunnels.

Readers of the Western Electrician are familiar with the details of construction, plan and purpose of the underground electric freight transportation system in Chicago operated by the Illinois Tunnel Company. Not a little has been published in this journal also in relation to the automatic telephone system, the cables of which are carried in these tunnels. At the time of the last preceding account there was nearly 40 miles of subway installed, being in practically every street in the Union Loop or central business district and extending short distances under the Chicago River. Since then the tunnels have been extended, until there are now 46 miles completed, reaching beyond the river, north and west, and going under the river in 11 different places. Further extensions are to be made. The bottom of the tunnels is about 40 feet below the street level.

It will be of interest now to consider briefly the operations of the company—what class of freight is being handled, in what quantities, and in what manner. The tunnels now cover the territory from Erie Street, eight blocks north of the river, to Sixteenth Street on the south, and from Lake Michigan to Halsted Street, five blocks west of the river. Permanent track has been laid in 41.53 miles of the subway, and 39.67 miles of permanent trolley has been installed. Over 40 miles of the system has its permanent lighting system installed, consisting largely of incandescent lamps supplied by current from the Chicago Edison Company. Duplex lead cable for lighting is installed in 25 miles of the tunnel, 15 miles being equipped with No. 6 weatherproof wire.

Except in several instances of steep grade where the tunnels are brought to the surface, the overhead trolley is the only means of motive power. On one or two of the grades mentioned a rack-and-pinion arrangement is used for safety and tractive power. The voltage on the trolley line is 240. Several systems of electric signaling for train operation are being tested.

In Fig. 1 is shown a typical basement connecting with the tunnels, showing trolley and track system and electric locomotive. Fig. 2 shows a car of merchandise for the first freight train leaving a big freight house on the day of opening the subway to freight traffic, August 15, 1906.

There are now in operation in the tunnels 65 electric locomotives and 590 cars. The locomotives are of several types and were built by the Morgan Electric Machine Company of East Chicago, the General Electric Company, Jeffrey Manufacturing Company of Columbus and the Goodman Manufacturing Company of Chicago. Some of these machines were fully described in the Western Electrician of November 10, 1904. That built by the General Electric Company is shown in Fig. 7, on a succeeding page. The Baldwin Locomotive Works is now building still another locomotive for trial.

By February 1, 1907, practically all of the railway passenger stations in Chicago were connected with the Postoffice through the tunnels. Nine of the principal railway freight houses had tunnel connections and others were being connected. Two coal-carrying railroads have special connections for carrying coal to the basements of downtown buildings.

At present some 20 of the large buildings in the business district have their basements connected with the tunnels and are enjoying the underground freight service. It is said that the plans of all new buildings include provisions for tunnel service, and many of the old buildings are arranging to connect.

The first freight business done by the Tunnel company was the removal of earth from excavations in the preparation for the construction of new buildings. This is now an important part of the company's business. This plan has many advantages over the old method. In the construction of several large buildings all the earth excavated was lowered into the tunnels and taken to the dumping grounds, and new material for the foundations taken in through the bores, with no inconvenience to the public. By the tunnel method there was removed from one basement over 2,100 cubic yards of excavation in 24 consecutive hours. The best record by teams in 24 consecutive hours, under similar conditions, is said to be 420 yards, and to do this the contractors were required to stop overhead work entirely. The tunnel method allowed the progress of overhead work without hindrance.

Many of the newer buildings in Chicago are constructed with three and four-story basements of sufficient depth so that the lowest basement is on a level with the tunnels. This offers excellent opportunity for the economical handling of coal and ashes and for loading and unloading merchandise.

Figs. 3, 4 and 5 show connections and sub-basements at Marshall Field & Co.'s retail store. Fig. 6 is a sectional view through the Chicago and Eastern Illinois Railway coal chutes. Various

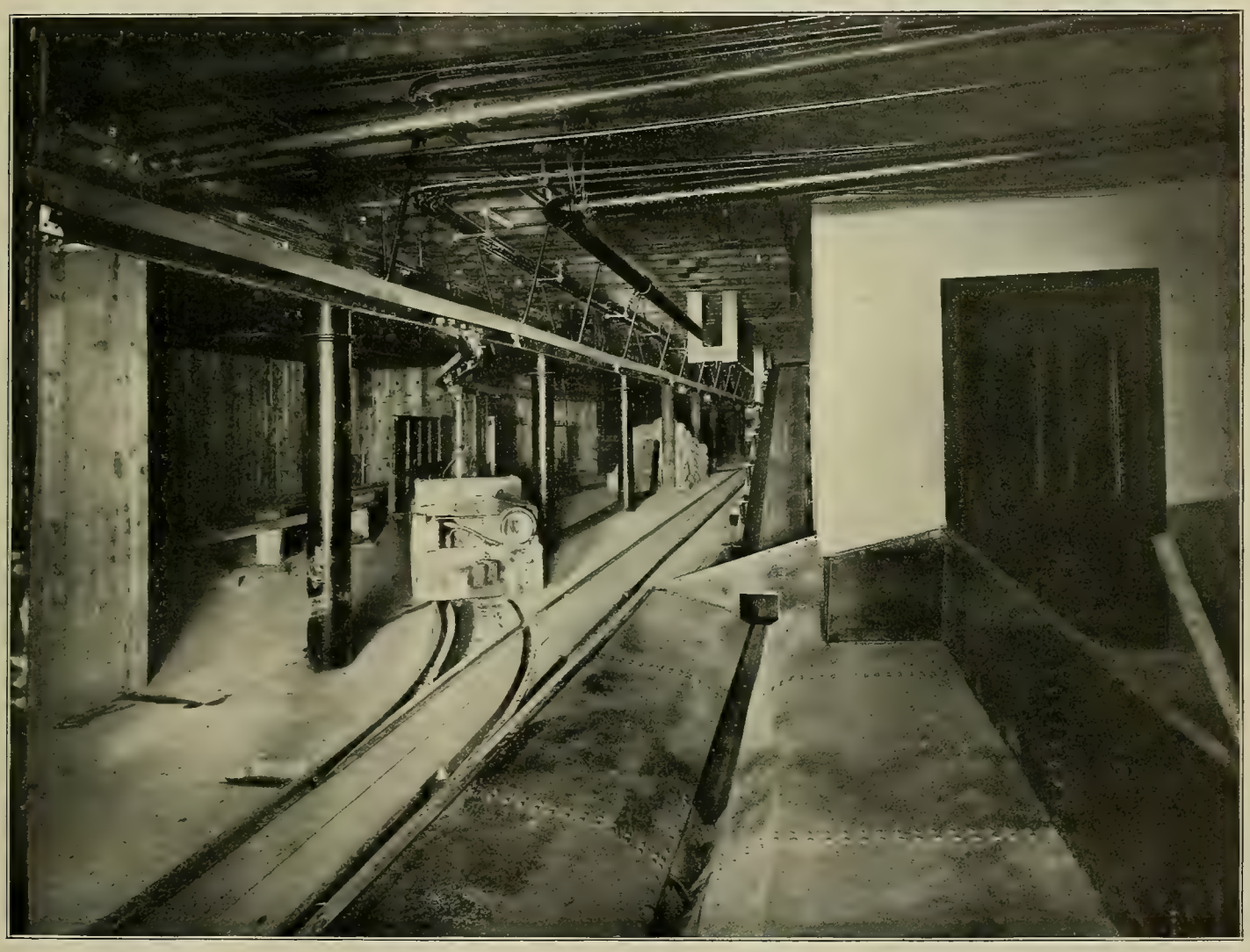


FIG. 1. TYPICAL OFFICE-BUILDING BASEMENT CONNECTION WITH CHICAGO FREIGHT TUNNELS, SHOWING COAL CONVEYOR AT THE RIGHT.

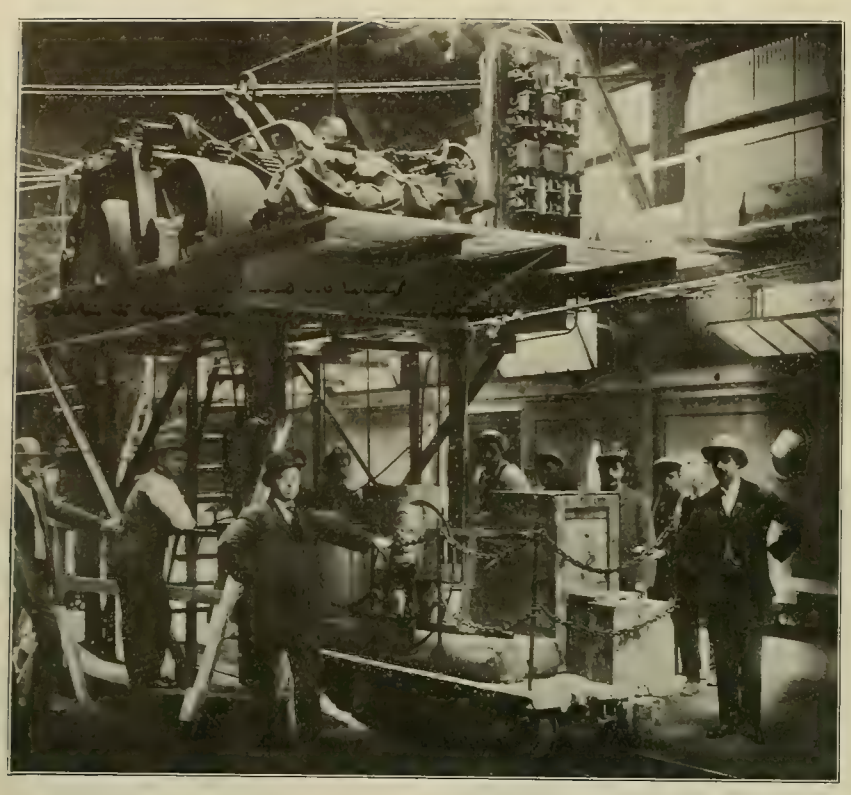


FIG. 2. FIRST CAR OF FREIGHT ENTERING TUNNEL ELEVATOR IN A RAILROAD FREIGHT HOUSE.

plans are used in making the building and freight-yard connections, those shown being among them.

Where it is not practicable to sink sub-basements under buildings already constructed the tunnel connection is made by shafts in which the cars are raised and lowered by electrically operated elevators. This is also the usual method of making the railway freight-yard connections.

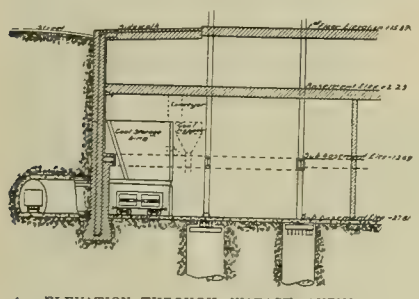


FIG. 4. ELEVATION THROUGH WABASH AVENUE END OF RETAIL-STORE TUNNEL CONNECTION.

Fig. 2 is a reproduction of a photograph taken at the time of the opening of the Chicago subway for freight traffic. The car shown is one from the first tunnel train sent out from the Chicago, Milwaukee and St. Paul Railroad freight house. The cars of the train were individually lowered into the tunnel by the elevator, shown in the picture. The locomotive is not raised to the surface; the cars, when not easily movable by hand, are drawn to and from the elevator platform by a cable.

Fig. 1 is a typical basement storeroom equipped for handling coal and freight from the tunnels. The track, trolley and locomotive are shown. By the side of the track is the conveyor belt for taking coal to boilers in the rear.

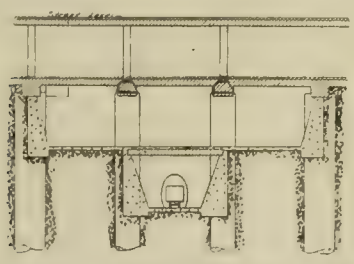


FIG. 5. SECTION THROUGH STATE STREET TUNNEL ENTRANCE AT LARGE RETAIL STORE.

Besides the coal and ash handling done through the tunnels, the freight yards and stores connected transfer much of their freight and merchandise in the tunnel cars. Merchandise trains are usually made up of seven or eight cars.

The tunnel company has for some time been transferring the United States mail between the Postoffice and the railroad stations, thereby permitting the removal of most of the clumsy mail wagons from the streets. Some trouble was encountered in getting this service into working order, which might be expected when the size of the undertaking is considered. Officials of the company are confident the service will prove satisfactory to the government. In one day last month 772 mail trains were run. They carried 27,250 mail bags, 2,209 parcels and 63 packages. The mail-handling apparatus has been described in the Western Electrician.

The automatic telephone system operated in connection with the tunnels is to be greatly extended, according to an official of the company, as soon as maturing plans for the development are worked out. It is not stated whether the tunnel company will develop the system or whether the telephone rights will be taken over by a combination of Independent telephone interests. In any event the system is to be extended throughout the city, it is said, and an opportunity afforded for outside Independent telephone companies to get their lines into Chicago.

The report of earnings from the subway for the year 1906 gives the amount as $221,176, compared with $108,300 for the year 1905. The present year will probably see this amount greatly increased.

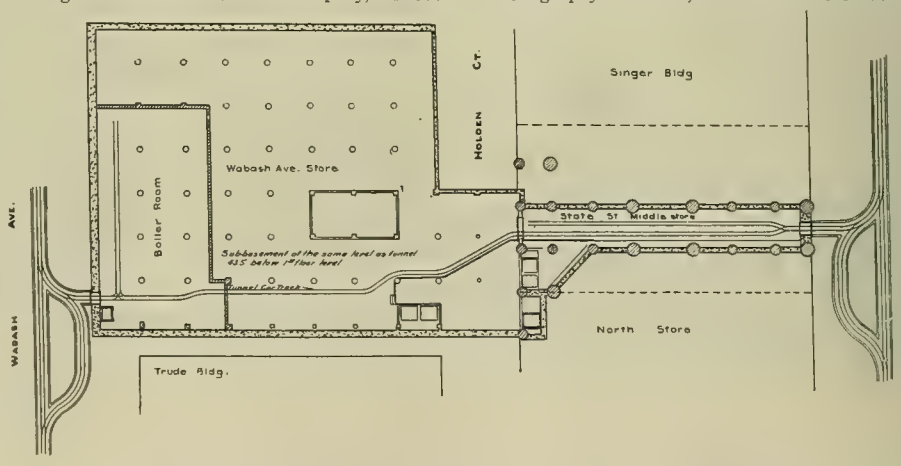


FIG. 3. PLAN OF SUB-BASEMENT AT TUNNEL LEVEL IN A LARGE RETAIL STORE.

Some great electrical engineering projects have been submitted to the New Zealand government by its engineer-in-chief in the course of a report on the utilization of New Zealand's abundant water-power. One of the most notable schemes aims at tapping the Huka Falls and supplying the Auckland district with 76,000 horsepower, the estimated cost of the necessary plant and works being $8,000,000.

Application of the Telephone to Railway Service.

At a recent meeting of the New England Street Railway Club in Boston Mr. C. J. H. Woodbury of the American Telephone and Telegraph Company gave an able and interesting discussion of railway dispatching, with special reference to the facilities afforded by the telephone in extending the zone of mental effort. Because it is the only electrical device which can be used without skill the telephone is rendered of especial value in the control of railway transportation, said the speaker.

In speaking of the early history Mr. Woodbury called attention to the fact that electricity was considered for railway signaling long before the devices for its application were invented, for in 1828 Edward Davy of England made a proposition for the application of electrical signals for indicating the direction of trains, whether stationary or in motion, which appears to be the first available record on the application of electricity to train movements.

The Wheatstone telegraph was applied for signaling on a cable railway at Blackwall, England, in 1835. On the whole, the application of electricity for the communication of intelligence in both directions appears to have originated with the use of the Morse telegraph in 1850 on the Erie Railroad by Charles Minott, general superintendent, although it is claimed that previous to that date railroad men had availed themselves of the telegraph to direct the movement of trains, but his work on the Erie Railroad included the systematic dispatching of trains. This, with steam railroads, has been developed into a most systematic and thoroughly organized department which is an essential portion of the operation of every steam railroad.

Of late years the telephone has taken the place of the telegraph to a very material extent, and its use is rapidly increasing, said the speaker. The facility which it furnishes for the instantaneous reply, and the conference over matters requiring a presentation of facts at one end and the exercise of executive action at the other without the interposition of skilled telegraph operators, is of great value, especially on occasions of emergencies.

The telephone is admirably suited for application to existing telegraph plant in railway service, for its attachment to such lines does not interfere with the use of the telegraph, nor does the simultaneous use of the telegraph affect the transmission of speech by telephone. This dual use of the same wires for composite systems is accomplished in a simple manner by the insertion of choke coils at the terminals, and also bridging condensers around the telegraph relays. These condensers will transmit the alternating currents used by the telephone bell and the undulatory currents of the telephone, but they do not conduct the direct currents used in telegraphy. That is, the condensers serve in the place of conductors for telephone service, and as insulators for telegraph usage.

These composite sets were first commercially used in New England by the Central Vermont Railroad, and their application rapidly extended to a number of steam railways throughout the country.

The manifold applications of the telephone are indicated by some of the railroads which also have connection with the mining of coal, and their private-branch exchanges not only connect with the offices at the headquarters of various divisions of the railroad, the operation of trains, but also extend down into the coal mines and out to the docks where the coal is shipped, and even connected to telephones in the cabins of the vessels transporting coal, or the tugs which tow the coal barges. On the Mexican Central Railroad all of the cabooses are equipped with telephones, so that all freight trains may be at any time in communication with the superintendent's office, in the same manner that the wrecking cars of steam railroads are equipped with telephones which can be attached temporarily to wires of telephone lines near the road, by means

of rods carrying wires ending in hooks, and in that manner coming in communication with the supervising officers. Many other interesting applications were cited.

Steam has been concentrating people into cities from the country for many years, said Mr. Woodbury, but electricity is distributing them back into suburbs, where they may live under freer conditions of light and air, with more hygienic surroundings, and its beneficence is establishing health and longer life for thousands upon thousands who

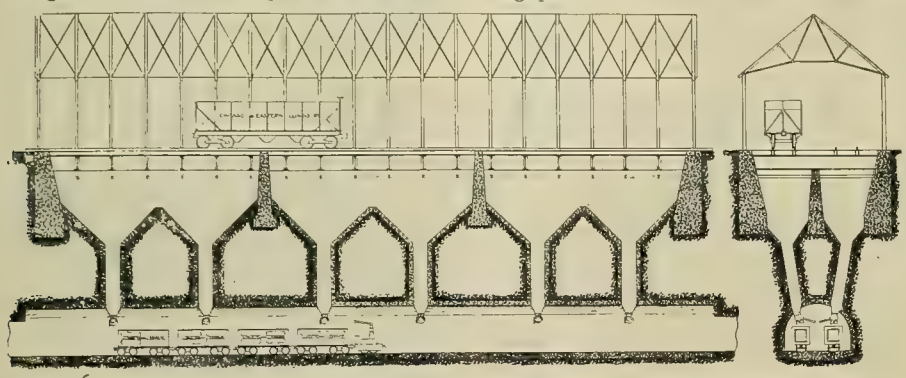


FIG. 6. SECTION THROUGH A RAILROAD COAL CHUTE FOR TRANSFER OF MATERIAL TO TUNNEL CARS.

must otherwise be crowded into congested parts of cities, thereby solving many of the complex problems threatening the great municipalities. After detailing some of the advantages of the electric railway, the speaker continued:

In the early days of electric railroads, when the motor was merely a substitute for the horses on the same cars, and even at similar speed, there was not the requirement of any signaling system more than the unfilled need which had already existed in the case of horse cars, but with the expansion of the carrying capacity of a road both as to size of cars and speed of propulsion, and, above all, the long distances of the interurban roads, conditions became radically changed and were comparable to those of the steam roads. This development of the transportation facilities became so much more rapid than that of the signaling that the early electric roads were afflicted with a number of mishaps which gave rise to many serious apprehensions as to the advisability of this change of power.

The application of the telephone for train dispatching has resulted in a marked economy of both plant and operation in that the ability of the superintendent to be informed as to the position of the various cars and to communicate with their operators gives a greater service efficiency to the road. Single-track railways in sparsely settled districts can be operated at an efficiency which should otherwise require a double-track road, merely by the use of the telephone for dispatching, because in case of cars failing to join at meeting points when they are due, they may, under this direction, avoid delaying the prompt car by directing it to proceed to another turnout. In case of failure to meet at scheduled turnouts, there is not the risk of collision by one car running wild to the next switch. Brief mention was made by the speaker of recent occurrences on electric railways where the telephone was the means of saving time, property and life.

There are three types of application of the telephone to railway dispatching:

(1) Fixed telephone sub-stations in booths placed at suitable points along the line.

(2) Jack boxes at poles to which portable telephones, carried in the cars, may be hung and connected for temporary use.

(3) Portable telephone sets hung upon the front of the car whose vestibule platform serves as a booth, and attachment made by flexible wires to jacks at numerous poles along the line.

On some railway lines the method of connecting a telephone on the car with the line is not by means of a jack at the side of one of the poles, but by a long slender rod carrying the wires, which may be hooked upon the main lines at any place.

The first method does not differ from arrangements of telephone booths with which all are familiar, except in minor details, and does not require explanation. Portable sets are generally preferred to fixed sets for long mileage and few cars.

Jack boxes on the pole must conform to numerous conditions, not merely to be shot-proof or fool-proof against meddlesome people, but also they must not afford shelter for hornets or other insects of perhaps less virulent disposition, but which impede any such apparatus by the nests which they make; they must also be proof against damage by rain or snow.

The telephone wires should be strung below lighting or power wires and well insulated at its points of support. The lines of such telephones must be transposed at least once in every eight poles, in order to prevent noises on its circuit induced from the wires in its vicinity carrying disturbing currents.

When two telephone circuits are on the same line, the transposition must be not only alternating the relative positions of the wires of one circuit to the other, but also of the two circuits.

When the spring jacks in an iron box attached to a pole are connected to a common-battery signaling system, the two plugs on one handle are of different size, so that they cannot be inserted with wrong poles.

Telephones are used on shipboad, not merely from the bridge to the engineer, but throughout the craft; also at the lookouts at the crow's-nest, or even at the masthead. Some of the Atlantic liners have two separate telephone equipments, one being for the use of the passengers and the other for the officers. When these vessels reach port, flexible wires connect the ship's telephone with the central-office system, before the hawsers are made fast to the dock.

On navigable rivers the changes in the level render the position of the landing stages for the

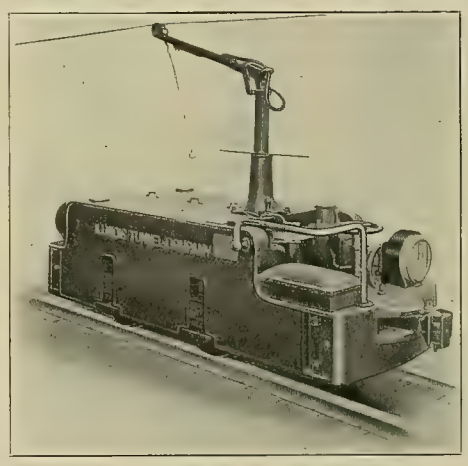


FIG. 7. A 4½-TON ELECTRIC LOCOMOTIVE USED IN CHICAGO FREIGHT TUNNELS.

steamers a variable one, and, by an ingenious reel, the telephone aerial lines are lengthened or shortened, as the case may require.

On men-of-war the telephone installations are extensive, not merely throughout the vessel, but the vessel is provided with a cable equipment to give the results of target practice.

The shores of the seacoast and of the Great Lakes are equipped with telephone lines which are used by the life savers in routine reporting of their patrol; also, when a vessel is approaching a lee shore the life crews can be concentrated at that point in a short time.

Telephones are attached to the tailboards of ranchers' wagons in the far West, and connections are made by plugs on flexible wires to jacks at frequent poles. In this manner, during an absence of several weeks, the party is in communication with the ranch house wherever it may camp.

Dr. Woodbury was followed briefly by Mr. A. B. Stetson, who exhibited various forms of telephonic apparatus, especially made for electric-railway use, and answered numerous questions brought out in the general discussion, which was participated in by a large number of the members.

National Electrical Code.

Arthur Williams, president of the National Electric Light Association, calls attention to the next conference on the National Electrical Code, which will be held in New York next month. The members of the association's committee on the Code are E. H. Davis, West and Willows streets, Williamsport, Pa.; Samuel Scovil, the Cuyahoga, Cleveland; Louis A. Ferguson, 139 Adams Street, Chicago; William Brophy, 17 Egleston Street, Jamaica Plain District, Boston, and Alexander Henderson, 39 Cortlandt Street, New York city. E. A. Norman, 55 Duane Street, New York, is acting as secretary to the committee. Mr. Williams suggests that it might be well to bring to the attention of the chairman of the committee, or any member, any changes in or additions to the existing rules which should be considered at the present time.

Household Electricity at the Peoria Pure Food Show.

As a means of familiarizing the public with the varied applications of electricity in the household the Peoria Gas and Electric Company of Peoria, Ill., made a large exhibit and gave cooking demonstrations at the Pure Food Show held in that city on February 6th to 16th, inclusive. The company secured the spacious stage of the Coliseum for its exhibit, which was prettily decorated, various appliances for cooking and heating being shown and demonstrated. The electric sign shown in the picture hanging from the proscenium arch was made of 30-inch letters.

To the left of the stage all the gas appliances were shown, from bathroom heaters to restaurant cooking ranges. The center of the booth was arranged as a cooking exhibit, and Miss Vawter of the Boston Cooking School gave two daily demonstrations in cooking. Seats were provided, as were also notebooks for the convenience of the ladies attending. For two weeks previous to the opening of the show coupon tickets entitling the holder to admission at 10 cents were distributed, the regular price of admission being 25 cents.

The booth on the right was made in the form of a square, and here all the electric cooking devices were displayed in actual operation. Miss Winnifred S. Potts made biscuits in the electric oven and served them with coffee from an electric percolator. Frederick A. Wilke from the general sales office of the General Electric Company was in charge of the exhibit and gave many demonstrations of the possibilities of the electric devices. Electric toasters, stoves, chafing dishes, frying pans, luminous radiators and broilers were displayed and demonstrated.

An ironing board was rigged up to demonstrate the advantages of electric irons. Outside the booth an electric washing machine and wringer, together with the electric mangle, were in operation. The electrical sewing machine was to be seen, and the whole exhibit attracted a great deal of attention.

Mr. Mackie, head of the new-business department of the Peoria Gas and Electric Company, planned and had charge of the exhibit. The first week the company gave away chances on an electric chafing dish and the second week a $50 gas stove was given away.

The chief event of the week was on Friday, when the ladies in charge of the demonstrations prepared a complete turkey dinner and served it to 400 ladies on the stage.

The stage exhibit was brilliantly lighted, a separate circuit being run in to take care of the lights. Mr. Wilke remained another week to follow up

EXHIBIT OF PEORIA GAS AND ELECTRIC COMPANY AT PURE FOOD SHOW.

the inquiries made during the show on electric heating devices.

While a pure food show was considered by some as a strange place for an electric exhibit, the company contended that when pure food is secured it must be properly cooked. The results showed that as much interest was displayed in the method of preparing the food as in the food itself.

House Wiring for Electric Heating.

The adoption of electricity for all domestic heating purposes brings about considerable change in planning for the additional electric circuits. While many of the smaller electrical heating devices may be conveniently used on the lighting circuit, the apparatus having greater current capacity, such as air heaters, large water heaters, ovens, etc., require heavier circuits. The advice of the local underwriters' inspectors in such matters may save expense and inconvenience.

In a home where electricity is less thoroughly woven into the fabric of daily living than in the house here described, such an elaborate arrangement is not, however, essential. Suitable outlets arranged in convenient places on the regular lighting circuit will care for many of the smaller devices and save expense in the initial cost of wiring in the less expensive residence. In all such work, however, the National Electrical Code rules should be followed and care should be taken that no branch lighting circuit with the auxiliary outlets for heating devices should have a capacity of more than 660 watts.

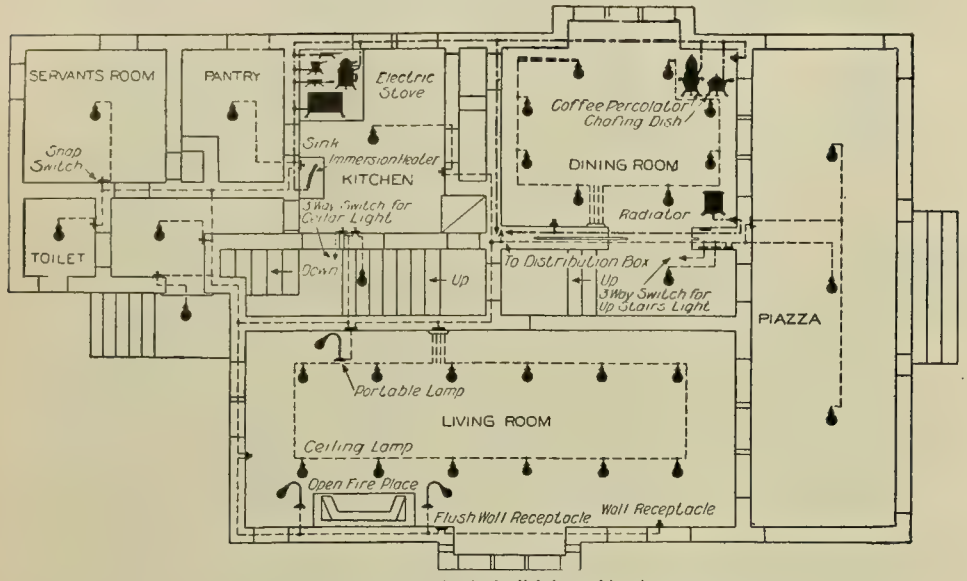
Reference to the accompanying plans will show in a general way the various circuits required in a house costing $10,000 or more. Eleven separate heater circuits are installed in the house under consideration. Eight terminate in the distributing panel box on the second floor, while three circuits in the basement laundry are brought together in a separate box in the basement. The current consumed on all the heating circuits as well as by a small motor used for driving the washing machine is metered separately and paid for on a basis different from that employed for lighting the house.

As may be assumed, four of the heating circuits are used in the kitchen and dining room. One each in a bedroom and sitting room, and two in the bathroom make the total. Forty-five amperes is the estimated maximum current consumed by the kitchen utensils, and this circuit is run with No. 6 B. & S. wire. The water-heater outlet at the sink is wired for 30 amperes and No. 8 B. & S. wire is used. In the dining room a small serving table is arranged for the principal heating devices installed on a separate circuit of No. 14 wire, the maximum current capacity in this case being 10 amperes. A second heating circuit in the dining room, run with No. 8 B. & S. gauge wire rated at 30 amperes, is used for the air heater.

On the second floor a heater circuit is arranged in the bedroom for the air heater, etc., with extra outlet for convenience in changing location of the heating devices. The bathroom, with its various water and air heaters, is fitted with two circuits. One is run with No. 8 B. & S. wire on the supposition that not more than 30 amperes will be used. The continuous flow of water to the heater for the bathtub supply requires a heater circuit of No. 4 B. & S., based on a maximum current of 60 amperes. The sitting room on this floor is arranged with a separate heater circuit for 30 amperes, No. 8 B. & S. gauge wire.

The three circuits in the basement are used respectively for the flatirons, washing machine and wash boiler. As has been mentioned, they terminate in a separate box, the electric iron being operated on a No. 14 B. & S. gauge circuit, while the remaining circuits are run with No. 8 B. & S. gauge wire.

Following is a list showing number and position of outlets, lights and switches, not only for the heating but for the lighting for the two floor plans shown.

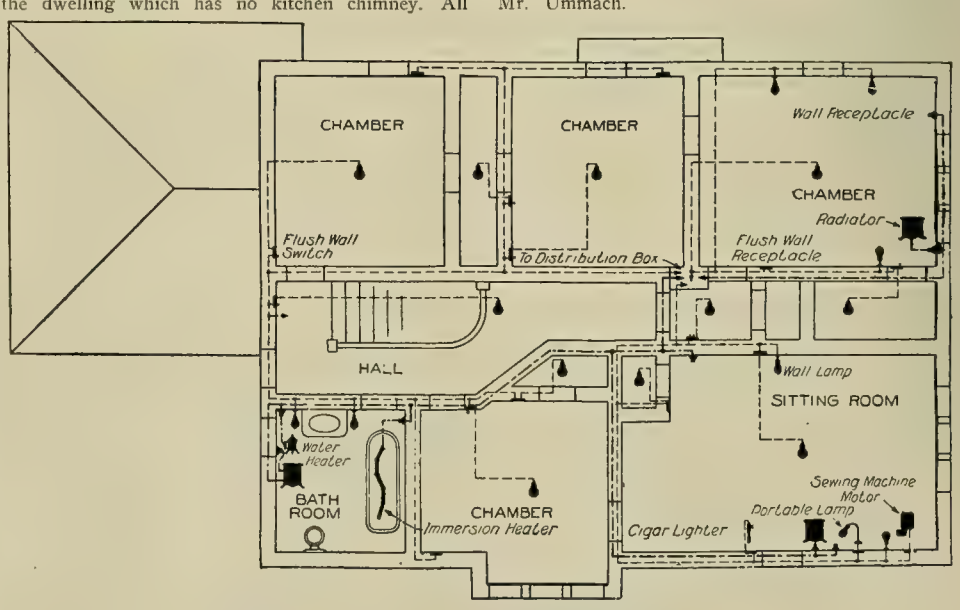


Note the separate circuits for lighting and heating.
GROUND-FLOOR PLAN OF A HOUSE WITHOUT A KITCHEN CHIMNEY.

	Lighting Outlets.	Lights.	Switches.	Heating Outlets.	Switches.
First Floor.					
Living room	9	9	2	3	3
Dining room	8	8	2	2	2
Porch	3	3	1	..	..
Hall	1	1	1	1	1
Kitchen	1	1	1	3	2
Pantry	1	1	..	..	..
Servant's room	1	1	1	1	1
Servant's bath	1	1	1	1	1 D. P.
Cellar	4	4	1	..	..
Laundry	1	1	..	4	3
Second Floor.					
Front bedroom (left)	1	2	1	2	2
Middle bedroom (left)	1	2	1	1	1
Middle bedroom (left) (clothes press)	1	1	..	..	..
Rear bedroom (left) (clothes press)	1	1	..	..	..
Rear bedroom (left)	1	2	..	1	1
Front bedroom (right)	3	3	..	2	2
Front bedroom (right) (clothes presses)	2	2	..	..	..
Middle bedroom (right) (clothes presses)	1	1	..	..	..
Middle bedroom (right)	1	2	1	1	1
Hall	1	1	1	..	..
Bathroom	2	2	..	3	1 D. P.
Attic	1	1	..	..	..

NOTE.—Three-way hall switch controls first floor front hall light. Living and dining rooms each have two double-pole (D.P.) switches to control alternate lights.

The two diagrams shown are of the well-known Hillman "electric house" in Schenectady, N. Y., the dwelling which has no kitchen chimney. All lighting, cooking and heating, except winter furnace heating, is done by electricity. The family consists of five persons, and, at five cents a kilowatt-hour for heat and power, the average total of 24 monthly bills, exclusive of lighting bills, was $6.69.



SECOND-FLOOR PLAN OF A HOUSE WITHOUT A KITCHEN CHIMNEY.

Fixture Design and Location for Residence Lighting.

The Chicago section of the Illuminating Engineering Society, at a meeting held on February 14th, discussed the subject "Fixture Design and Location for Residence Lighting." After dining together at a restaurant the members repaired to the assembly room in the Edison Building, placed at the disposal of the society by the courtesy of the Chicago Edison Company. An exhibition of photographs and lantern slides was given, illustrating various lighting designs in private residences.

Chairman George C. Keech introduced Mr. R. C. Spencer, of the architectural firm of Spencer & Powers, who opened the discussion from the viewpoint of the architect. In the course of his remarks Mr. Spencer referred to the fact that there was a very strong tendency on the part of electrical men to follow blindly the old traditional forms of fixtures devised for the use of gas. As a consequence many electric fixtures, he said, were as clumsy as some of the old types of gas fixtures. In order to improve on these conditions it was important to bear in mind that electric light comes through a wire and not through a pipe. The speaker said that side-brackets were all right under certain conditions, but that in many cases the middle of the room was not well lighted. It was essential that houseowners put in plenty of outlets and switches, for an insufficient number of these was often the cause of inefficient lighting. Mr. Spencer predicted the doom of the chandelier.

Mr. H. K. Holsman, who referred to lighting from concealed sources, gave it as his opinion that concealed lighting of all kinds was a mistake. However, should it be desired, it was necessary to have plenty of outlets.

Mr. F. R. Farmer said that in many cases the purchaser of the lights and fixtures was the owner of the house; hence the number of clumsy fixtures to be seen everywhere. In many instances one single chandelier was the only light in a large room.

Mr. J. R. Cravath thought there was a future in box-fixture lighting, for many good results had already been obtained. Mr. Keech thought that the new high-efficiency lamp would make a great difference in the system of lighting.

A review of the discussion was given by Mr. H. Von Holst, who thought that the problem of lighting was not as difficult as many imagined. A little thought given to the subject, he said, would be of invaluable help. In designing fixtures for various rooms, the first thing to be considered was the use to which the room was to be put. The central fixture, the speaker thought, should be barred altogether from the living-room of a house. He thought that the question of fixtures in residences should revert to the architect. Concealed lighting, he said, had no place in small houses. Other speakers were Messrs. W. B. Griffin, J. T. Baker of the Welsbach company, and Mr. Ummach.

Mr. W. R. Stansel proposed a vote of thanks to Mr. Spencer and to the Chicago Edison Company for giving the society the use of the room. Mr. Cravath suggested that a committee be appointed to draw up by-laws for the Chicago section. The chairman stated that he would appoint a committee of three for that purpose.

Busy Signal for Small Automatic Telephone Exchanges.

The busy signal used in telephone exchanges, as is well known, is of an intermittent or throbbing character. This is so that it may readily be distinguished and so that it will not be confused with noises produced on the line by induction from electric light and power wires.

The interrupter device, which is commonly used, has a heavy weight on the arm to reduce its vibrations to a comparatively slow periodicity. This arrangement is satisfactory in a manual exchange, where some attention can be paid to its adjustment, but in small automatic exchanges, where there is no one in attendance and where the interrupter is sub-

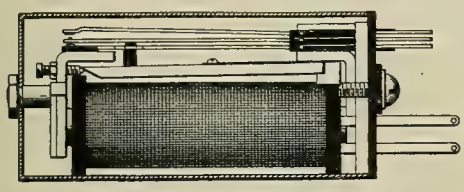


FIG. 1. SIDE ELEVATION OF RELAY.

jected, at times, to low temperatures, the arrangement is not always reliable. This is mainly on account of the fact that the extreme variations of temperature cause changes in the structure supporting the back contact, through which the current for the operation of the device passes.

A patent recently issued to Albert M. Bullard and William H. Matthies of New York and assigned to the Western Electric Company of Chicago, has for its object the production of a device which will be an improvement over existing devices of this character.

It is asserted that the new device is a slow-acting circuit-breaker which can be operated at any temperature, and which is self-starting, which starts promptly, and which operates on wide margins of adjustment. Instead of operating on the principle of mechanical inertia, as heretofore, it utilizes electromagnetic inertia produced by a heavy closed copper secondary encircling the iron core of the device.

The apparatus consists of two magnets or relays, each having a heavy copper tube driven over its iron core and with the small wire winding wound upon the copper tube. The armature approaches and recedes from the pole-piece with a marked degree of sluggishness—a phenomenon well understood in the art.

Of the drawings, Fig. 1 is a side elevation, with the casing in section, of a relay suitable for the work required, and Fig. 2 is a diagram of the two relays and the circuits which embody the invention.

It may be stated that the circuits of the relays are so designed that they alternately short-circuit each other's winding, thus producing a slow recipro-

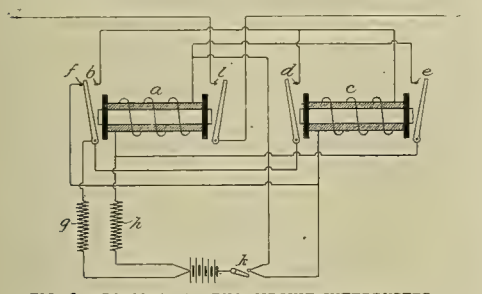


FIG. 2. DIAGRAM OF THE CIRCUIT INTERRUPTER.

cating movement of each armature, which is utilized to make and break at regular intervals the busy-tone circuit leading to the switchboard.

Referring to Fig. 2, when the battery circuit is closed relay (a) operates its front contact (b), and thus closes a circuit through relay (c), which attracts its armatures, and in so doing closes contact (d), which causes relay (c) to remain thereafter locked up independent of contact (b) of relay (a). Contact (e) of relay (c) short-circuits relay (a), which thereupon releases its armatures, and its back contact (f) in turn short-circuits relay (c) and of course causes relay (c) to release its armatures regardless of the locking-circuit closed at contact (d). Now the opening of contact (e) of relay (c) allows relay (a) to operate, thus beginning a second cycle identical with the first. Each cycle may occupy about one second of time. These cycles follow one another with great regularity and are kept from becoming too frequent by, first, the sluggishness of the copper-jacketed relays; second, by the short-circuiting method of de-energizing the respective relays, and, third, by the plan of causing the second relay (c) to lock up its armature, thereby permitting the armature of the first relay—that is, relay (a)—to fully recover before current is diverted from relay (c). The resistance coil (g) likewise tends to slow the reciprocative movement by reducing the amount of current used for the operation of the relay (c) and proportionately increasing the sluggishness of its armature movement. This resistance (g) also serves to prevent short-circuiting of the battery when contact (f) of relay (a) is closed. The resistance (h) is to prevent a short-circuit of the battery when contact (e) is closed by relay (c). The switch (k) is for closing the battery-circuit to start the interrupter. The contact (l) of the relay (a) is included in the circuit of conductors (m) (n), which may lead to a busy-tone apparatus and to the switchboard or mechanism of the exchange, respectively, in a manner well understood. The purpose of the combination of the two relays is to cause a retardation in the closing and opening of the contact (l), which is included in the tone-circuit.

The apparatus as thus described causes cycles of about one-half second duration. The time can be varied by adjustment of the relays as may be thought most desirable.

In Fig. 2 two armatures are shown simply for clearness of illustration. In practice the inventors employ relays of the general character shown in Fig. 1, in which the contacts are, in the case of each relay, controlled by a single armature.

It is claimed that the device works well in practice and that the changes in frequency, due to variations of battery voltage within practical commercial limits, are negligible.

Cable-boring Insects in Chicago and Elsewhere.

In the Western Electrician of January 12th last appeared the first mention of insects which have been found to be the cause of trouble by boring holes in the lead sheaths of cables carrying electric signal circuits at one of the packing plants at the Union Stock Yards, Chicago. One of the accompanying illustrations is a picture (enlarged) of the insects which were the cause of the trouble, while another photographic reproduction shows their destructive work on the lead coverings of the signal circuits.

Thousands of these insects have been found at

FIG. 1. CABLE-BORING INSECTS (ENLARGED 2½ TIMES) FOUND IN "BONE HOUSE" AT CHICAGO STOCK YARDS.

the Stock Yards, and they are believed to thrive only in places devoted to the storage of bones and hoofs, none having been found in other localities. Fig. 1 is a picture of some of the bugs which surrounded the damaged cable when it was taken up in an investigation to learn the cause of the trouble. In the picture the bugs are 2½ times larger than the actual insect. Fig. 2 is a section of the Stock Yards cable and shows the work of

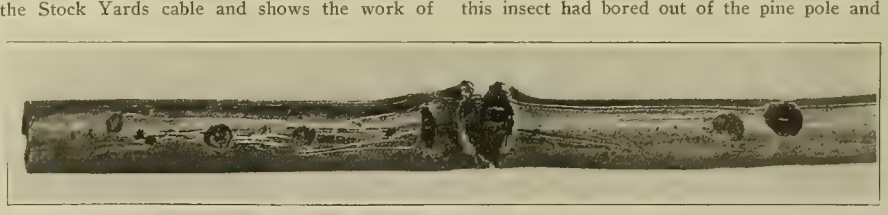


FIG. 2 LEAD-SHEATHED CABLE (ACTUAL SIZE) REMOVED FROM "BONE HOUSE" IN CHICAGO STOCK YARDS AFTER INJURY BY BORING INSECTS

the insects. The picture shows the actual size of the cable.

The discovery of these insects has been the cause of some interesting discussions, and the similarity of the bugs to others found in different parts of the world is the cause of some fear of a new danger to lead cables in the United States. Definite conclusions as to the characteristics of the Chicago insect cannot be given at this time, as an official report of a thorough study of the subject has not yet been made. Specimens of the insect have been turned over to entomologists of the Field Columbian Museum in Chicago, who will watch this borer in its various stages of development and make a thorough investigation of the insect and its habits to determine the order and family to which it belongs.

Until a few years ago nothing was heard of cable-boring insects, and damage of a character similar to that in the present instance was laid to other causes. In the middle of 1904 there was a report of aerial cables pierced in Shanghai by a species of wasp.

Probably the most complete data on the subject of danger to lead-covered cables from insects are contained in a paper on the subject presented at

FIG. 3 JESUIT BEETLE OF AUSTRALIA (LESS THAN HALF NATURAL SIZE).

the International Electrical Congress in St. Louis in 1904 by Mr. John Hesketh, electrical engineer for the state of Queensland, Australia. As early as 1896 Mr. Hesketh's attention was called to perforations in the sheathing of aerial lead-covered telephone cables. Defects were found in all kinds of cables and the holes pierced alike various kinds of insulations and tape.

An exhaustive investigation was begun with the result shown in Mr. Hesketh's paper.

He tells of a number of instances where insects were found to be the cause of the damage, and he gives a good description of the various pests and their habits. Some of the illustrations of the Australian insects and the damage they do are very similar to corresponding illustrations of the Stock Yards case, as will be noted by reference to Fig. 3, reproduced from an illustration in Mr. Hesketh's paper. This specimen is known as the

FIG. 4. LEAD-GNAWING BEETLE (LARVA) OF AUSTRALIA.

beetle Bostrichus Jesuita, Fabr. (order Coleoptera, family Bostrychidæ), or Jesuit beetle, which is very common in Queensland. The perforations shown pass successively through tarred tape parceling, lead sheathing, untarred tape surrounding conductors, and metal-foil covering of individual copper wire. The illustration is rather less than one-half natural size.

Other insects mentioned by Mr. Hesketh which were known to bore into cables are the beetle Ecelonerus and the Orthorrhinus Cylindri-rostris, or Elephant beetle. A drawing made from completely dried-up samples of larvæ of the Ecelonerus beetle is shown in Fig. 4.

A caterpillar (Xyleutes, Boisduvali, Rotsch) was known to gnaw a hole nearly a quarter-inch in diameter through a lead-covered conductor.

In the discussion of the Hesketh paper a member told of an insect which gets under the bark of southern pine and after a while develops into a fly. In more than 100 cases in one southern city this insect had bored out of the pine pole and into the lead covering of the cable. A case in Savannah, Ga., was that of an insect which made holes in the ends of the tubes that are used to protect the wires at the cable terminus.

Chicago men have suggested that it would be interesting to determine the object of the insects in boring into the cables, whether it is the lead or the insulation they are after. Some have suggested the use of aluminum-covered cables as a possible remedy.

The insects and the piece of cable from which the accompanying illustrations were made were kindly loaned the Western Electrician by the Underwriters Laboratories of Chicago.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

THE LATEST information which the Western Electrician has been able to obtain in relation to the operation of the freight tunnels underlying the central business section of Chicago is presented elsewhere in this issue. This electrically operated underground freight-transportation service has attracted much attention, and the development of the possibilities of the project is being watched with interest. So far as the actual transporting of coal, merchandise and other classes of freight is concerned, this development has only just been fairly begun. The desirability of the tunnel freight system from the viewpoint of convenience and as a means of relieving congestion on the busy streets cannot be questioned; as to the practicability, economy and safety of the scheme, however, it is yet too early to get a fair opinion from those who are now availing themselves of the tunnel service. The system itself is now one of considerable size. Forty-six miles of tunnel have been completed, 65 electric locomotives and 590 cars are in service, and about 40 miles of permanent track and trolley are installed.

MR. JOHN J. CARTY, chief engineer of the New York Telephone Company, is proposed as a suitable candidate for the presidency of the American Institute of Electrical Engineers by Prof. Morgan Brooks, an old personal friend, in a letter published elsewhere in this issue. The suggestion is an interesting one and deserves careful attention. Mr. Carty is a former vice-president of the Institute, of which he has been a member, including his term as associate, for 17 years. He is a telephone engineer of distinction, and among his confreres his name carries weight abroad as well as at home. It has been many years since a telephone man was elected president of the Institute, while it is doubtless accurate to say that no engineer distinctively a telephone engineer has ever filled that position. It will be recalled also that Mr. Carty was prominently mentioned as a candidate last year, but magnanimously withdrew in favor of another gentleman. For these reasons the mention of his name at the present time will be received with much interest.

IT IS certainly most unfortunate that several serious accidents have marked the operation of railroads newly transformed from steam-locomotive to electrical operation. Such was the sad disaster at Atlantic City of October 28th last, when an electric train plunged from a drawbridge and 57 persons lost their lives. In that case the coroner's jury found that the accident was caused by the neglect or oversight of the man in charge of the draw. The electrical equipment was in no wise at fault. The subject is recalled by another terrible accident on a former steam road electrically equipped, which happened on February 16th in the northern part of New York city. Here the cars of a suburban train drawn by electric locomotives were derailed when rounding a curve at high speed, and 21 persons were killed and about 100 were injured. In this case also there seems to be no fault to be attached to the electrical apparatus, although, at the present writing, the precise cause of the disaster does not seem to be known. Perhaps it was caused by a broken wheel or a broken rail; perhaps the motorman was taking the curve at too great a speed. But, so far as known, the accident would have happened just the same if the train was drawn by a steam locomotive. Whatever the cause, however, it should be ascertained, if possible, and made public. Electric railroading should be, if anything, safer than steam railroading, although the human equation is to be reckoned with in one case as well as the other. Especial pains should be taken, of course, in instructing new motormen, or old motormen running over a strange route or under a new set of conditions. Railroad companies are bound to use electric power for train propulsion to a constantly increasing extent, and from the merest self-interest they should do their utmost to prevent the public from forming the notion, however ill-founded, that in some mysterious way the electrical equipment is responsible for accidents.

MUNICIPAL CONTROL rather than municipal ownership, long advocated by the Western Electrician as the best solution in sight of the perplexing problems growing out of the relations of public-service corporations and the public itself, will be given a trial in Chicago on what may be termed a scientific basis if Alderman B. W. Snow's proposal is carried into effect. Mr. Snow offered a resolution in the City Council on February 18th which calls for the creation of a board of control for the class of corporations mentioned. On his motion the resolution was ordered published and deferred. It directs the committee on judiciary to prepare an ordinance creating the board. The outline for the ordinance provides that the board of control shall consist of three members to be appointed by the mayor to serve two years, removable by the mayor when two-thirds of the Council approve, or by the Council when two-thirds of the aldermen approve. The member may not own stock or be interested in the operation of any public-service corporation in Chicago, and shall engage in active participation in no other business.

Provision also is made for a chief clerk and an attorney and such other help as shall be required, including mechanical and electrical engineers and technical experts.

Some of the duties of the proposed board of control may be stated as follows:

Supervision and regulation of public-service corporations to the full extent that the right of such supervision and regulation is reserved to the city.

Enforce compliance by such companies with all lawful orders or ordinances of the City Council.

Collect and compile information bearing upon the relation of such corporations to the municipality.

Make such investigations as may be necessary to furnish the City Council with such data as may be asked for, and perform such other duties as may from time to time be assigned it by the City Council.

Make recommendations for legislation necessary for proper regulation of such corporations and such other information as may aid in properly and effectually regulating such corporations.

Any public-service corporation which shall object to carrying out any order of the board may file objections in writing and demand a public hearing, and at such hearing the board shall sit as a body, and the decision of a majority of such board shall be final and binding.

It will be observed that this proposal retains the principle of private ownership and operation, which seems to be vital to good service in the public utilities of American cities. Massachusetts follows a somewhat similar plan in relation to the treatment of gas, electric-light and street-railway companies in that state, and in no other commonwealth are the relations of the government and the corporations on so satisfactory a basis.

Under this general idea the state or municipality may be expected to say, in effect, to the public-service corporation: "Be good; don't be greedy; give good service at a fair price; extend the service and reduce the price as fast as may be done with good judgment; be progressive and in touch with modern practice; do an open, honest, straightforward business on a legitimate investment of capital. In return we will protect you from unfair or unwarranted competition. You shall have a monopoly as long as you deserve it. You shall have a chance to earn a fair and reasonable return for your skill and your capital invested. What remains of the profits, after allowing for depreciation and all items of like character, may be applied to reduce the price of the service to the consumers or may be turned into the treasury of the community granting the franchise."

Municipal control will not be perfect, of course, for it must necessarily be carried out by very human, imperfect men. Much will depend on the spirit in which the subject is approached on both sides, and very much indeed on the character of the members of the board of control if there ever should be such a body. Nevertheless, the idea has worked out well as far as it has been tried and promises well for a more extended and diversified effort. With the right sort of men in control—not corporation men or anti-corporation men, but just honest, intelligent, fair-minded men—we should like to see Alderman Snow's plan given a trial in Chicago. And if municipal control solved the problem under the complicated and vexatious conditions which have come about in this city, it should prove equal to the strain put upon it anywhere else.

Direct-current Compensators for Balancing Electric Circuits.[1]

By H. M. Biebel.

A direct-current compensator is a device whereby one or more neutral wires can be introduced into an ordinary two-wire circuit, these neutral wires making it possible to obtain circuits of proportionately lower voltage. The use of a direct-current compensator set makes it possible to generate direct current at a comparatively high voltage and to deliver it for use at a lower voltage, thus combining the cheapness of high-voltage transmission with low-voltage receiving or translating devices.

It is not the only way of obtaining a three-wire system, but it is the only way of obtaining a four or five-wire system, should such ever come into general use, which becomes possible when the latest type of incandescent lamps is considered on small units.

The direct-current compensator for a three-wire system originally consisted of two machines coupled together mechanically, one machine of a voltage equal to that of the supply circuit and the other machine of a voltage equal to one-half that of the supply circuit. The question of the transference of energy by a compensator set is an interesting one. This transference of energy by the compensator set results in a heavier load being thrown upon the main generator than would be the case if no compensator set were used.

A shunt-wound compensator set with the fields of the two units in series or in parallel between the two outside wires will not give good regulation, owing to the IR drop in the armature windings of the unit operating as generator, and the drop in speed of the unit operating as motor, as the load increases.

The regulation of a shunt-wound compensator will be improved by cross-connecting the shunt fields so that with unbalanced loads the field of the unit which is operating as a motor is connected to a circuit having a voltage lower than its own, thus weakening the motor field, increasing the speed of the set, and increasing the voltage of the unit operating as a generator. At the same time the field of the generator unit is connected to a circuit whose voltage is higher than its own, thus strengthening the field and resulting in a still further increase in the generator voltage.

Exact balance can be obtained in a shunt-wound compensator by connecting the two fields in series and placing between them a small rheostat, the lever arm of which is connected to the middle point of the two armatures. By moving the lever away from the middle point so as to strengthen the generator field and weaken the motor field, we can get an exact balance of voltage for that condition of load. If now the excess load should suddenly be shifted over to the other side of the neutral, the difference between the voltages on the two sides of the neutral would be quite large, as the inherent poor regulation of the shunt-wound compensator set is made worse by the strengthened motor field and the wekened generator field.

This style of connection will give good results where hand regulation of the rheostat is not objectionable and the load changes are not so sudden but that they can be followed up closely by the attendant. A machine having two independent armature windings and two commutators on the armature can be used as a compensator set, but will not give close regulation.

In order to obtain automatic regulation and practically equal voltages on each side of the neutral under all normal conditions of unbalanced load, it is necessary to use compound-wound units. There are a number of different ways of connecting the shunt and series coils, the usual method being to connect the series coils in the armature circuit and the two shunt fields in series across the outside wires. When starting up, both units will operate as differential motors, but upon being thrown into circuit and any unbalancing of load occurring, the unit then operating as a generator will be a cumulative compound-wound machine.

By proper adjustment of this compound winding on both machines we can get a practically constant voltage division up to and well beyond the normal capacity of the compensator set. As the motor current is greater than the generator current, the differential action on the motor will be greater than the compounding action on the generator. The speed of such a compensator set will be higher at full load than at no load, which means that at full load the motor is operating at a lower point of its saturation curve than at no load, and if this differential action is carried to an extreme point by reason of excessive overloads, a point may be reached where the motor will "spill over," that is, the motor will attempt to reverse its direction of rotation.

One way of overcoming this tendency is to short-circuit the series coils of both machines when a certain current value has been reached or to short-circuit the series coils of that unit operating as a motor. The first is the simpler method, but results in a greater unbalanced voltage than would be the case with the second method. The first method requires a double-pole switch, normally held open, actuated by an overload coil connected in the neutral wire. When this switch is released it closes, short-circuiting the series coils of both machines.

The second method requires a reverse-current relay, which operates to close the circuit through either one of two solenoids, which in turn will act to close a switch, or a "circuit closer," which short-circuits the series fields of the unit operating as a motor. If the excess of load shifts to the other side of the neutral the current in the neutral will be reversed, the reverse current relay will operate to take off the short-circuit on the one unit and then short-circuit the series coils of the other unit. A new method of connection has lately been used which overcomes this trouble and requires no short-circuiting device.

The efficiency of a compensator set is calculated by the following method, first shown by Mr. C. T. Wilkinson:

Let RV = Line voltage,
I_M = Motor current,
I_G = Generator current,
C_S = Shunt current in each unit,

then the output of the compensator set will be $V(I_G + I_M)$, the input will be $I_M \times 22 + C_S \times 2V$, and the commercial efficiency of the compensator set will be

$$\frac{(I_G + I_M)V}{2V(I_M + C_S)} \text{ or } \frac{I_G + I_M}{2(I_M + C_S)}.$$

Taking actually obtained figures for the motor and the generator currents and calculating the efficiency from the above formula, we find that it is very nearly the same as that of either unit by itself. The commercial efficiencies of a line of compensator sets varying from one kilowatt to 150-kilowatt capacity will vary from 78 per cent. to 92 per cent.

The question of how to protect the compensator set against excessive overloads and how to protect the lamps against a failure of the compensator set may be answered in several different ways, depending upon whether the lamps can be cut off the circuit or not, and whether the compensator set must be kept in circuit at all hazards or not. When the lamps can be cut off the circuit, a circuit-breaker with an overload release coil connected in the neutral wire can be used when the compensator set gives good regulation.

Where a shunt-wound compensator set is used where the difference between the voltage on each side of the neutral is a measure of the unbalanced load, a differential coil can be connected to the circuit so that when the voltage difference exceeds a certain value this differential coil will close a circuit through a tripping coil on the main generator circuit-breaker or on the lamp feeder circuit-breaker.

The ordinary no-voltage release coil on the starter will protect the compensator set against trouble after a shut-down due to momentary cessation of voltage. To protect the lamps against the danger of excessively unbalanced voltages, due to unbalanced load, if the compensator set should accidentally shut down, the handle or lever of the starting box can be arranged so as to make a connection while returning to its starting position, such that a tripping coil on the main circuit-breaker shall operate to open them, thus cutting the lights off the circuit as the compensator set shuts down.

It has been recommended to fuse the compensator set at 100 per cent. overload and not to use circuit-breakers or special tripping devices, or in other words, protect the lamps rather than the compensator set. A large number of compensator sets have been installed connected in this way, and so far no trouble from this or any other source has been reported.

The features of a good modern compensator set are:

1. Easy to connect and easy to throw into circuit. 2. Practically absolute balance at all normal loads without rheostat adjustment. 3. The easy operation of two or more sets in parallel. 4. The use of standard stock parts throughout.

Where it is desired to operate 110-volt lamps on a 220-volt circuit and the lamps can be so wired that the loads on each side of neutral will be approximately the same, a compensator set will enable the installation to operate successfully. Its capacity need be only a small per cent. of the total load, subject to unbalance, say about 10 per cent., and this might even be reduced to 5 per cent. where the lamps are well balanced.

If the load on any given generator station could be arranged so that the motor load would be on one set of feeders and the lamp load on other feeders, the compensator set could be installed at or near the center of distribution of the lamp load, and the feeder drop could be taken care of by the main generators, the compensator set simply dividing the voltage obtained at the center of distribution. Any unbalance of voltage which would exist on the lighting mains would be due to the compensator set itself.

Discussion.

Mr. C. A. S. Howlett said that there was one point about compensators which was not generally understood, and that was their simplicity. The average person imagined that dealing with compensators meant getting into complications. He cited an instance where in a small country town a three-wire system had been installed by a man whose entire experience had been confined to the operation of a small creamery. He had been advised repeatedly to get an experienced electrician, and when subsequently some one made inquiries regarding the compensator the creamery expert informed him that he had himself installed the compensator, and that it had been running successfully for several days. In answer to a question put by Mr. C. G. Atkins, Mr. Biebel stated that the question of when to use a three-wire machine depended on the engineer and the character of the load. Mr. Pratt thought that the compensator was generally considered as a necessary evil. He had installed quite a number of them, but only where he found it absolutely necessary. Mr. Kline wondered how much additional capacity was allowed in the generator in the case of three-wire machines. Mr. Biebel stated that the winding was simply designed to take care of the additional heat generated in the armature and that there was no increase in the capacity. Among others who took part in the discussion were Professor Rowe of Leland Stanford University and Mr. Roper. The lantern slide shown during the reading of Mr. Biebel's paper added much to the interest manifested in the subject treated.

1. A condenstion of a paper read before the Electrical Section of the Western Society of Engineers, Chicago, February 15, 1907.

Copper Exported and Imported.

A curious feature of our foreign commerce is found in the fact that although the United States produces one-half of the world's copper and exports far more than any other country, it is also one of the largest importers of that commodity. The value of copper imported into the United States in 1906 was over $37,000,000, including in this total $6,750,000 worth of copper ore, while we were at the same time exporting over $90,000,000 worth of that metal, including in this sum a little less than $2,000,000 worth of copper ore, of copper ingots nearly $85,000,000, and of other copper manufactures between $4,000,000 and $5,000,000. This anomaly of the greatest copper-producing country of the world importing such large quantities of copper grows, apparently, out of the fact that the United States has superior smelting and refining facilities and that the copper from its immediate neighbors at the north and south—Canada and Mexico—flows to its smelting establishments and refineries. A considerable part of the pig copper imported is brought in for the purpose of extracting the precious metals which it contains, and a part of this comes from European countries. How much of this $37,000,000 worth of copper imported is re-exported under the title of American copper cannot be determined, as any imported article which has undergone a further process of manufacturing after entering the United States is, when exported, reported to the Bureau of Statistics as a domestic manufacture.

COMMUNICATION.

Mr. Carty Suggested as President of the Institute.

To the Editor of the Western Electrician:

In the coming election of officers by the American Institute of Electrical Engineers I would like to propose the name of John J. Carty of New York for president. Mr. Carty is a telephone engineer of international reputation, and we have few of which this statement can be made. The discovery that telephonic "cross-talk" is due to electrostatic rather than to electromagnetic induction was considered revolutionary at the time Carty announced it in his famous Institute paper of 1891; and his patent for the "bridged" connection of telephones in party lines has been fought vigorously enough in the courts to prove its value. He has, perhaps, done more than any other one man to dignify telephone work and place it on a par with other more commonly recognized fields of engineering research.

Carty has served the Institute many years as manager, and is now chairman of the directors' committee on finance, in which position he has devoted much ability and time to the pressing conditions connected with the establishment of the Engineering Building, the present home of the Institute.

We have not placed a telephone engineer in the presidential chair since Alexander Graham Bell was elected, 16 years ago. I propose Carty's name on the basis of a long-time friendship, of which I am proud. A number of prominent members of the Institute in Chicago agree with me that Mr. Carty would be an admirable selection for president this year, and that the Institute would honor itself in placing him at its head.

Morgan Brooks.

University of Illinois, Urbana, February 16, 1907.

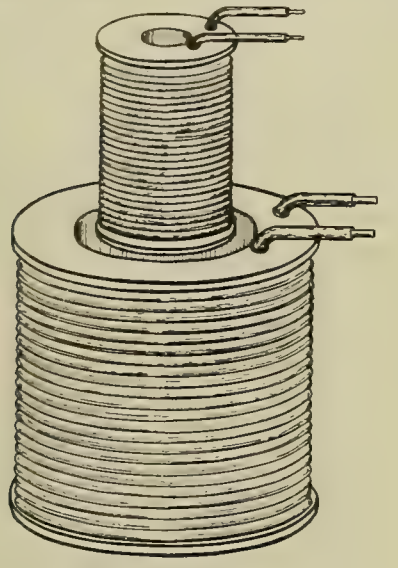
ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo R. Metcalfe.

IV.—Elements of Electricity.

Induction.

In the previous chapter we have briefly reviewed the production of dynamic currents chemically and by heat. As was stated, the third and by far the most important method is by induction. We have already described the effects of induction of a magnet upon another magnet or a piece of iron. In a manner somewhat analogous, a coil of wire, as, for example, a solenoid, when carrying a current, in-



SOLENOIDS ILLUSTRATING PRINCIPLE OF INDUCTION.

duces an electric current in another coil brought near to it.

In the case of a direct current, however, the induced current would be only momentary, during the period of motion of the inducing coil. If the two coils were held in a stationary position there would be no induced current in the second coil. This action will be best explained by the diagram given above, which illustrates two solenoids, one of which can be plunged within the other. If a continuous direct current is passing through the coils of the smaller solenoid, and it is plunged inside the larger one, a current will be induced in the latter solenoid which will last only during the time that the smaller solenoid is moving, and will die down when it comes to rest within the large one. If the smaller one be removed, a similar current will be induced in the larger solenoid, but it will flow in a direction opposite to the current which was induced when the smaller one was plunged into the larger one.

If a permanent magnet were substituted for the smaller solenoid, the currents would be induced in exactly the same way on introducing and withdrawing the magnet from the interior of the coils. In both cases the induction takes place only while the magnet or solenoid is in motion, and it dies out as soon as they come to rest.

From the experiment with the iron filings it is known that the solenoid acts in the same manner as the permanent magnet, and that both are surrounded by a field of force, and from the last experiment we find that an induced current is set up in a conductor when it moves in such a direction as to cut the lines of force of a magnetic field. The intensity of the induced current in such a conductor is proportional to the rate of increase or decrease of the lines of force passing through the circuit.

The induction coil is the basis of all transformers, and in its most elementary form consists of an iron core with two windings, one upon the other. The winding directly upon the iron core is called the primary coil and the outside winding the secondary coil. In the accompanying illustration (A) is the iron core, (BC) the primary coil and (DE) the secondary coil. If the current is passed through the inner coil a momentary current will be induced in the outer coil which continues only while the primary current is increasing from zero to its maximum amount. When this maximum is reached the induced current ceases.

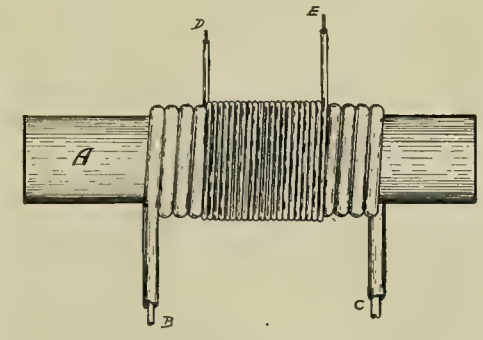
On breaking the primary current another momentary current is induced in the secondary coil, the direction of which will be opposite to that previously induced. The current induced by closing the primary circuit is opposite in direction to the current in the primary, and that induced by the breaking of the primary is in the same direction as the primary current. Any change of strength in the primary current will produce induced currents, and the strength of the latter depends upon the amount or abruptness of the changes in the primary.

Induction coils may be arranged to produce a very high electromotive force, which will cause sparks to pass between widely separated points. Such coils are made with comparatively few turns of heavy wire for the primary, suitable for carrying a heavy current, and the secondary coils are made of several thousand turns of very fine wire. The current for operating such an induction coil is taken from a few voltaic battery cells, and a switch, or other device, is used for interrupting the primary circuit. The making and breaking of the primary induces a very high electromotive force in the secondary. In other words, in the primary circuit we have a comparatively large current at low voltage, and in the secondary a very small current at high voltage. Powerful coils of this kind have been built which will produce sparks several feet in length.

The induction thus far described between two coils or conductors having no electrical connection is known as mutual induction. There is also another inductive action which is called self-induction. In the case of the induction coil the primary coil is subject to the same variation in field strength as the secondary coil, and the primary itself is therefore acted upon inductively as well as the secondary. This action of the primary upon itself is known as self-induction, and it opposes any increase or decrease in the current. The larger the number of turns in the coil, the greater is the self-induction, and it is also greater in a coil containing an iron core. In a coil having a large number of turns, self-induction causes the current to increase in strength very gradually after the circuit is closed, and it also tends to prolong the current after the circuit is broken.

Electromagnets.

Referring again to the similarity of action of solenoids and magnets, it will be remembered that all of the lines of force pass through the body of the magnet and through the interior of the solenoid. For this reason, if a piece of iron is placed in the interior of a solenoid, it will be strongly magnetized, as more lines of force will pass through it in this position than in any other location about the solenoid in which it could be placed. A piece of soft iron surrounded by a coil in this manner is called an electromagnet, and the



PRIMARY AND SECONDARY TRANSFORMER WINDINGS ON IRON CORE.

electromagnet forms the foundation of all dynamo-electric machinery. Electromagnets may be made much stronger than permanent magnets, and as their magnetism depends upon the current flowing around them, it can be varied and closely regulated. The iron remains a magnet only while the current surrounding it is flowing, although slight traces of residual magnetism generally remain after the circuit is broken.

Electromagnets are used in numerous ways, besides being the basis of dynamo-electric machines. They are also used in telegraphic instruments and telephones, electric bells and in a great variety of electric measuring instruments. They may be made very powerful, so as to have great lifting strength when built in the shape of a horseshoe magnet. In this form they are frequently applied on electric cranes for lifting heavy girders or iron plates, or even pieces of hot iron, by simply bringing these magnets into contact with the piece to be lifted, and closing the circuit through them. They are capable of lifting weights of hundreds of pounds, thus dispensing with hooks or chains for lifting purposes.

Theory of Dynamo-electric Machinery.

From the principles already explained, the reader will now be able to grasp the general theory of dynamo-electric machinery. Returning to a simple horseshoe magnet, if a loop or coil of wire is passed across the ends of such a magnet, so that the wires tend to cut the lines of force passing from the north to the south pole, a current will be generated in the loop or coil. This current is induced, as we have already seen, by the magnetic field surrounding the poles of the magnet, and this induced current only appears when there is a change in the number of lines of force being cut by the loop. In passing from the weaker to the stronger part of the magnetic field the induced current in the loop will be increasing, and in passing out from the stronger to the weaker side of the field again, the current in the loop will be decreasing. The induced current in this loop of wire is therefore of a variable character as the loop passes across the pole pieces of the magnet. The current commences at zero, grows to a maximum, and then decreases again to zero, and this same cycle occurs each time the loop passes the pole pieces of the magnet.

This is really the primitive form of dynamo, and is the principle upon which all electric generators are based. Instead of a permanent horseshoe magnet an electromagnet is substituted, which is much more powerful, and which induces much more powerful currents in the generator. The loop of wire is changed in the modern dynamo to a number of coils of wire which are arranged upon an iron core, this combination being known as an armature. The armature is revolved in front of the poles of one or more electromagnets, so that the armature coils are constantly cutting the field of force of the electromagnet. The field of the generator is a large electromagnet, or a series of electromagnets, and may be compared to the primitive horseshoe magnet. The function of the field is to produce a field of force or magnetic field in which the armature revolves. The current produced by the machine is induced in the armature coils, which may be compared to the simple loop which was passed in front of a horseshoe magnet.

From the foregoing explanation it will be seen that a pulsating current is produced in each armature coil as it passes the pole-pieces, the current rising in each coil from zero to its maximum pressure, and dropping again from its maximum to zero. This pulsating current in each coil will also occur in alternate directions as the coil passes from the north to the south pole, or from the south to the north pole of the magnet. The full cycle of changes in each coil will therefore be as follows: Beginning at zero, the current rises to its maximum pressure in the positive direction, then falls to zero and rises again to its maximum in the opposite or negative direction, then falls again to zero. Thus the current in every generator coil is an alternating current, being first in a positive direction and then in a negative direction, and in some generators the current is led off from the machine as alternating current. These are known as alternating-current generators. In other generators, known as direct-current generators, machines are provided for taking the current from the machine when it reaches its maximum pressure in one direction. This device for producing a direct current is known as the commutator.

With this general understanding of the principles of magnetic induction, we are now prepared to examine the details of construction of any kind of an electric generator, and no matter what complications may occur in the methods of winding, methods of control, etc., the simple magnet with the loop of wire passing across its poles will be found to be the basis of its design.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

The Schley Conduit Company has been organized in Pittsburg, Pa., to construct and maintain an underground system in the Thirteenth and Fourteenth wards of Pittsburg. The application for a charter has been signed by William K. Johnson, A. T. C. Gordon and W. G. Rock of Pittsburg. The purpose is for a general conduit system for wires of all kinds.

QUESTIONS AND ANSWERS.

Some Simple Testing Methods.

R. B., Jackson, Mich.: Referring to the article in the Western Electrician of December 29th last on "Some Simple Testing Methods," please answer the following questions:

1. In Fig. 11, is the resistance of the slide-wire 500 ohms?

2. In the reference to Fig. 9 there is the equation $\frac{30 \times 10}{6} = 50$. Where do you get the 6?

3. On page 521, "How to Make an Ohmmeter," I notice that the non-inductive coils are wound with twice the length of wire required. Does this mean to use wire of double the length with no more resistance than there would be in a coil of smaller wire with a certain resistance?

4. Explain how 972,000 ohms is obtained in the example of Fig. 4. Also, in the example of Fig. 5, explain the 200 ohms.

ANSWERS.

Mr. Coar, the author of the article, supplies the following answers:

1. No. The 0 to 500 marks are used to designate the number of divisions into which the scale wire is divided. The scale wire may have from 50 to 100 ohms resistance, depending upon the size and material selected.

2. A reference to Fig. 9 will show that 6 represents the number of inch-divisions on one side of the point where the "feeler" is in contact. There are 30 inch-divisions on the other side, making 36 in all.

3. The idea is first to obtain the proper length of wire for the required resistance; then take this length and double it back on itself, as illustrated,

METHOD OF WINDING NON-INDUCTIVE COIL.

winding it in this manner, treating both wires as one, upon a spool until finished, when the two ends are fastened to the proper terminals.

4. In the first case we are dealing with a voltmeter having an internal resistance of 18,000 ohms, and the full voltage of the generator (G) is 110 volts. By arranging to test this plant for insulation, as shown in Fig. 4, we find that we obtain a deflection of two volts, or, in other words, the insulation resistance is sufficiently low to allow 110 volts to force enough current through this fault and voltmeter circuit to cause a reading of two volts. Then, by the formula, the resistance of the fault = resistance of voltmeter $\times \left(\frac{\text{full voltage reading}}{\text{reading through fault}}\right) -$ resistance of voltmeter,

or $X = 18{,}000\left(\frac{110}{2}\right) - 18{,}000 = 972{,}000$ ohms.

Or we might say, if we obtain a reading of 110 volts with 18,000 ohms, the resistance of the voltmeter, and we obtain a reading of two volts through the fault, it is evident that the resistance of the fault must be considerably higher than that of the voltmeter, or, by direct comparison between the two readings, we obtain, $18{,}000 \times \frac{110}{2} = 990{,}000$ ohms in the circuit. But this product not only represents the resistance of the fault, but also the resistance of the voltmeter, because it is in the circuit, so we have to deduct this 18,000 from 990,000, leaving 972,000 ohms as the resistance of the fault proper.

In Fig. 5 we measure the drop of voltage around a coil whose resistance is known to be 100 ohms. With the voltmeter arranged as shown in Fig. 5, we obtain a reading of five volts. Now, when we substitute an unknown coil in place of the one having 100 ohms resistance, we obtain a reading of 10 volts, which would prove that this latter coil was higher in resistance, because a larger portion of current was shunted around it through the voltmeter. In this instance the reading obtained around the unknown coil was twice as great; hence the resistance of the unknown coil should be twice as great, or two times 100 ohms, or 200 ohms.

The Question of Frequency Again.

J. B. H., St. Louis: Are there any 100 or 133-cycle electric plants now operating in the country, and, if so, where are they located?

ANSWER.

The 100-cycle periodicity is very seldom used in this country, and only a few plants can be found where it is employed. As to 133-cycle plants, there are a number of comparatively small size scattered throughout the country, although they are less numerous than the 60-cycle installations. In Missouri, for instance, the Aurora Light, Ice and Storage Company, the Boonville Electric Light and Power Company, the People's Gas and Electric Company of Chillicothe, Maryville Electric Light and Power Company, Moberly Gas and Electric Company, St. Charles Electric Light and Power Company, King Electric Company of St. Louis, Magnolia Light, Heat and Power Company of Warrensburg, and a number of others report the use of 133 cycles. Several central-station plants in the same state use 125-cycle current, and one, the Laclede Gas Light Company of St. Louis, has 100-cycle apparatus, it is believed.

The Luminometer.

R. B., Jackson, Mich.: How can a luminometer be constructed that will do accurately what Mr. Willcox speaks of in the Western Electrician of January 26, 1907, page 87, column 2?

ANSWER.

The luminometer is constructed on the simple principle of balancing a small lamp placed inside a box against the outside illumination by means of a grease-spot disk, such as is employed in the ordinary Bunson photometer. The inside lamp can be connected to a lighting circuit by a flexible cord or put on a battery, and by raising or lowering this inside lamp by means of a rheostat the illumination can be adjusted equal to that of the exterior lighting to be tested and a point of balance can be obtained by watching the spot. Additional refinements can be added to make the measurements more exact, but this, in general, is the principle of the instrument.

Climax Wire.

R. B., Jackson, Mich.: What kind of metal is Climax, and what is the price, compared with copper?

ANSWER.

"Climax" is an alloy of nickel and steel and has a resistivity of 525 ohms per mil-foot at 75° F. Inquiries as to price should be addressed to the manufacturer.

BOOK TABLE.

WIRELESS TELEGRAPHY. By A. E. Kennelly, A. M., Sc. D. New York: Moffatt, Yard & Co. 1906. Pp. (5 by 7½ inches), viii., 211, with 66 illustrations. Price, $1.

The production of this work is a further evidence of Professor Kennelly's great technical versatility. As announced by the publishers, the book tells "the whole story of wireless telegraphy from its invention to its very latest development, including the most complete explanation of its underlying principles and their application." The work, however, deals only in a very limited way with wireless telegraph practice and operation. But as an elementary treatise on the phenomena of electromagnetic waves, their production and propagation through space, the work is quite original and instructive. Nearly two-thirds of the volume is devoted to a lucid and complete non-technical discussion of the phenomena involved.

Professor Kennelly has written a book which will be found especially valuable to those practicians and operators who have not previously had an opportunity to study the theory of wave motion in the ether and in other media. The author has, as he states, "taken the liberty of describing things and operations without tracing each to its appropriate inventor." Not even the names of Hertz or Marconi appear in the book. This procedure has, of course, greatly handicapped the author in not being able to refer to dates or to mark properly the various stages of progress of the art of wireless signaling. Nevertheless the work furnishes a valuable addition to the already published literature on the subject of radio-telegraphy.

Alleged Noiseless Railroad Tie.

The invention of a noiseless railroad tie for steam and electric lines is said to be the product of the mind of John G. Snyder, a traveling salesman, who, during years of sleepless nights in sleeping-car berths when the noise of the train made sleep impossible, thought out the device. Large orders for the ties are said to have been placed by the Pennsylvania road.

The device, according to Van Norden's Magazine, consists of a steel case, or shell, filled with a composition of asphalt and stone. At the bottom the steel shell does not close upon the asphalt, but allows it to rest upon the ground, and it is this that furnishes the resilience which reduces the noise of rolling stock to practically nothing. The rails are fastened on the tie by steel clamps instead of spikes, which preclude possibility of the rail spreading. The tie costs from $2 to $2.75, according to dimensions, and a minimum life of 25 years is said to be guaranteed. If a success in practice the same system can be applied to city surface car lines, and noisy stret cars need not be known.

Chicago City Railway Earnings.

At the annual stockholders' meeting of the Chicago City Railway Company last week it was reported that the net earnings of the company for the year ended December 31, 1906, were equal to 9.58 per cent. of the capital stock of $18,000,000, being a slight increase over the preceding year. From the statement of earnings the following figures are taken: Passenger receipts (increase $532,774.63), $7,773,446.29; receipts from other sources, $97,680.30; total (increase $540,046.45), $7,871,126.63; operating expenses, taxes, depreciation and interest on floating debt (increase $503,697.75), $6,146,304.42; net income (increase $45,348.70), $1,724,822.21; dividends (same amount 1905), $1,620,000; surplus for the year (increase $45,348.70), $104,822.21.

Passenger receipts per day were $21,297.11. Fare passengers carried increased 7.34 per cent. over 1905, the number being 156,177,363. The number of fare and transfer passengers carried was 250,800,469, an increase of 7.45 per cent. At the close of the year the company had 1,291 electric cars and 767 cable cars (no cable lines are now in operation). The mileage of single-track electric lines is 243.56.

The total expenses for the year were $6,146,304, an increase of $503,697, or 8.92 per cent. The increase was due largely to the increased volume of business necessitating more cars and labor to handle the same, to which was added the heavy track repair account and the increased interest charges on money borrowed, due to the large sums being expended for new cars and construction of power plant and other buildings.

The directors met after the stockholders' meeting and re-elected, with one exception, the old officers. F. D. Hoffman was elected treasurer.

New Electric Train on New York Central Wrecked in The Bronx.

The White Plains and Brewster express, one of the first new electric trains over the New York and Harlem Division of the New York Central Railroad, was wrecked with great loss of life near Two-hundred-and-fifth Street, New York city, at 6:40 p. m., February 16th. The exact cause of the accident has not been determined. The train is scheduled to leave the Grand Central Station at 6:15. Only the night before its schedule was changed, taking off many of the stops and giving commuters beyond Plainsville fast service. Including those who have died in hospitals more than 20 deaths are the result of the wreck. Nearly 100 persons were injured, some of them seriously.

The train consisted of five passenger cars, with two of the new electric locomotives ahead. It ran on track No. 3 of the five third-rail tracks out of the station. Just after leaving a curve, it appears, the last car left the track. When it tipped over it pulled the next coach from the track and then the next two followed. The locomotives, it is said, still remained on the track when brought to a stop. The cars were dragged about 200 yards.

Officials of the road are equally vigilant with the various authorities to ascertain the cause. There are reports that the train was moving at a terrific speed, causing the rear coaches to be whipped off. The schedule calls for 56 miles an hour over the section in which the wreck occurred, but officials declare the train was not moving faster than the rate of 50 miles an hour.

Vaporizing Gold in the Electric Furnace.

Professor Moissan, in vaporizing gold in the electric furnace, finds that 100 to 150 grains can be evaporated in two or three minutes. By condensing the cold vapor on a cool surface, either filiform masses or cubical crystals can be obtained. It is found that gold, like copper and iron, dissolves a certain amount of carbon when in the liquid state, but this separates out as graphite on cooling. Gold is found to be less volatile than copper. The properties of distilled gold are the same as those of hammered gold, or the melted metal reduced to a fine powder. When an alloy of copper and gold is distilled, the vapor of copper comes over first, showing that there is no definite compound. In the case of alloys of gold and tin, the latter metal burns in contact with air. This tin oxide is found to be of a purple color, due to a deposit of fine gold on its surface.—Mechanical World.

Warrantable Expense for Meter Testing.[1]

By Oliver J. Bushnell.

During the last decade wonderful improvements have been made in all kinds of electrical machinery and apparatus. Only a little more than 10 years ago there was exhibited at the Chicago World's Fair a "Jumbo" generating set consisting of two 400-kilowatt dynamos directly connected to a 1,200-horsepower vertical engine, and later, when this was installed in the Harrison Street station of the Chicago Edison Company, the advisability of such large units was seriously questioned. Today dynamos of 12,000-kilowatt capacity are in daily operation by the same company. A like progress, though perhaps not quite so apparent, has developed the electricity meters of the present. The old chemical meters and fan-braked induction meters have been discarded for instruments which, with proper care, will give almost absolutely accurate results throughout their whole range. Meters which can run with such accuracy are naturally more delicate than their predecessors. Friction has been reduced to a minimum in their design and all the parts are carefully proportioned and adjusted. If such meters as these are to retain their accuracy, the bearings must be kept polished, the starting torque adjusted to local conditions and all parts clean and free from dust.

As a result of these conditions, meter testing is a well-recognized branch of the work of up-to-date companies. There is hardly a central-station manager who now questions the advisability of comparing customers' meters periodically with a reliable standard, any more than he would neglect to compare his watch occasionally with a standard chronometer. The principle of the matter is well accepted, but when it comes to expending the money necessary for the work some are apt to be "penny wise and pound foolish."

Periodic Tests.

Probably the most important point to be considered in connection with our subject is the frequency with which meters should be tested. Most central-station managers believe that, as a matter of general policy, meters should not run much longer than a year without testing, both as a protection to the company against loss, and as an assurance to their customers of the correctness of their bills. These men would doubtless also assent to the proposition that it would pay to give special attention to meters involving a large amount of income. We cannot, however, arrive at the proper frequency of tests with any correctness without a study of the conditions which affect meter accuracy.

We find that in all meters the revolving part is mounted on a jeweled bearing, which in time becomes rough; again, that the permanent drag magnets are liable to change from aging, rough handling or short-circuits; again, that in commutator-type meters, the commutator and brushes will wear and become rough from sparking; lastly, that all meters are influenced more or less by vibration, dampness, dust and other conditions of installation. Jewel wear, the first of these causes which affect meter accuracy, is influenced chiefly by the weight of the moving element, the number of revolutions of the shaft and vibration. The first of these is constant for a given type of meter; the second is easily ascertained from the meter readings, and the influence of the last can be learned from successive tests.

Just how much wear a jewel will stand is somewhat uncertain. Sapphire, which is almost universally used, is of uneven structure, and variations in the quality of jewels cannot be eliminated by the most careful inspection in their manufacture. In a report on "Jewels and Pivots" in commutator meters, made a few years ago by the meter committee of the Association of Edison Illuminating Companies, it was suggested as a result of about 200 time tests that 800,000 revolutions be taken as the limit of wear of sapphire jewels in meters not subject to vibration, with half that number as the limit where vibration was constant. Since that time commutator-type meters have been very much improved, and in the latest type the weight of the moving element is only one-third as much as formerly. It does not appear that the decrease in jewel wear is directly proportional to the decrease in weight of the moving element, but it is probably nearly so. It would doubtless be more accurate to adopt a different limit of revolutions for each type of meter, in which the weight of the moving element is different, but for convenience 1,000,000 revolutions has been quite generally adopted as the limit of wear for sapphire jewels in all commutator meters.

The writer has not any direct data on the wear of sapphire jewels in induction meters, and here again the weight of the moving element varies in different types of meters; but from a comparison of these weights with those of the moving elements in commutator-type meters and from the lesser number of jewels found defective in annual tests of induction meters, it is evident that a jewel will stand at least two or three times the number of revolutions in an induction meter that it will in a commutator type. The writer believes the limit of wear of 2,000,000 revolutions, adopted by a large eastern company, is certainly safe.

About 2½ years ago there was discovered a process of cupping diamond jewels for meters, and since then they have come into considerable use. One company has made tests of these jewels up to 9,500,000 revolutions without the stone showing any wear, but in some of the tests the shaft points became so flat as to introduce considerable friction. What the average life of the jewel is we cannot state, but believe that it can safely be taken at five times that of sapphire jewels, and that it is probably more than this. Although the adoption of diamond jewels largely removes jewel troubles, the elements of magnet change, commutator friction and deterioration, due to local condition, still remain to be considered. These are so uncertain that they cannot be classified directly, and the old limits of registration between tests originally adopted for sapphire jewels have been adhered to quite generally among those companies which are using diamond jewels, on account of possible deterioration from these other causes.

There is an important factor also in meter construction to be considered in this connection which makes the size of the meter an element to be considered in determining the frequency of tests. Meters of a given make have approximately the same full-load torque in all sizes. It follows that a meter of large capacity will at times necessarily operate with much less torque than a meter of small capacity, with a resultant increased liability to error. To illustrate, suppose a five-ampere 100-volt meter and a 50-ampere 100-volt meter are both recording a load of one 50-watt lamp. The first is running on a 10 per cent. load, with 10 per cent. of its full-load torque, and the other on a one per cent. load, with only one per cent. of its full-load torque.

As the full-load torque of both meters is the same, it follows that the small meter has 10 times as much torque on one lamp as the large one. Suppose also that it takes one-half of one per cent. of the full-load torque to overcome the friction of the bearings, the small-capacity meter would run five per cent. slow, while the large-capacity meter would run 50 per cent. slow on the 50-watt load. It is at once evident that meters of large capacity should be kept in better condition and more frequently tested than those of small capacity.

In accordance with the foregoing considerations meters should be classified for testing somewhat as follows:

First—A limit should be set within which all meters should be tested.

Second—A classification should be made according to sizes, so that the large meters will be tested oftener than the small ones.

Third—A classification should be made according to the work done by the meters, so that they will not be allowed to exceed a fixed number of revolutions between tests.

Fourth—Changes in classification should be made to allow for local conditions, as made evident by the results of successive tests.

In order to find out the methods now used in meter testing, the writer sent out a number of questions on the subject to 12 of the largest companies in the country. The first two were as follows:

1. How often are your electricity meters tested?
2. On what basis is the frequency of tests determined?

Following are four of the answers received:

First Answer.—1. By inspection once a year. 2. The basis of the frequency of tests is assumption that meters should be inspected at least once a year.

Second Answer.—1. From one month on largest meters to 15 months on induction meters in residential districts, all meters coming, as a rule, within either one, three, six, nine or 12-month classes. 2. On the basis of the work which the meter is doing, the intention being to test at every million revolutions of the disk in direct-current meters and every 2,000,000 revolutions in induction meters.

Third Answer.—1. As a general rule, once in 12 months; some are tested monthly, quarterly and semi-annually. 2. The period is decided by the amount of the monthly registration, varying, of course, with the various sizes of meters. All meters tested more than once a year are equipped with diamond jewels. Our data show that a meter equipped with a diamond jewel need not be tested until it has made a million or more revolutions.

Fourth Answer.—Our meters are tested each time they are returned to meter shop, regardless of time they have been installed. Others that have been installed three years are changed, tested and cleaned up. We do not test meters on customer's premises unless requested to do so.

Commenting on these replies, the writer believes that the first system must result in the meters measuring the largest consumption showing the poorest accuracy.

The second tends to keep all meters on a level of accuracy at the same per cent. loads, but will result in a disproportionate loss from the large-capacity meters on light loads.

The third system, which takes the size of the meter also into account, will not only keep up the accuracy of the meters under heavy service, but will also maintain the accuracy of the large-capacity meters operating considerably under light-load conditions.

The fourth system, the writer believes, is faulty both in allowing too long a time between tests, even for induction meters, and also in the method of testing, which will be taken up later.

The classification adopted by the writer about two years ago for commutator meters was as follows:

Annual tests for meters of five to 10 amperes capacity.

Semi-annual tests for meters of 15 to 50 amperes capacity.

Quarterly tests for meters of 75 amperes capacity and above.

Meters making over 1,000,000 revolutions of the disk between tests on above classification to be changed to more frequent class, so as not to exceed that number between tests, up to the quarterly class.

It has not been thought necessary to test any meter oftener than once in three months. Where a meter has not retained its calibration for this length of time, an investigation has been made. Such rapid loss of accuracy is usually found to be due to commutator trouble, caused either by excessive vibration or heavy momentary overloads. In the first case, the meter has been moved or mounted on a spring board, and in the latter a larger meter has been installed, with a better resultant accuracy than if the old meter had been left as it was and tested monthly. All meters tested quarterly have been equipped with cupped diamond jewels, and the semi-annual class are being so equipped as rapidly as they can be obtained.

A study of the data compiled from the tests made according to the foregoing schedule reveals some interesting facts. In the first place, the accuracy of the meters improves in an increasing ratio the more frequent the testing. The quarterly tests at one-half load show 15 per cent. more of the meters to be accurate than the annual tests, and 10 per cent. more than the semi-annual tests, while the improvement shown by the light-load tests, which are made at one-tenth load, is still more marked. The same increasing ratio of improvement the more frequent the testing is seen in the average accuracy obtained from these tests, which was as follows:

	One-half Load in Per Cent.	One-tenth Load in Per Cent.
Annual tests	97.3	89.6
Semi-annual tests	97.8	90.8
Quarterly tests	99.1	96.5

An important showing from the data of the meters out of calibration is the ratio of the meters slow to those fast, which, at one-half load, was more than two to one, while at one-tenth load it was five to one. On still lighter loads, the ratio would doubtless be further largely increased. It was also shown by the data that the type "C" commutator meters maintained their accuracy much better than the older types with heavier moving elements, especially on light loads, where the greatest improvement was needed. A better accuracy was shown by the annual tests of type "C" meters than by the semi-annual tests of meters of the older types.

The writer has not given the above schedule, however, as a model, but rather as an illustration. In the light of the results obtained, he expects to make some changes for the coming year. It would seem as though some differences should be made in the classification of commutator meters as regards the type, though the use of diamond jewels in all of the older types may largely obviate the necessity. In particular, however, it would doubtless be advantageous to test more of the meters quarterly, placing at least more of the meters of the older types in this class.

Induction meters have so far been classified by the writer on an annual basis for testing. Owing to the light weight of the moving element and the absence of commutator friction, these meters retain their accuracy much better than the commutator type. Data, compiled from about 14,000 annual tests, showed an accuracy almost identical with that of commutator meters under quarterly testing. As it is probable, however, that the meters measuring the largest consumption are below the general average, it is expected the coming year to test the larger meters and those showing over 3,000,000 revolutions between tests on a semi-annual basis.

Installation Tests.

Having decided on some schedule for periodic testing, an important point to be next considered is the advisability of making installation tests. It is well known that meters transported some distance are liable to slight changes in calibration;

[1] A paper read before the Northwestern Electrical Association at Chicago on January 16, 1907. The author is superintendent of the meter department of the Chicago Edison Company.

also that direct-current meters, unless connected according to polarity markings, or, even if so connected where influenced by magnetic fields from other conductors, will show some error on light loads. The questions sent out by the writer brought back the information that two of the largest companies in the country make a test on every meter installed before the first bill is rendered, notwithstanding the fact that the meters have previously been corrected in the testing room. In the Chicago Edison Company it has been the practice to have all meters after installation inspected, and cleaned and adjusted, if necessary, so as to run freely on a light load. In order to get some information as to the condition of meters after their installation, and as to whether an inspection or test is advisable, the writer made 100 tests of commutator meters and 100 tests of induction meters immediately after they were installed, these meters having all been adjusted in the shop before being sent out. The accuracy after installation, as shown by these tests, was rather disappointing, especially so in commutator meters on light loads. Tests were then made on an equal number of meters after the usual starting inspection. These tests showed a decidedly improved condition of these meters over the others, especially on light loads, and a better accuracy than that shown by any of our periodic tests. Still, there were some meters which showed a change of from five to 10 per cent. in their whole calibration. It is particularly desirable that the bills of a new customer should be absolutely correct. If a meter is slow for two or three months and then is corrected, it leads to the suspicion, when the bill goes up, that the company is increasing the bills arbitrarily after it feels sure that the customer will be permanent. The conclusion seems warrantable that both alternating-current and direct-current meters involving considerable consumption ought to be tested within one month after installation. The direct-current meters will be left in a more permanent condition if allowed to run for two weeks before testing, so that the commutator will have become oxidized. For the large class of small meters for offices, apartments and houses a careful inspection appears to be a sufficient safeguard. Perhaps a good division would be that meters which it is advisable to test oftener than once a year should have an installation test and others an inspection only.

Methods of Testing.

The methods of testing should have some attention, which, of necessity, is very much abbreviated. The first important point is to have accurate standards. A laboratory standard voltmeter, a standard shunt and a precision indicating wattmeter make excellent working standards. These should be returned to the factory occasionally for calibration, unless the company has a laboratory, where they can be checked. In the absence of these, a set of the working instruments should be kept for checking other instruments only, and returned to the factory for recalibration every six months.

Meters can be tested on the customer's premises or brought in and tested in the shop. Some have contended that the latter is the more accurate way, as conditions are more favorable for correct measurements. The necessity for installation tests, which is shown in a previous part of this paper, proves conclusively, however, that meters should be tested under local conditions in which they are to operate, and after all danger of change from transportation is over. Even if a meter is taken out and installed with the utmost care, so as not to disturb the original calibration in the slightest, frequently some change in the light-load adjustment is necessary to adapt it to local conditions of vibration or adjacent magnetic fields.

Four methods of testing are in general use:

1. With ammeters, voltmeter and stop-watch.
2. With calibrated resistance, voltmeter and stop-watch.
3. With indicating wattmeter and stop-watch.
4. With check-recording wattmeter.

The first method is used only on direct-current work, and the second should be only so used unless the resistance is absolutely non-inductive. Self-contained shunt Weston ammeters, on account of temperature error, should not be used except in small sizes, and even then the current should be kept on the instrument only during the time necessary to make each test. Resistance shunts with negligible temperature coefficient and millivoltmeters should always be used for measuring large currents. The indicating wattmeter should be used only for alternating-current work, as it is not reliable on direct current, owing to the influence of external magnetic fields. The check-recording wattmeter has the advantage of not requiring a stop-watch, yet if a portable load is used the inspector can tell the per cent. load on the meter with sufficient accuracy. An ordinary meter can be placed in a carrying box and used for checking, but it is better to use one of the special test meters, of which there are two or three kinds on the market. These meters are built with several field windings, so that the full torque of the meter is available at different loads The meter under test can accordingly be tested with equal accuracy at heavy and light loads by connecting to the field coils of the corresponding capacity in the test meter. This method is particularly advantageous where a meter must be tested on a fluctuating load.

Each method of testing has its advantages, and each will be found best, doubtless, for some kinds of work. The writer has had all in use, and finds no particular advantage of one over the others in the amount of work which can be accomplished. He inclines to the belief, however, that the test meter with several field windings will soon have more general adoption and prove slightly more economical than other methods.

The number of meters which can be tested by an inspector in one day has been variously reported by the different companies from which data were secured at from six to 10. The writer believes an average of about seven should be obtained in testing commutator meters and eight or more in testing induction meters.

The use of diamond cupped jewels is recommended in all of the older type commutator meters where the jewel is subject to heavy wear. Sapphire jewels may be once repolished, but the stones should be removed from the screws and polished and inspected, the same as new stones, and set in new screws. If polished in the old setting some of the powder is apt to be left in the screw and cause trouble. Pivots also may be used a second time if they are carefully repointed and polished. A new pivot or shaft should always be inserted when a jewel is changed.

It is advisable to test meters at two points. The light-load calibration is usually made at one-tenth load and heavy load at from one-half to full load. It makes no difference whether one-half or full load is used, as far as the final calibration of the meter is concerned, but the reports of the meters as found would doubtless show better on a full-load test. One-half load is used by the writer as being nearer the running condition of the meter.

Whatever tests are made an accurate record should be kept and the results carefully tabulated. Only by an accurate knowledge of the condition of his meters and a study of the results of his testing can a central-station manager satisfy himself as to whether or not he is warranted in the expense he is incurring.

Cost of Testing.

We now come to the question which many may consider the most vital to the subject. What will a thorough system of meter testing cost? Whatever is said on the subject will doubtless be questioned by a good many, as the practice of different companies varies so much, both as to the amount of testing and the expense items which are included under this head. The expense in the same company also would vary with the character of the customers served and the amount of consumption measured. Nevertheless, approximate figures may be arrived at as a general guide to good meter practice. These figures might be expressed in cents per kilowatt-hour generated output or in per cent. of metered income, but it seemed to the writer that they would be more readily understood and of more accurate application if based on the number of meters in service. The writer collected some data on this subject, but the classification of accounts varies so in different companies that the figures are not readily comparable or all applicable to the expense of meter maintenance only.

Meter testing, in the broad sense we wish to use, should include all maintenance expenses and cover periodic testing, shop testing and repairing and installation tests and inspections. The money actually spent on this work in different companies from which figures were received varied from 48 cents to $1.63 annually per meter installed. The writer must accordingly draw largely on his own experience and the figures of the companies with which he is connected for his conclusions. Naturally the expense for direct-current meters is greater than for induction meters. It is customary also to distribute direct current largely in business districts, where the wear on the meter is greater on account of longer use, and alternating current in residential districts.

A thorough system of testing, based on the principles outlined in this paper, cannot be carried on, according to the estimate of the writer, for less than about 75 cents per meter installed for induction meters, and $1.50 per meter installed for commutator-type meters annually. It is possible that there are some companies with few large customers and little increase in business which could do the work for two-thirds these figures, but for a progressive, growing company they are not too high. These figures include the cost of all instruments, apparatus and supplies necessary for carrying on the work, as well as the cost of material used in the meters and labor. The salaries of meter testers is assumed to be from $50 to $65 per month for the most part, and helpers for testing large meters at $40 per month.

It must be borne in mind that the amount given will not be spent on every meter. A third of it would cover the cost for a large part of the meters which are tested annually, but two or three times this amount would be necessary for other meters which are tested quarterly. The general average is also brought up by the cost of installation tests and inspections, and of repairs to defective meters, together with the cost of instruments and general supplies.

These figures are based on a system of testing which experience has shown to be advantageous. It is not the intention, however, to limit the expenses to these amounts, as further experience may demonstrate the advisability of still more expenditure for this purpose. Of course, for meters measuring little consumption, the limit of expense is reached when reasonable accuracy is obtained, but for meters measuring a large consumption the cost of meter maintenance may be inconsiderable as compared with a loss of a fraction of one per cent. in registration.

The high cost for direct-current meters is partly on account of the introduction of cupped diamond jewels. These cost about five times as much as sapphire jewels, but their use is fully warranted both by the better accuracy obtained and by the longer life of the jewel. The Chicago Edison Company has put in service over 3,000 of these jewels in the last two years, half of which have been in use over a year, and as yet only about one per cent. of them have become worn. Compare these results with data on sapphire jewels, of which 40 to 60 per cent. are found defective in annual testing, and the value of the cupped diamond jewel is readily apparent.

It may be objected that not yet has it been shown that the estimated expense for meter testing is warrantable. The reply, in the first place, is that any reasonable expense is warrantable which will make a company's bills accurate and its dealings with its customers honest. In the second place, that in all probability the expense will be more than met by the increased revenues from accurate meters. This statement is difficult of demonstration, as we are unable to know just what the accuracy of the meters is under working conditions, either with or without testing, but we will give two illustrations which will hardly leave any doubt as to its truth.

About two years ago the Chicago Edison Company changed from a system of annual testing, with semi-annual testing of a few of the largest meters, to the classified system outlined in this paper. Under the old system the meters ran from 15 to 16 months between tests, owing to interruptions in the work and changes of inspectors. After the change sufficient help was employed to keep the work strictly up to the schedule. As a result of this testing the unaccounted-for output decreased from 8.7 per cent. to 7.1 per cent. of the total generated, showing a saving of 1.6 per cent. As the generated output for the year was 76,454,000 kilowatt-hours, the saving amounted to 1,223,264 kilowatt-hours. This represents additional energy paid for, so to determine the income saved to the company it must be multiplied by the average price received. Assuming this to be seven cents per kilowatt-hour, we find the saving amounted to over $85,000. This is 60 per cent. more than the total meter-department expense, about three times the total expense for testing and repairing meters, and eight times the additional expense over that previously expended for testing.

Take another example. In a suburb near Chicago the meters had been allowed to run much as they pleased for several years. A year ago they were all overhauled and some of the old types discarded. This fall the income showed an increase of 38 per cent. over the previous year, and one-half of this increase was attributed by the manager to the improved accuracy of the meters.

Meter testing, however, as stated above, is a matter of ethics as well as economy. Suppose your average accuracy is at present so high that the cost of testing will not be covered by the increased income, still it is the duty of lighting companies to take all possible precautions to prevent inaccuracies in their bills. Fortunately the meters manufactured today retain their accuracy better than those of a few years ago, and when these older types have all been worn out or discarded, it is hoped that less frequent testing will be necessary. Present conditions, however, demand that companies should give more attention to meter testing than is ordinarily done. It is also a fact that those companies which have done the most in this line best appreciate its economic value.

Discussion.

President Almert called on R. C. Lanphier of Springfield, Ill., to open the discussion, but Mr. Lanphier (who is the author of the excellent paper on meters recently published in the Western Electrician) said that his was the manufacturer's point of view and he preferred to hear from the central-station operators. W. B. Voth of Sheboygan, Wis., said he believed in testing meters once a year, or once in six months in a large installation. A condensed report of the succeeding discussion follows:

F. W. Insull, North Shore Electric Company, Evanston, Ill.: We know in our own company that it pays to test meters, and it pays for several reasons. The first reason is that in the fall of the year pretty nearly every customer comes in for the purpose of making a few remarks about

the increase in the size of his bill. Now if we know that the meter has been tested within a period of, say, six months, we occupy a strong position; and if we feel that we have good ground to believe that the meter is correct we can talk intelligently with our customers.

Another good reason for testing meters is that very often we have a person come in and say that it is all very well for the company to test meters, but it is best to have an outsider come in and test the meter. Of course, we readily agree to that. The last instance of that kind was with a man who had a bill of a little over $99—a rather large bill for one month's lighting—and he said, if the consumption was right he was perfectly willing to pay the bill. He suggested that a certain professor come up and test the meter, and we agreed. He said, "Will you assist the professor?" and we said, "Certainly." This gentleman went up and tested the meter and found it within one per cent.—and of course we rejoiced.

Another reason why it pays is because it increases your income. Now you can go through a district and test up meters (and especially in districts where the meter test has not been done for two or three years) and get a large and proper increase in the income. Of course, there is a disadvantage in letting the period run so long, because every customer in the district knows when the man has been through testing meters, and very often they come back at you with the remark, "Well, the man has been around 'fixing' the meters, and this is the result—larger bills!" And they seem to think that we really have been "fixing" those meters; but I might add that where such cases have come under our notice, it has been in districts where we have just taken over a new territory; and, of course, in that case, the first thing we do is to look at the meter.

Our company is made up entirely of small independent companies which have been taken over in the last five years, and I do not know of any district taken over that has had right-up-to-date meters. They have been allowed to drag along; any old meter at all would do! And if it were once set and no complaint made, the meter was not tested or inspected unless it stopped. We found that this often represented a large loss, and the substitution of correct meters meant frequently a 50 per cent. increase in the bill, and sometimes more; and so, from my point of view, I would urge the testing of meters regularly.

Secretary Adams, Lincoln, Neb.: What has been done by you with reference to throwing out old types of meters?

Mr. Insull: We throw out all old meters, and sell them for as much as we can get—say, $2.50 or $3 each.

Mr. Wheeler, Eau Claire, Wis.: What do you call an "old" meter?

Mr. Insull: I would not want to mention names, but we buy what we think are good meters, and we practically throw out all the rest. Of course, we use more than one type of meter.

Mr. Wheeler: Is it an induction meter?

Mr. Insull: Yes; all our meters are induction meters.

The Secretary: Mr. Bushnell, do you throw out old meters?

Mr. Bushnell: We "junk" meters all the time, every little while. Whenever they accumulate we sell them for junk. Most of them are sold to second-hand meter companies, but we do not get as high as $2.50 or $3 for them. We think we are doing well if we get an average of $1 a meter for them.

As I understand, these meters are fixed up without any regard to their light-load accuracy, but simply so that they will run with tolerable evenness. They are sold to small stations, principally, I presume, in Wisconsin. (Laughter.)

I think if a small company is going to get any, they had better get the best meter on the market. If they are going to buy second-hand junk, that may run along two or three years only by coaxing, they will lose more money in all probability in the first year than a good meter would cost them. I am glad that point was brought up, for it is a good one.

We do not confine ourselves to any make. A meter which is 12 or 15 years old, is apt to have outlived its usefulness. Some of them we can make over by the addition of new starting coils, but many of them are worthless, and are thrown away. Then there are certain old styles of induction meters that never did have any light-load accuracy, and those are thrown away.

The Secretary: Where the company is throwing out the 110-volt direct-current type of meter, and putting in the alternating meter, do you think it pays to change it over and put on the resistance necessary, and use it for power purposes?

Mr. Bushnell: Change a 100-volt meter to a 500-volt?

The Secretary: Yes.

Mr. Bushnell: I do not think it will be found to be very satisfactory. The 500-volt meter, even as sold, is not very satisfactory; and the 100-volt meters have commutators of too small size to run very satisfactory on 500 volts.

Mr. Insull: I do not want to leave the impression that the meter we buy is the only good meter, because we have bought meters from different manufacturers. But, as a rule, we contract for our full supply from one company, as we need it, as that is the more economical method. There are many good meters on the market, but many bad meters are installed, and it will pay the central station always to have good meters.

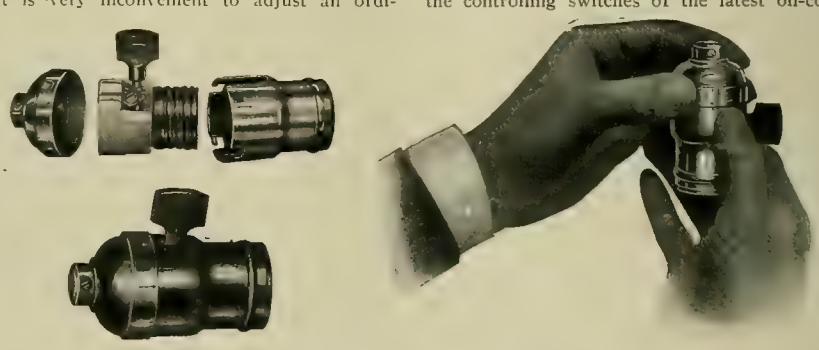
President Almert, Chicago: I have had the same experience that Mr. Insull has spoken of, in taking over small properties, with either no system of inspection of meters, or where they are tested no oftener than once in 18 months or two years. These small companies, of course, are not as fortunate as the large ones. The man who does that class of work is a general utility man; he is lineman, wireman and everything else; or else the superintendent, if he has time, does the work himself; and their experience is necessarily limited, and in most cases they have not the facilities for doing the work.

As Mr. Insull has stated, any meter is considered a good meter in some of these small central stations. A small station taken over a short time ago showed that for the month of November, with 160 meter customers and 40 flat-rate customers, 67½ per cent. of the total kilowatts generated for the month went to the flat-rate customers in the lost and unaccounted-for current, and the meters had not been tested for a period of 18 months. I only wish this instance had come under my notice a little earlier, so that there could have been an opportunity to make the test and see what the exact results would be; but there is no doubt that the loss to the company would be shown to be very great.

Irving P. Lord, Waupaca, Wis.: I move that a vote of thanks be tendered Mr. Bushnell for his able and interesting paper. (The motion was seconded and unanimously carried.)

Security Snap Socket.

A new socket known as the "Security Snap" socket, which does away with the inconvenience of the screw-fastened type, has recently been perfected by the General Electric Company. Such a device has been particularly needed in fixture work where it is very inconvenient to adjust an ordinary screw-jointed socket in the husks. Moreover the "Security Snap" socket is so constructed that it is not necessary to tip the shell to make the fastening. It may therefore be used in small husks as conveniently as in large ones.



SECURITY SNAP SOCKET.

Reference to the accompanying illustrations will make the construction of the new socket clear. The security of the bayonet joint is combined with the convenience of a spring-snap connection. In order to facilitate the assembly of the socket the cap and shell are marked with arrows and a star. To disunite the socket the thumb is pressed on the star, the arrows brought into line and a straight pull brings the socket apart. In assembling, the cap and socket are arranged with arrows in line, the shell is inserted in the cap and turned until the socket locks.

As the shell is fastened by three bayonet joint catches the connection is rigid and the joint is held securely by the automatic lock.

Artesian-well Power in Florida.

Several years ago the use of artesian-well power in South Dakota and other points in the Northwest attracted some attention, and the Western Electrician described and illustrated a small electric-light plant driven in this manner. In some cases the underground flow became exhausted after a time, although others are still in operation, it is believed. A similar utilization of underground waterpower is now reported in Florida, where a mill owner is said to be operating his mill from an underground stream of high pressure.

On the outskirts of St. Augustine, says the Florida Times-Union, under which area is known to be one of these subterranean streams, the proprietor of a mill decided some time ago to try to coax a flow of water to the surface, thereby supplying his machinery with perpetual power. By means of an ordinary drilling machine he sunk a hole, and at the depth of 130 feet struck water, but this being of low pressure the drilling was continued. A solid rock stratum was then encountered, so hard in places that only a few inches could be bored through in a day, and after boring through some 400 feet of solid rock the high-pressure subterranean stream was tapped. An eight-inch pipe was quickly sunk 130 feet to the top of the rock stratum—the drill hole through this serving the purpose of a pipe—and a stream of water spurted 22 feet above the ground level.

A wheel of 16 feet diameter having been rigged, the pipe was continued to a level of 18 feet, a sluice was erected to carry the water from the mouth of the pipe to the top of the wheel and 15 maximum horsepower was to be had for the asking.

More Electric Power for Pachuca, Mexico.

The Compania Electrica e Irrigadora of Pachuca, Mexico, which for about six years has been supplying to the city of Pachuca electrical energy for power and lighting in that city from its Juando generating station, has now in process of construction a new plant, the Elba generating station, which has been found necessary to supply the rapidly increasing demand for power in Pachuca.

The new Elba station is located on the same stream as the Juando station, this stream being the waters of the drainage canal from Mexico City. At the Juando station there is in operation approximately 3,000 horsepower, comprising six 375-kilowatt Westinghouse generators, which supply the energy at 440 volts, the voltage being raised to approximately 25,000 volts, three-phase, by means of various banks of large transformers. At the Pachuca end of the transmission line this voltage is reduced to 2,200 volts for general distribution to the various customers.

All of the new apparatus for the Elba plant as well as the other necessary additions to the Juando plant and the receiving station at Pachuca will come from the works of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

The Elba plant will be equipped with four 1,540-kilowatt generators, generating current at 2,200 volts. There will be two 125-kilowatt exciter generators for exciting the fields of the alternators. The main switchboard will comprise nine panels, the controlling switches of the latest oil-controlled type being operated from the main switchboard by electric contrivances.

The voltage of the generators is raised to approximately 25,000 volts by means of nine 540-kilowatt transformers, and the energy is transmitted at three-phase to the Juando plant, where it is connected in multiple with the Juando circuits to Pachuca. A double pole line obviates the possibility of a shut-down, which might occur on either of the circuits. In Pachuca a second receiving station has been built in which will be installed an 11-panel switchboard with all the necessary distributing circuits to the various customers.

Traveling cranes have been provided in the new Elba station, a 10-ton crane over the transformers and a 20-ton crane over the generators. The necessary number of transformers has been provided at the second Pachuca distributing station to handle the additional energy supplied by the Elba plant. All the necessary switching apparatus and 10 375-kilowatt Westinghouse transformers will be installed in the receiving sub-station.

The line to Pachuca is about 50 kilometers distant from Juando, and another line, 25 kilometers in length, was extended some time ago to Dublan, at kilometer 71, on the Central Railway, where a sub-station is located with complete equipment for supplying some 500 horsepower used in the cement works of the Compania de Cemento Portland at that place. This latter company has found electricity to be so far superior to steam not only in economy but in convenience that arrangements are being made to double its present capacity.

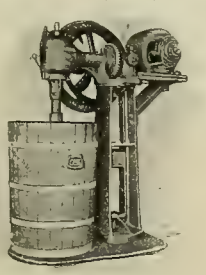
Col. Dodd Martin and G. W. Frasier of Oklahoma City, Okla., are organizing a company to manufacture, under a patent, the "Granger electric mail box." It is the intention of the promoters to establish their plant at Dallas, Texas. The new patent is composed of an ordinary galvanized mail box upon which the house number is placed and so connected that when the postman deposits a letter it will give a signal on the inside of the house.

Some Domestic Motor Applications.

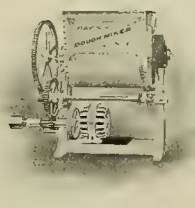
To a constantly increasing extent electric power finds employment in the household, the club, the restaurant, the hotel, in driving small machinery which replaces manual drudgery in the domestic arts. Some examples of interesting applications of this sort are described and illustrated herewith.

A particularly useful appliance of this nature is the Blakeslee dish-washer, which possesses a number of interesting characteristics. It greatly reduces possibilities of breakage and chipping, for both the dishes and the basket that holds them remain stationary in the water. On account of the rapidity with which the dishes can be cleaned for using again, fewer dishes are required. The machine is sanitary both in construction and operation, for it not only cleans the dishes but is self-cleaning as well. A machine that washes 6,000 dishes an hour requires no more floor space than two persons.

Sewing Machine.



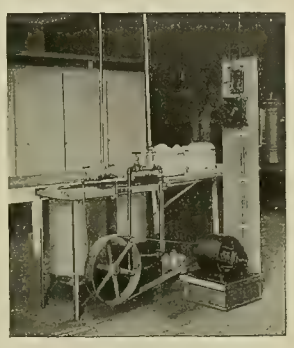
Ice Cream Freezer.



Dough Mixer.

Coffee Grinder.

Dust Collecting Tanks and Vacuum Pump.



Dish Washer.

SOME INTERESTING DOMESTIC MOTOR APPLICATIONS.

The Day dough-mixer mixes in a few minutes the barrel of flour that it would take a man two or three hours to mix. The motor is provided with a pulley, so that it may be disconnected from the gear of the mixer and used for driving other machinery when the mixer is not in operation.

The coffee grinder affords a good example of the use of the small motor drive with economy and satisfaction. That the grinder is not required for constant, but for intermittent, operation, is an argument in favor of electric power, for constant operation of the grinder would admit of cheap labor, but (to take the case of a retail store) it generally falls to the lot of the salesman, who is paid for more important work, to grind or pulverize the coffee that he has just sold.

Quality, speed and economy are the three essentials in ice-cream making, all of which are attained by the use of the motor-driven Mills freezer, which freezes the cream more quickly than hand power, and hence requires less ice and salt. The direct-connected motor occupies less space than any other form of drive.

In pleasing contrast to the old method of scrubbing, sweeping and dusting by hand are those of the devices manufactured by the Sanitary Devices Manufacturing Company and operated by electric motors. This system of cleaning floors, walls, carpets, furniture, etc., does not stir up the dirt, but removes it. The scrubbing attachment sucks up the dirty water and carries it to the sewer. It eliminates the use of soap and leaves the floor clean and dry. The equipments are manufactured in various sizes, both stationary and portable. The smallest plant, designed for use in private residences, occupies no more floor space than a good-sized stove.

One of the applications of electricity that means a saving in fatiguing labor to the housewife is the driving of the sewing machine. The wires that carry the current to the motor are inserted in an ordinary socket and can be removed when it is desired to put the machine away. The current required for a family machine is no more than a 16-candlepower incandescent lamp consumes. The motors made for this service are provided with extremely simple devices developed by the Singer Sewing Machine Company for starting and stopping, increasing or decreasing the speed by means of slight foot pressure.

In both construction and operation the Westinghouse small power motors have proved themselves worthy adjuncts to such devices as those referred to above.

Important Merger of Canadian Electrical Concerns.

The Dominion Power and Transmission Company, incorporated on January 27th last by the Dominion government, with a capital of $25,000,000, is a merger which includes the Hamilton Cataract Power Company, with all its branches, including the Cataract Power, Hamilton Electric Light Company, the Hamilton street railway, the radial railway and the Hamilton and Dundas Railway, and also the Hamilton, Grimsby and Beamsville and Brantford and Hamilton electric railways, the Hamilton terminal station and the Western Counties Electric Companies. The merger has been approved by all the shareholders of the Cataract Power Company. The representatives of the new company say that they have projects so large that they will take the full capital. Besides its existing powers, which include development of waterpower, smelting and treating ore, the manufacture and sale of lumber, general dealing in merchandise, telephone and telegraph powers, etc., the company is seeking power, under the title of the Radial Railway Company, to cover Western Ontario with electric railways.

Ground-connection Clamp and Terminal Fuse.

Among the new products recently put on the market by the Chase-Shawmut Company of Newburyport, Mass., are an all-copper ground-connection clamp and an extended terminal fuse. The ground-connection clamp, Fig. 1, is said to eliminate the danger from shock and fires in connection with an underground system. Its use is strongly recommended to contractors. The clamp is made in two parts, and when installed is locked in such a manner as to give the maximum contact upon the device upon which it is installed. It is simple in construction and requires only a pair of pliers to install it quickly and properly. It is also used to a large extent for grounding the metal sheaths on cable, and for grounding conduit installations. For this latter purpose it is recommended as simple and cheap. It is made in sizes from one-half to three inches and designed to take a No. 4 wire.

FIG. 1. GROUND CONNECTION CLAMP.

FIG. 2. EXTENDED TERMINAL ENCLOSED FUSE.

Concerning the extended terminal fuses, Fig. 2, the company states that before the advent of National Electrical Code fuses the manufacturers of enclosed fuses made a type A or screw-clamp contact fuse. In developing these fuses the manufacturers in many cases made them up in different lengths for fuses of a given capacity. This fact has continually been a source of annoyance. To obviate this, and to reduce and simplify the stock of type A fuses necessary for the user to have on hand, the Chase-Shawmut Company has developed and completed a line of fuses having a long or extended terminal on one end. This terminal is made of soft copper, and scored at different standard lengths. After once fitting the fuse to the base, the projections may be removed with pliers or hacksaw. This fuse will reduce the stock to one-third of the amount of fuses obliged to be carried before this extended terminal fuse was developed.

Reported Sale of Stromberg-Carlson Company to Bell Interests.

It is reported that the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., or the controlling interest in it, has been sold to the American Telephone and Telegraph Company, or, in other words, that this important Independent telephone manufacturing company has been absorbed by the Bell interests. The story is that the United States Independent Telephone Company of Rochester, a holding company closely allied with the Stromberg-Carlson interests, has been absorbed by the Bell interests also.

Writing under date of February 16th, the Indianapolis correspondent of the Western Electrician gives the following interesting account of the effect of the rumor in that city:

"Indiana telephone circles have been stirred considerably during the last week by a well-founded rumor of the sale of the United States Independent Telephone Company of Rochester, N. Y., to the Bell interests. This is of particular interest to Indianapolis, as by the purchase of the Rochester plant the Bell people will obtain one-quarter control in both the Indianapolis Telephone Company and the New Long-distance Telephone Company, owned by the Brailey syndicate, since the United States Independent Telephone Company of Rochester controls that amount of stock in both companies. The sale of the Rochester company has been confirmed by Mr. Brailey, and there is much speculation in Indiana as to what effect the passing of the Rochester Independent Company to interests hostile to the Independents will have.

"According to the heaviest stockholders of the Indianapolis Telephone Company and the New Long-distance Telephone Company any effort of the Central Union Telephone Company (Bell) to merge the interests of these companies with their own will be defeated. Despite the fact that, through the confirmation of Mr. Brailey of the purchase of the United States Independent Telephone Company and the Stromberg-Carlson Manufacturing Company by the American Telephone and Telegraph Company, 25 per cent. of the stock of the Indianapolis companies has been acquired, control of the Indiana companies will abide with the stockholders in this state.

"The stock of the New Telephone Company of Indianapolis is controlled by eight voting trustees, of which number the United States Independent Telephone Company has one member, and also one member on the board of directors. The Bell interests by this deal have acquired one-quarter interest in the New Long-distance Telephone Company of Indianapolis, but the control of the stock is represented by the other 75 per cent., which is pooled. The directors of the Indiana companies are deeply stirred by the confirmation of the sale and the stockholders avow that they will not sell their stock. They declare that the sale will not affect the present operation of the local companies or their control. Only one-fourth of the stock will pass into the hands of the Central Union Company, and with the majority of the stock held by the present stockholders the Indianapolis companies will remain in the field as Independent companies."

It should be stated that the rumor of the sale of the Stromberg-Carlson Telephone Manufacturing Company has received no official confirmation. In answer to a telegraphic request from the Western Electrician for the facts in the case that company answered by wire on February 19th: "We have no confirming information."

Telephone News from the Northwest.

A bill has been introduced by Representative W. L. Case of Cloquet, Minn., in the Minnesota Legislature, to increase the gross-earnings tax on telephone companies from three to four per cent.

Gas exploded in the conduit of the Tri-State Telephone Company, on Blaisdell Avenue, Minneapolis, resulting in blowing out two manholes. The covers went sailing through the air. The gas got into the conduit from a leaking gas main, and was confined there by the frost and snow over the openings, until a spark from some source started the fire. The fire department was called out to put out the fire, which was burning the insulation from the wires in the conduits.

The Western Wisconsin Telephone Company of Arcadia, Wis., has increased its capital stock from $65,000 to $75,000.

H. E. Close has sold the local telephone exchange at Milton, N. D., to Frank Delling.

A. W. Lohr has purchased the telephone exchange at Orange City, Iowa.

There is talk of the two companies operating exchanges at Iowa City, Iowa, consolidating.

The Laporte City (Iowa) Farmers' Mutual Telephone Company has filed articles of incorporation with a capital of $24,000. O. A. Wallace is president and A. A. Sloan, secretary.

The Norwalk (Iowa) Telephone Company has sold its system to the Southern Iowa Telephone Company. A number of radical improvements are planned.

George Coddington has been elected president and general manager of the Auburn (Neb.) Telephone Company, to succeed J. C. Killarney, resigned.

The Bell Telephone Company is contemplating establishing an exchange at Greenwood, Neb. R.

GENERAL TELEPHONE NEWS

J. W. Kremier and R. J. Grisham of Basehor, Leavenworth County, has purchased the telephone plant at Potter, Kan.

The Central Union Telephone Company proposes to erect a large modern telephone exchange at Lima, Ohio, to cost $25,000.

The new directory of Indianapolis Central telephone subscribers has just been delivered. The edition consists of 18,300 copies

The Southern New England Telephone Company has purchased a site and will erect a modern telephone exchange at Middletown, Conn.

The Ludington Telephone Company of Eau Claire, Wis., has been incorporated with a capital stock of $12,000. Improvements will probably be made in the plant.

A company is being formed at Paragould, Ark., to establish telephone lines connecting that city with Marmaduke, Rector, Greenway and Piggott and the surrounding country.

The Connecticut Home Telephone Company of Hartford, Conn., has been incorporated with a capital stock of $100,000, with the privilege of increasing it to $500,000.

At a meeting of the directors of the Cumberland Telephone and Telegraph Company it was decided to increase the capital stock of the company from $20,000,000 to $30,000,000.

The recent advances in the price of material, and especially copper wire, has occasioned a number of Indiana telephone companies to abandon contemplated improvements.

The Bethel Telephone Company of Rich Hill, Mo., is the name of a new organization organized for the purpose of doing a general telephone business there in the near future.

All the rural telephone companies in Woods County, Oklahoma, are calling a meeting to be held this month to form a county organization. This meeting will probably be held at Carmen, Okla.

The Mississippi Valley Telephone Company of Carthage, Ill., has been authorized to increase its capital stock from $50,000 to $100,000. A number of improvements will be made in the near future.

The South Side Telephone Company of Portsmouth, Va., has been incorporated and is arranging to make improvements in its system, including the installation of a new switchboard with a visible-signal system.

The Home Telephone Company of Hammond, Ind., has filed a mortgage for $400,000 to the Union Trust Company of Indianapolis. The mortgage covers the cost of extensive improvements now being made in the plant.

The Parkersburg (Ind.) Telephone Company has filed articles of incorporation, proposing to operate in Parkersburg and throughout Montgomery County. The business of the company is in Ladoga. D. S. Armstrong heads the directors.

The Plattsmouth (Neb.) Telephone Company is arranging to extend its lines to Sioux City by way of South Omaha. It is expected to have several toll stations in Omaha by spring. Tom E. Parmele is president and J. N. Wise, general manager.

Among recently incorporated telephone companies are the following named: Farmers' Mutual Telephone Company, Belvidere, Neb.; Greasy Valley People's Telephone Company, Paris, Ark.; McPherson (Kan.) Rural Telephone Company; Hartford and Colby Mutual Telephone Company, Colby, Kan.; Crawford Telephone and Telegraph Company, Crawford, Texas; Blue Grove (Texas) Independent Telephone Company; Ask Creek Farmers' Mutual Telephone Company, Red Willow, Neb.

CORRESPONDENCE.

Continental Europe.

Paris, February 7.—Electric locomotives are used for coal hauling on a large scale in one of the large mine plants in Germany, in the Achenbach shaft at Dortmund. The mine level lies at a depth of 520 meters below ground, and from the shaft mouth the distance to the south end of the mine is about 1.3 kilometers, but it is intended to increase the distance to five kilometers more. The mine locomotives are required to haul a thousand tons of coal daily. Power is furnished for the plant in the shape of 2,000-volt three-phase current, which is taken by a rotary-converter plant consisting of two motor-generators of 50 kilowatts each. These machines give 230 volts direct current for the locomotives. An overhead trolley wire is used for the current along the line. The line is well lighted by 16-candlepower incandescent lamps placed 150 meters apart, and a Hildebrand block-signal system with colored lamps is employed. Two 30-horsepower motors are mounted on each of the locomotives. One haul consists of 25 loaded cars, on the average, but this may rise to 50 cars at heavy loads.

Dr. Branly of Paris, whose early work in the invention of the coherer is well known, has been perfecting a system of wave signals, by which he is able to control the action of any kind of mechanical apparatus at a distance. This may prove to be very useful in practice. Motors may be set running, lamps lighted and all kinds of operations carried out at the will of the operator in the distant station. To carry this out, each device to be operated is allotted a disk, placed upon a motor-driven shaft. One disk makes contact for part of a revolution for each apparatus. By sending an electric wave at the proper time the operator acts on a coherer in the receiving station, and this circuit closes the relay belonging to the first mechanical device, through its contact disk. Thus it is set running, and when the second disk makes its contact, a wave signal acts on the second relay for another device, and so on. To start the motor there is a special relay allotted to it. In order to show what disks are ready to act, each of these is made in turn to send a signal to the sending station, and the signals are read on a paper strip, giving the exact time when each disk is in contact. On each mechanical device is a special relay which causes a second set of signals to be sent back in order to show whether the device has already operated as has been desired.

A credit of $10,000,000 is to be asked of the Norwegian Parliament for the purchase of electric locomotives and other equipment for the lines of railroad which are to use the electric system. Hydraulic power will be used to supply the current. It is said that British electrical firms are to furnish a large part of the electric outfit for the railroads.

At Brussels a combined electrical museum and laboratory has been established, and it will soon be opened to the public. It will be equipped with the most recent forms of electric apparatus, and this will be placed at the disposal of competent experimenters, who can thus make any kind of researches in the electrical field. The museum includes four large halls. In the first is a machine plant which is fitted up with dynamos, as well as with frictional electric machines, batteries, etc., so as to afford all the different sources. In the second hall will be placed electric lamps, telegraph and telephone apparatus and agricultural machines, driven by motors. The library is placed in the third hall, and the fourth is occupied by dynamos and motors. Two professors will be in attendance and at the disposition of the public, and there will be a series of lectures which forms one of the features of the institution.

For the city of Naples, an important hydraulic project is in consideration. The project has already been approved by the provincial commission of Naples, and relates to a hydraulic plant to be erected on the Volturno River, in the Campobasso province, whence the current will be sent to Naples by a high-voltage overhead line. According to the plans which have been drawn up, the entire plant, including hydraulic station, pole line and sub-station in the city, will call for an expenditure of about $1,000,000.

In the district of Venetia an important hydraulic work is being carried out at Ponte di Serra for the dam upon the Cismon River. The water supply from the stream will furnish about 20,000 horsepower, and this will be sent over a pole line of considerable length as far as the towns of Padua and Schio. A. DE C.

Great Britain.

London, February 6.—A new gasoline-electric transmission system, mainly for use on gasoline omnibuses, is being put upon the market here. It is received very well, and in the proper quarters is considered an ingenious system. Practically all such systems hitherto have utilized direct current, but in this case polyphase apparatus has been adopted, the inventors placing their faith in it mainly on the experience gained in stationary work, which has demonstrated, as all electrical engineers are aware, powerful starting torque and freedom from commutator and brush troubles. The test car of the inventors consisted of a 40-horsepower gasoline engine running at 800 revolutions per minute, a fan, a polyphase alternating-current generator combined with a direct-current series-wound exciter, magnetic clutch to obtain direct drive at top speed, and a polyphase induction motor coupled direct by means of propeller shaft fitted with universal compensating joints to the back axle, fitted with differential gear. A feature of the fitting of the gear to the chassis is that by undoing the universal joint and the supporting lugs, the complete set of electrical machinery can be lowered from the chassis. The system allows, by the agency of the magnetic clutch, a direct drive at top speed, and an electrical drive at the slow speed. Down a declivity, as soon as the force due to gravity causes the speed of the "rotor," which is coupled direct to the back axle, to exceed synchronism, the motor becomes a powerful magnetic brake, and all shocks are avoided. The fact that the arrangement practically does away with all noise is a considerable point in its favor.

There has been a good deal of feeling in certain quarters at the issue of a scale of charges for various kinds of tests by the National Physical Laboratory authorities, and complaints have been made privately in official quarters that through force of circumstances the laboratory was exceeding the powers given to it at its origination in 1898, in that it was interfering with the testing work of a commercial nature carried on by private laboratories and institutions. The origination of the difficulty lies in the fact, of course, of the scanty grant made by the government toward the upkeep of the National Physical Laboratory, and consequently a certain amount of commercial method has had to be introduced into its management in order to enable the making of both ends meet. This, of course, was not the original intention, and a committee of inquiry has been appointed to report upon the past and future development of the institution in question.

A Board of Trade return just issued shows that there now exist in England 2,240 miles of tramways and light railways. Since 1878 the capital expenditure in this direction has increased from over $20,000,000 to $300,000,000, the number of passengers now carried being, roughly, 2,236,000,000, compared with 146,000,000 in 1878. The route mileage of electric lines is 1,994 miles. One hundred and seventy-five undertakings are in the hands of local authorities, companies owning 137 undertakings, the latter figure being a decrease of seven compared with the previous year.

The telephone operators in Glasgow, since the acquisition of the system by the Postoffice, have displayed considerable dissatisfaction at the terms which have been offered them, and have threatened to strike. They assert that the hours are longer and the rate of pay lower than is the case with the corporation. G.

Dominion of Canada.

Ottawa, February 16.—The owners of the Metropolitan Electric Works, situated at Britannia, within eight miles of this city, and which have been lying in an incomplete state for a number of years, have signified their willingness to sell out to the city of Ottawa for the sum of $200,000. The city is looking for a power development to operate the civic electric plant.

The Shawinigan Falls Terminal Railway has recently placed an order with the Canadian General Electric Company of Toronto for a 600-horsepower electric locomotive to be operated from alternating-current single-phase lines of the Shawinigan Water and Power Company for the purpose of moving freight cars as required for the large factories located at Shawinigan Falls. This is the first locomotive of this type to be used in Canada, and its operation will be closely watched by railroad men, because with numerous waterpowers distributed throughout the country the possibilities of the economical use of electricity for local lines is one which cannot long be neglected.

The Toronto Electric Company's report for the year ended December 31, 1906, showed income of $899,578, with expenses, including interest on debentures of $336,730, or a little over 11 per cent. on the paid-up capital of $2,997,900. After paying three quarterly dividends at the rate of seven per cent. per annum and one at the rate of eight per cent., a balance of $119,459 was carried forward to profit and loss, bringing the total up to about $218,057. During the last year 62,352 lamps were installed and 2,020 horsepower motors.

Rates of $24 per horsepower per annum for 11 hours a day electric power and of $30 for 24-hour power, quoted by the Ragona Water and Light Company to the Ontario Hydro-electric Power Commission for the benefit of the town of Steelton, Ont., have been "turned down" as excessive. The commission has notified the town to pass a by-law requesting the commission to supply the amount of power required without reference to prices. W.

Winnipeg, Man., February 16.—F. E. Cambridge, city electrician for the city of Winnipeg, has been instructed to at once prepare estimates for the cost of putting a red light over each fire-alarm box.

It is thought improbable that Calgary will proceed with the development of the electrical power at Kananaskis Falls. The Canadian Pacific Railroad is making an effort to develop power at that point and several people are applying for a franchise to provide the city with power. Mayor Cameron of Calgary has charge of the matter.

A deputation from Vegreville, Alberta, has waited on the provincial government asking for aid and instructions toward installing a municipal telephone system. F. Morrison heads the movement.

It is stated that tenders for the supply of electrical machinery for the Winnipeg power plant will be called before the end of this month. The total cost of the construction of this plant is estimated at $3,500,000. R. R.

New York.

New York City, February 18.—The second annual dinner of the Iowa Society of New York took place on Friday evening, February 15th. Greenville M. Dodge, the president of the association, presided. Theodore P. Shonts, now at the head of the Interborough-Metropolitan system, spoke on the subject of "Transportation." Secretary Leslie M. Shaw spoke on "Some Things Accomplished." Addresses were also made by Senator J. P. Dolliver and Frank O. Lowden. Though the Iowa society is the youngest of the state societies, it makes claim to including in its membership a relatively larger number of distinguished New Yorkers than any other like association.

An interesting method of testing transmissions has been introduced at the factory of the Electric Vehicle Company. A chassis is mounted on blocks and a transmission set secured to its supports as in the finished car. The transmission is coupled direct to a water-cooled friction brake. An electric motor running at a speed of from 500 to 1,500 revolutions per minute is coupled direct with the transmission and is located approximately in the same position as in the motor in the completed car. The motor is then run and the friction developed by the transmission working against the brake affords the same amount of load stress as in actual road work. So great is the friction developed in the brake that a circulation of water at a pressure of 80 pounds to the square inch is necessary to prevent the brake becoming red hot.

Mr. R. B. Garland of Ansonia, Conn., thinks that wireless electric lamps are feasible. He says that he has successfully experimented with them, but as yet is not prepared to give out the details, stating merely that he has applied the principles of wireless telegraphy to lighting.

Notwithstanding the elaborate plans of the Pennsylvania Railroad to bring passengers into Manhattan Island by tunnel, the directors of the company have just authorized additions and extensions to the Jersey City terminal station which will cost approximately $300,000.

William A. Lord, city counsel of Orange, N. J., has been directed by the railroad committee of the Orange Common Council to draft a measure declaring the franchise of the Orange and Passaic Valley Railway forfeited on the ground that the company does not operate the line in a manner conducive to the comfort and convenience of the public. The line is conducted by the Public Service Corporation and forms a part of its trolley service through the northern part of the state.

At a meeting of the American Society of Mechanical Engineers that was held in the auditorium of the Engineers' Building on February 12th, Prof. Charles M. Allen, professor of experimental engineering of Worcester Polytechnic Institute, delivered a lecture on the subject of "Gasoline and Its Uses," using the lantern to illustrate many interesting experiments.

Gross earnings of the subway and elevated lines for the last quarter of 1906 were $5,815,232, an increase of $633,330 over the corresponding quarter of the previous year. Net earnings for the quarter were $3,450,066, a gain of $405,818; surplus, $1,171,816, an increase of $208,535.

The management of the Erie Railroad has organized a company with a capital of $300,000 to perform construction work on a branch in New Jersey. The company is named the Erie Terminal Railway Company. All the work is to be done west of the Hackensack Meadows.

The extreme of luxury in the appointments of automobiles has probably been reached in the magnificent limousine car which Miss Beatrice Morgan will receive as a wedding gift when she becomes the bride of Frederick S. Pruyn next month. The novel features consist of a tiny boudoir, or boudoirette, built in the body of the car. It can be shut off from the rest of the tonneau by sliding panels. It has just space enough for owner and maid to squeeze inside. A beautiful dressing case swings from the wall and a miniature lavatory occupies a corner. Mirrors line the whole interior and the boudoirette is lighted by safely shaded incandescent lights. This handsome car has also a buffet, a kitchenette, and even, by drawing curtains, a smoking room.

The electrification of the North Shore division of the Long Island Railroad from Flushing to Great Neck will be accompanied by the double tracking of the road between these two points so that steam will be practically disused on the entire division. The double tracks now extend to Flushing and the contractors are to be limited to 120 days to carry the grading on to Great Neck.

President Bird S. Coler of the Borough of Brooklyn has sent to Governor Hughes a copy of a proposed bill which he thinks will solve the local transportation problem. It provides for the abolition of the present Rapid Transit Commission and the election of a new board by the people this fall. The board is to consist of five members, one from each borough, the term to be for four years and the salary $12,000 a year. D. E. P.

New England.

Boston, February 16.—A Superior Court jury has rendered a verdict of $600 against the Boston Elevated Railway Company in the suit of J. Sullivan, who fell asleep in a car and was carried past his destination to the end of the route. Upon his attempting to return without paying another fare, the conductor ejected him from the car and he sued for damages, alleging assault.

It is stated that the General Electric Company will soon move part of its transformer department from Lynn, Mass., to the Stanley Electric Company's works at Pittsfield, Mass. This would mean the transference of about 500 employes.

The Worcester Polytechnic Institute has received a Crocker-Wheeler generator of a capacity of 200 kilowatts and an upright Ball engine. They will be directly connected in the power laboratory.

The Co-operative Telephone Reform Association and the New England Telephone and Telegraph Company have been holding conferences regarding a reduction of telephone rates and improved service in the Boston suburban district, and, as a result, they have formulated a plan on which the Massachusetts highway commissioners will hold a hearing on March 4th. Under this plan each suburban exchange will have its own district, which will include such other exchanges as are most frequently called. At present there is a toll rate of 10 cents between each of the 42 suburban exchanges and Boston. Under the proposed plan this rate will affect only five of these exchanges.

The John Cummings laboratories of mining engineering at the Massachusetts Institute of Technology are being enlarged and developed so that the latest ideas in ore dressing and metallurgy will be presented to the students. The apparatus in the laboratory of general physics has been increased. Among the new apparatus are complete instruments for testing incandescent and arc lights. The equipment for electrochemical measurements in the electrochemical laboratory has been increased by the importation of a number of fine Hartmann and Braun resistance boxes, so that each student has his own. One of the research rooms has been fitted with thermostat and standard apparatus for the measurement of electric conductivity of solutions and voltaic potentials. Prof. Harry Goodwin and Dr. Maurice DeK. Thompson are investigating the free energy of hydriodic acid, the electromotive force of voltaic cells composed of fused salts, the melting point of refractory oxides, and dropping electrodes. A portable D'Arsonval galvanometer, a Hefner standard lamp and several newer type incandescent lamps have been received recently.

The Boston Elevated Railway Company has obtained titles to 26 parcels of real estate along the proposed site of its elevated railway between the North Station and the Charles River, in Boston, the tax valuation being $202,600.

Charles W. Morse has been sued by his associates in the Massachusetts Telephone and Telegraph Company, the suits being based on the alleged selling of the control of that company to the New England Telephone and Telegraph Company. Oakes Ames sues for $250,000, A. S. Temple sues for $150,000 and F. A. Cutting sues for $75,000.

In the Massachusetts Supreme Court, February 12th, proceedings against the New York, New Haven and Hartford Railroad Company, the Webster and Dudley Street Railway Company and the Worcester and Webster Street Railway Company came up. The action seeks to defeat the merger of the three companies.

In a talk before the Jamaica Club, at Jamaica Plain, Boston, recently, F. S. Curtis, vice-president of the New York, New Haven and Hartford Railroad Company, predicted that electricity would be exclusively used for motive power on railroads, 25 years from now.

Henry S. Pritchett, president of the Massachusetts Institute of Technology, was elected president of the National Society for the Promotion of Industrial Education, at its first meeting. B.

Indiana.

Indianapolis, February 16.—The Evansville and Southern Indiana Traction Company has executed a mortgage of $4,000,000 to the Trust Company of North America, covering funds obtained by the retirement of old bonds and to forward the plans of consolidation and improvement of the property.

The American Engineering Company announces that it has disposed of the bulk of stock of the "educational" electric traction line which is to run from Lafayette to Green Castle via Crawfordsville, thus connecting three college towns. It is the intention to begin work on the line March 1st.

In Lake County there is a strip of land that has caused much worry and expense to steam and electric roads. This strip sinks several feet each year, beginning usually in December. A crevice appears and refuses to be filled, although hundreds of thousands of tons of gravel have been dumped into it. The phenomena have completely baffled the engineering department of the traction and steam lines.

A report is current in this city of a merger of all the electric railways of Eastern Indiana and Southwestern Ohio. According to the apparently well-founded report, Randall Morgan of Philadelphia, W. Kelsey Schoepf and W. S. Rose of Cincinnati are behind the merger, which it is said will include the interurban lines in the territory named and the street-car lines of Indianapolis and Cincinnati. The amount of capital involved in the proposed consolidation is said to approximate $100,000,000.

Traction companies in this state are meeting defeat on their petitions for subsidy assistance to build their roads. The farmers and many others have concluded that the roads can and will be built without subsidy aid and vote against the proposition.

At a meeting of the directors of the Fort Wayne and South Bend Railway Company the contract for building the road was awarded to the Indiana-Illinois Construction Company. Work will begin March 1st.

The following bills relating to electric-railway companies are pending in the Indiana Legislature: Requiring lavatory convenience on all interurban cars; compelling the erection and equipment of modern terminal stations in all cities of 35,000 inhabitants; to prevent utility corporations, including carriers, from raising rates for any commodity after once reduced to meet competition; to enlarge the powers of the railroad commission and extend its jurisdiction over the interurban companies, and empower the commission to designate what kind of safety devices should be used on interurban cars, and regulate crossings; to limit the fare on electric interurban lines to 1½ cents per mile.

The Matthews electric steel casting plant of Matthews, Ind., has been purchased by a Chicago company and will be operated under the name of the Armor Steel and Foundry Company. This was a great industrial institution during the days of natural gas and will again become a thriving plant by the addition of new machinery.

A bill has been introduced in the Indiana Legislature providing that city councils may fix the rates for gas, electric light, heat, water, telephones, etc., instead of by franchise contracts. S. S.

Texas.

Austin, February 15.—A bill pending in the State Legislature provides that all interurban electric railways shall be empowered and required to act as common carriers for hire of passengers, freight and express, and to provide suitable equipment and facilities for the transportation thereof. Reports of the business are to be made to the State Railroad Commission, but the commission shall have no jurisdiction in the matter of making rates. The charges for the transportation of freight and passengers shall not exceed the tariff charges for a similar or like service by the steam roads.

A bill which authorizes the construction of a causeway across Galveston Bay, to connect the mainland with Galveston Island and the city of Galveston, is pending in the Legislature. This measure was introduced in the interest of the Houston-Galveston interurban electric railway. The early construction of this interurban line is assured. The surveys have been completed, and only a few minor details are lacking before actual construction work will be started. The Stone-Webster syndicate of Boston is behind the enterprise. C. A. Stone, member of that syndicate, is now in Texas, inspecting its different properties. Important improvements are being made to the system of street railway in Houston which the syndicate owns. The proposed interurban line will connect with the Houston system as well as with the system of street railway in the city of Galveston.

The Buckeye Transit Company of Lorain, Ohio, is making good progress with its plans of building an interurban electric railway between Temple and Waco, with a branch line to Marlin.

The project of building an interurban electric line between Bryan and College Station, a distance of six miles, is being promoted by a syndicate of North Texas men. Local citizens of the two places have subscribed $8,000 in cash as a bonus toward the enterprise. J. M. Hall, city engineer of North Fort Worth, is in charge of the survey.

The Central Texas Traction Company, which has its headquarters at Corsicana, is making active

preparations to begin construction of its proposed interurban electric railway from Corsicana to Palestine, with a branch line to Fairfield. J. V. Watkins is general manager of the company.

The Dallas Interurban Electric Railway Company, which was recently organized with a capital stock of $2,400,000, will soon begin the construction of an interurban electric railway between Dallas and Greenville, a distance of about 40 miles. The company will build several other interurban lines, according to present plans. Much of the preliminary work for the building of these lines has already been done. H.

Illinois.

Peoria, February 16.—The Village Board of East Peoria has entered into a contract with the Peoria Gas and Electric Company to light the village. The schedule calls for more than 30 lights at an annual cost of $1,010.

With the building of the transmission line to Washington, the Eagle Electric Works of Washington will extend its lines to light Metamora and other small nearby towns. The old plant at Washington will be converted into an artificial ice plant. As the Peoria Gas and Electric Company will furnish 24-hour service, the Eagle company will use motors for the waterworks pumping at Washington.

Manager Nelson of the Peoria Railway Company has ordered several types of street-car fenders to put on the cars here for trial.

In a bill introduced before the House of Representatives, rates are fixed for telephone companies in cities of over 100,000 population. The maximum is fixed at $60 per year, and in cities of less population at $36 per year. At the same time telephone corporations are declared to be common carriers.

The monthly meeting of superintendents of the Illinois Traction Company was held in Springfield this week. General Superintendent N. G. Linn of Bloomington, J. E. Johnson of Danville, John Glover of Champaign, George M. Mattis of Urbana, J. P. Doan of Jacksonville, M. L. Harry of Decatur, and Purchasing Agent W. H. Burke of Champaign were present, also General Manager L. E. Fisher. They let a contract for 1,200 gas stoves to be used by the various utility companies. The next meeting will be held in Decatur on March 13th.

The People's Mutual Telephone Company of Marshall has been incorporated with a capital of $5,000 to operate a telephone system. Incorporators, James Davison, James Pickens and John Welsh.

The Illinois Traction Company has placed an order with the Danville Car Company for $200,000 worth of cars. The contract calls for 12 cars for the city lines in Danville, six electric locomotives, 20 34-foot interurban cars, 10 46-foot interurban cars and 20 express trailers, all to be of the latest type, including all the late improvements. V. N.

Northwestern States.

Minneapolis, February 16.—It has been announced that the Minneapolis, Rochester and Dubuque Traction Company will begin laying rails connecting those cities by May 1st. The company expects to have 1,000 men at work on the right-of-way by June. The contract calls for completing 26 miles of road daily.

Fire in the five-story building occupied by the Northwestern Electrical Equipment Company, 131 East Fifth Street, St. Paul, caused a loss of $30,000.

An election will be held at Mount Ayr, Iowa, for the purpose of voting bonds for an electric-light plant.

The Le Sauk Milling Company will put in an electric-light plant for the purpose of furnishing lights for Sauk Rapids, Minn.

The Business Men's Association at Emery, S. D., is pushing a project for getting an electric-light plant there.

William Moeller has been granted a 20-year electric-light franchise at Parkston, S. D.

There is talk of selling the municipal electric-light plant at East Grand Forks, Minn.

The Cascade Milling Company will be granted a franchise for an electrical plant at Sioux Falls, S. D.

There is agitation for an electric-light plant at Duncombe, Iowa.

An electric-lighting system and power plant is projected at Farragut, Iowa.

Prof. S. W. Beyer of Ames will prepare estimates for a concrete dam for developing electrical power at Fort Dodge, Iowa.

It was voted to establish a municipal electric-lighting system at Tama, Iowa.

William Holmes of Menominee, Mich., will build a dam and power plant for furnishing electric-lighting and power to Marinette, Wis., and Menominee, Mich.

The Aitkin (Minn.) Power and Light Company has been granted a franchise. R.

Mexico.

Mexico City, February 13.—The syndicate of Canadian capitalists who installed and own the large hydro-electric plant at Necaxa, and the electric street-railway systems of Mexico City and Puebla, have under consideration the installation of similar plants in other parts of Mexico. W. F. Tye of Montreal, Canada, engineer for the syndicate, and James D. Schuyler of Los Angeles, Cal., hydraulic engineer, also connected with the Canadian syndicate, have been investigating the power possibilities on the Conchos River, in the state of Chihuahua. They have selected a site for a large hydro-electric plant at La Joya on that stream, it is reported. Transmission lines will be built to the cities of Chihuahua, Parral, Santa Rosalia, Jiminez and a number of prominent mining districts of that part of the country. The Conchos River Power Company, which was organized a few months ago with a capital stock of $1,500,000 gold, also has in view the installation of a large hydro-electric plant at a point on the Conchos River near La Joya. R. M. Burke of Chicago, former United States consul at Chihuahua, and B. J. Mahoney of Chicago are among those interested in the Conchos River Power Company.

The Parral Power and Reduction Company has completed its auxiliary electric power plant of 1,500 horsepower. It is transmitting the electrical energy to Ninas Nuevas for the operation of mining plants.

Alfred Burlon will install a hydro-electric power plant on the Moctezuma River, in the state of Hidalgo. The power will be used for operating a number of industrial concerns in that section.

An electric power plant is to be installed on the Verde River, in the state of Morelos, by Ramon Sanchez Valdes.

Felix Rodriguez has taken steps to install a large hydro-electric plant on the Cupatitzio River, near Morelia.

Rafael L. Zaldana has made application to the federal government for authority to install a hydro-electric power plant on the San Geronimo River at a point near the town of Resumidero. W. D. H.

Pacific Slope.

San Francisco, February 14.—It is announced that another large isolated electric power plant will be installed in the basement of the Pacific Company's new $500,000 business block that is being erected at the southwest corner of Fourth and Market streets.

The City Electric Company recently made application to the State Board of Harbor Commissioners for permission to run an electric-light line, partly on poles and partly underground, from Meiggs' Wharf to Channel Street.

The Ocean Shore Railway has decided to extend its line from Santa Cruz, the present southern terminus, to Watsonville, an addition of 20 miles. For the purpose a new company has been incorporated. The Ocean Shore and Eastern Railway Company is the name of it. One of the important features of the application is the request made by the new company to operate the railroad both within and without the state. The main office of the company is in San Francisco. Work is in progress on the upper end of the line, between San Francisco and Halfmoon Bay. A single-track standard-gauge road will be completed to the latter point next May, and the electric power house will then be constructed there. It is the expectation to have the 83 miles of road from San Francisco to Santa Cruz in operation by October next.

F. G. Baum of San Francisco, who is the electrical engineer of the newly incorporated California-Nevada Electric Power Co., says that it is the intention to develop power from streams on the eastern slope of the Sierra Nevada range. The water rights controlled by the company are capable of developing 50,000 horsepower, and, if the market demands it, that capacity can be doubled. Central Nevada and the eastern portion of California are to be supplied with electric power for railroads, mines, quarries, municipalities, etc. A modern hydro-electric plant will be installed and three-phase transmission lines built to a number of points.

The Owens River aqueduct is in actual course of construction, the first mile having been completed. In the head of the valley, where the canal is being dug, a party of surveyors is at work, making survey for the hydraulic power plant for generation of electric current. The power will be transmitted along the canal and will be used for operation of the dredges required. Water will be conducted about 240 miles for the use of the city of Los Angeles, Cal. The best power site on the river is claimed by the Los Angeles municipal system, to the exclusion of private concerns, which had prior water rights.

The Mono Electric Power Company, backed by Edson F. Adams of Oakland, is still working on its project for developing electric power from the water of Owens River and transmitting it nearly 100 miles to Goldfield and other mining towns in Nevada. Leon M. Hall of San Francisco is the company's consulting engineer. If the bill now before the California Legislature in the interest of the Los Angeles municipal water plant becomes a law, it will take in both banks of the river, ignoring this company's rights, it seems.

The Pacific Power Company has all the necessary land in and around Battle Creek bottom, comprising some 12,000 acres of land, and is now engaged in constructing a power plant of 15,000 horsepower and anticipates that it will be completed by September 1, 1908. The market for the power is almost unlimited, and the cost of producing it is at a minimum. Hunt, Dillman, Meredith & Allen, the company's engineers, estimate that the cost of developing the 15,000 horsepower, together with the purchase of all the land, will not exceed $800,000. This means a cost of $50 a horsepower for installation, which is exceedingly low. At least 6,000 acres of land purchased is first-class farming land, and the water may be used for irrigation as well as for power purposes.

An electric generating plant operated by water-power is to be installed at the dam of the Nameless Mine, and plans have been completed for the transmission of current from the mines to a rock-crusher plant at Jasper Point, on the Yosemite Valley Railroad in Merced County, California. The generator will supply about 250 horsepower, 150 of which will be used in the rock-crushing operation.

Superintendent Farrar of the municipal electric-lighting plant at Medford, Ore., is desirous of having the present plant replaced by entirely new station equipment, poles and wires, at a cost of about $20,000. He has estimated that it would cost $15,000 to repair the plant, which is not worth more than $10,000 as it stands. A special report by an electrical expert will probably be ordered by the City Council.

The Santiam Electric Company, through Joseph M. Healey of Oregon City, has filed specifications for the construction of seven power canals along the North Santiam River, developing a great deal of power. Five will be constructed in Linn County, Ore., following the south bank of the stream, and two in Marion County, paralleling the north bank. At headwaters of each canal it is planned to erect dams 60 feet high in the Santiam. Where the topography of the country permits canals, each will be 10 feet deep and 50 feet wide at top. Where open flume is practicable, each will be 48 feet wide and 10 feet deep. Where pipes must be used, lines will consist of four pipes, each 11 feet in diameter.

Sealed proposals have been received by the Water Board of the city of Portland, Ore., for furnishing and delivering at Portland one single-acting triple-plunger pump of vertical type, together with the electric motor for its operation. The pump is to have a capacity of 500,000 gallons in 24 hours against a head of 300 feet. D. D. Clarke is engineer of the Water Board, City Hall, Portland. Delivery by the successful bidder must be made not later than June 1st, at the power house of the City Park, whence water is to be forced up into the hills.

Attorney Mohler, appointed by the City Council of Cashmere, Wash., to ascertain the amount that the town can be bonded for to install an electric-light and water system, has reported that limit would be $13,268. A.

PERSONAL.

Samuel Murdock has been appointed general manager at South Bend, Ind., of the Chicago, South Bend and Northern Indiana Railway.

Charles J. Wells, formerly an electrical supply man of Detroit, Mich., recently died at El Paso, Texas, where he had gone to regain his health.

A. C. Murray, who for several years was purchasing agent for the Indiana Union Traction Company, has been appointed assistant general manager at Springfield of the Illinois traction system.

H. J. Gille has been elected chairman of the Minnesota branch of the American Institute of Electrical Engineers, and Barry Dibble was re-elected secretary. Both are residents of St. Paul.

E. C. Folsom of Newark, N. J., has been appointed general superintendent of the Saginaw-Bay City Railway and Light Company at Saginaw, Mich. He was with the Detroit United Railways for several years.

Edward Goedjen, who has been in the employment of the Two Rivers (Wis.) Water and Light Commission as an electrician for the last year or more, has been given the position of manager of the Mayville Electric Light and Power plant.

William T. Oviatt of Bridgeport, Conn., formerly of Waterbury, and for many years in charge of the electrical department of the Connecticut Railway and Lighting Company there, has been appointed superintendent of lighting by the Consolidated Railway officials of Waterbury.

The board of trustees of the Western University of Pennsylvania, Pittsburg, has recommended that honorary degrees be awarded to 29 distinguished foreigners, who are to be present at the founders' day exercises of Carnegie Institute in April next. Among those to receive the degree of doctor of laws are William Marconi and Sir William Henry Preece.

General Construction Superintendent Fredericks, who has had charge of the construction work of the Chicago and Milwaukee electric railroad in the vicinity of Waukegan, Ill., has resigned his position and will leave for Kansas City, where he has accepted a similar position with an electric railway. John Scott, for some time overhead-construction superintendent, has been given Mr. Frederick's place.

Bion J. Arnold of Chicago has been retained by the city of Toronto, Canada, to give expert advice on the traction situation there. The street-railway company in that city is operating under a franchise ordinance and under certain regulations imposed by the municipality. There is a misunderstanding between the company and the city, and the municipal executive has asked Mr. Arnold to straighten out the difficulties. An expert from The Arnold Company's offices is at present in Toronto.

Following the recent resignation of R. F. Blackwell as general manager of the Cœur d'Alene and Spokane Railway, comes the announcement of the appointment to that position of Clyde M. Graves. Mr. Blackwell's resignation will not take effect until some time in March, when Mr. Graves will assume the management. Mr. Graves will continue in his present position as general manager of the Spokane Traction Company after assuming the management of the Cœur d'Alene division next month.

ELECTRIC LIGHTING.

An electric-light plant to cost $10,000 will be erected at Teague, Texas.

William F. Lyons has asked Kansas City, Mo., for an electric-light franchise.

William Moeller has been granted an electric-light franchise in Parkston, S. D.

Tama, Iowa, has voted bonds for the purpose of installing an electric-light plant.

The Charles City (Iowa) Water Power Company has asked the city for an electric-light franchise.

The city of Tekamah, Neb., has decided to expend $10,000 for the erection of an electric-light plant.

Chillicothe, Mo., has voted bonds to the amount of $100,000 for an electric-light plant and waterworks.

The Midland Electric Light Company of Cumberland, Md., has been organized with a capital of $5,000.

The Torrington (Conn.) Electric Light Company has voted to increase its capital stock from $200,000 to $300,000.

The Lena (Ill.) Electric Light and Power Company has been incorporated by G. W. Bender and others at $12,000.

The electric-light plant at Homer, La., was destroyed by fire on February 8th, the loss being estimated at $4,000.

The South Bend (Ind.) Electric Company will soon install new machinery, including a steam turbine, which will cost $100,000.

The city of Franklin, La., is ready to receive bids for the enlargement of its electric-light plant. John C. Lewis, mayor of the city, can give particulars.

Final arrangements have been made, it is reported, by the City Council of Herington, Kan., for the transfer of the electric-light plant from private corporations to the municipality.

The Mount Vernon (Ind.) Electric Company is being reorganized to supply the towns of Coseyville, Cynthiana and Waynesburg with electric light. A large electric plant, it is said, will be built at Mount Vernon.

The East St. Louis (Ill) Gas Light and the Belleville Gas and Electric companies have consolidated. They will be known as the St. Clair County Gas and Electric Company. The capital stock was increased from $350,000 to $3,500,000.

The Florida Electric Company of Jacksonville, Fla., has been awarded the contract for the electrical illuminating and power plant for "Dixieland." The lighting scheme for this display calls for 20,000 four-candlepower incandescent lights and a motor service for roller coaster, circular swings, etc.

ELECTRIC RAILWAYS.

The Des Moines, Winterset and Creston Electric Railway Company has been granted a franchise by the voters of Winterset, Iowa.

Bids will be received by the Hattiesburg (Miss.) Traction Company until March 5th on all machinery and material necessary for the building of a street-railway plant.

The Southern Pacific Railway Company of Oakland, Cal., has purchased a site for the purpose of erecting thereon an electric power plant for all local lines and for the extension of the local system to San Jose.

It is reported that a New York syndicate will build an interurban line from Butte to Helena, Mont., provided these two cities will contribute $500,000 of the $3,000,000 capital required. The distance covers about 50 miles.

The Paducah (Ky.) Southern Railway Company has been incorporated with a capital stock of $50,000. The company will soon begin the construction of a line from Paducah to Hickman, passing through Graves, Hickman and Fulton counties.

A bill has passed the United States Senate providing for the construction of an electric railway through the military reservation at San Pedro, Cal., by the Los Angeles Interurban Railway Company, an annual rental to be paid to the government for the use of the right-of-way.

The annual report of the Twin City Rapid Transit Company of Minneapolis and St. Paul shows the gross earnings of the road for the last year to have been $5,644,988.34, as compared with $4,759,262.76 for 1905. The surplus now amounts to $719,680.95, as compared with $497,932.59 in 1905.

The Lansing, Owosso and Saginaw (Mich.) Interurban Railway Company is negotiating for the purchase of the Owosso and Corunna Electric Company's plant in Owosso. The former has offered $85,000, and the Owosso company is said to be holding out for $100,000. The possessions include five miles of track and trolley in Owosso and Corunna, a power house and a street-lighting system.

The committee on municipal ownership of the American Street and Interurban Railway Association consists of C. D. Wyman (chairman), general manager Stone & Webster, Boston, Mass.; John A. Beeler, general manager Denver City Tramway Company, Denver, Colo.; George F. Chapman, general manager United Railroads of San Francisco, San Francisco, Cal.; H. M. Sloan, general manager Calumet Electric Street Railway Company, Chicago, Ill.; J. J. Stanley, general manager Cleveland Electric Railway Company, Cleveland, Ohio.

RADIO-TELEGRAPHY.

The recently established wireless-telegraph service from the Eiffel Tower in Paris to Bizerta, Tunis, is working successfully.

The Topeka (Kan.) Capital says: "It has been proposed to the War Department that wireless telegraph stations be put in operation at Forts Riley, Leavenworth and Sill for the purpose of giving the army, and particularly the Signal Corps, instructions in the practical operation of the system. With the proposed stations in operation, daily communication could be accomplished between the three posts and the system put to practical use."

According to a newspaper dispatch the French government has decided to erect many radio-telegraph stations, some of which are intended to be extra powerful. The coast and interior stations for commercial purposes will include plants at Ouessant, Marseilles, Algiers, Boulogne, Havre, St. Nazairs, Nice and Cape Corso. Stations under the administration of the minister of marine will be erected at Toulon, Bizerta, Oran, Dunkirk, Cherbourg, Brest, Lorient, Rochefort and Ajacio.

A number of very interesting results in radio-telegraphy have lately been achieved in the case of certain North-German Lloyd steamships equipped with Marconi apparatus. The Kaiser Wilhelm II., for example, has received signals from very distant points, although the ship's wireless equipment has not been considered to be effective outside a radius of 200 miles. On a recent voyage to New York while the vessel was off Texal it was in communication with Crookhaven, some 600 miles away. The Nantucket lightship was picked up at a similar distance, while the Cunard liner Caronia was on one occasion reached at a distance of over 1,000 miles, and on another at a distance of 1,200 miles. It has been noticed that such long ranges have only been possible when the ship has been either on the Newfoundland banks or near the Dutch coast, the inference being that atmospheric conditions are especially favorable to long-distance transmission in the two localities mentioned.

POWER TRANSMISSION.

A power plant to generate electricity will probably be erected on White River, near Mountain Home, Ark.

The Commonwealth Power and Electric Company of Georgetown, Colo., has been incorporated with a capital stock of $2,000,000.

As soon as the necessary connections can be made and the proper appliances installed, the York Haven Water and Power Company of York, Pa., will furnish electricity for the Pennsylvania Steel Company's big plant at Steelton. The contract to furnish the steel company with electricity is considered one of the most important deals in which the York Haven company has been identified. About 1,500 horsepower, one-third of the amount used in the plant, will be furnished.

It is reported that the Great Western Power Company has completed preliminary arrangements at Big Bend, Cal., for the construction of a large power plant there. The old Big Bend Tunnel is to be enlarged and lined with solid concrete. It will have an inside measurement of 235 square feet. A new tunnel 3,500 feet long will be driven from the end of the old tunnel up to the north fork of the river. Present plans call for the development of 50,000 horsepower. The total capacity of the plant, it is said, will be 100,000 horsepower. The company figures on an expenditure of between $5,000,000 and $6,000,000.

PUBLICATIONS.

The Chase-Shawmut Company of Newburyport, Mass., has issued two interesting folders describing the ground-connection clamp and the extended terminal fuse illustrated in this issue.

The Automatic Oil Cup Company of Milwaukee has published a bulletin describing and illustrating the Bangs automatic oil cup. The features of the cup are its positive feed arrangement, the certainty of its not being stopped up by sediment, and its oil economy. The Bangs cup is made for any bearing and in all types and sizes.

A reprint of Bulletin No. 1407 has just been issued from the mining-machinery department of the Allis-Chalmers Company. It relates to the Bennetts pouring spoon, one of the latest improvements in accessories for converting stands. A copy will be sent to anyone interested in the subject on application to the Allis-Chalmers Company.

A prominent electrical concern suggests that readers of the technical journals, in asking for catalogues or bulletins, should give their official positions and the names of the companies with which they may be connected. It is said that not a few of the applications received for trade literature are apparently made by persons who have no deep interest in the subject and who will seemingly derive no benefit from the publication.

The General Electric Company of Schenectady, N. Y., has just issued bulletins Nos. 4481, 4482, 4484 and 4486. Bulletin 4481 treats of signal relays, a general description of type DN-105 being given with illustrations. Two views are shown, one in the molded insulation department of the company's plant, where relay insulation is manufactured, and the other in the enameled wire department, where magnet wire for relays is made. Bulletin 4482 contains information serving as a guide to the design of medium and small capacity central-station switchboards. Two types of switchboards are described, with diagrams, one for 2,300 volts and the other for 10,000 volts. In bulletin 4484, railway signals, top-mast, direct connected two and three position type are treated, in which considerable space is devoted to showing the advantage of top-mast mechanisms. Several illustrations are shown of the General Electric top-mast motor signals used on the Baltimore and Ohio and New York Central railroads. The CQ motor is described in bulletin 4486, tabulated open, semi-enclosed and enclosed ratings for CQ standard shunt-wound motors being given. The bulletins are, as usual, handsomely printed and clearly illustrated.

SOCIETIES AND SCHOOLS.

The ninth annual meeting of the Canadian Mining Institute will be held at the King Edward Hotel, Toronto, Ont., on March 6th, 7th and 8th.

A special meeting of the American Institute of Electrical Engineers under the auspices of the high-tension transmission committee will be held on March 22d in New York city.

The New York Electrical Society will hold its next meeting at the Engineers' Building, 29 West Thirty-ninth Street. Prof. Harold B. Smith of Worcester Polytechnic Institute will lecture on "Power Transmission Voltages of Today and Tomorrow."

As a result of the recent reception to representatives of labor and capital at the home of Mrs. Potter Palmer the western branch of the National Civic Federation is about to be opened in Chicago. Employers and unions throughout the city almost unanimously approve the plan. The local branch at the beginning will embrace three departments, "conciliation," "welfare" and "educational economics." The prospects of the movement are considered gratifying.

Ten research fellowships of the annual value of $500 each have been established in the engineering experiment station connected with the College of Engineering of the University of Illinois, Urbana, Ill.. Graduates of American and foreign schools of technology are eligible for appointment to these fellowships. The establishment of these fellowships indicates the beginning of graduate work in the true sense in the field of engineering—that is, investigative and research work carried on by men who have already taken their degrees in engineering.

MISCELLANEOUS.

A bill has been introduced in the Wisconsin Senate making the stealing of electric current a grand larceny offense.

Work on the new electric power plant which is to be built at Mechanicsville, N. Y., by the Delaware and Hudson Railroad Company has been commenced.

Sealed proposals will be received by the United States Department of Agriculture at Washington, D. C., until March 12th for the construction of a power house for the department.

Among the exhibits of Philadelphia-made goods shown in the department stores that took part in the Industrial Exposition held in Philadelphia recently was a little electric cutting machine which cuts fifty thicknesses of cloth at a time for ladies' coats.

The bridge over the Chicago River at Madison Street, Chicago, was operated by electricity for the first time on February 13th. According to Thomas Pihlfeldt, city engineer of bridges, the city will save $50 to $75 a month by the application of electricity in this direction.

The exports of crude and manufactured rubber from Hamburg to the United States during 1906, reports Consul-general Hugh Pitcairn, amounted to $3,197,173, of which $2,864,840 represented crude and $332,333 the manufactured product, an increase of $237,802 and $46,964, respectively, over 1905.

An international exhibition of class or technical newspapers and periodicals will be held in Copenhagen, Denmark, during the months of May and June, 1907, under the auspices of the Association of Danish Professional Newspapers and Periodicals. The exhibition, which will be presided over by Sigurd Berg, minister of the interior, will be held in the exhibition hall of the Society of Industrial Arts. Exhibits of graphical trades and of the advertising art will also be shown.

It is stated that a number of enterprising farmers in South Dakota are forming an association for the purpose of introducing electricity in the farming communities. They expect to utilize electricity in plowing and cultivating the soil, harvesting the crops, running farm machinery and lighting the homes of the people. It will be applied to dairies, creameries and other local industries. Power is to be put in the home for the purpose of running sewing machinery, laundry appliances and everything requiring physical labor.

TRADE NEWS.

The Fort Wayne Electric Works announce the removal of their Cincinnati office to 1125-1126 Union Trust Building.

The Automatic Electric Signal Company of Milwaukee, Wis., has been incorporated by George L. Baldauf and others with a capital stock of $25,000.

Fire on February 12th did much damage to the building occupied by the Northwestern Electrical Equipment Company at St. Paul, Minn. The loss to the company is estimated at $15,000.

The Clark Electric Company of Detroit, Mich., has filed articles of incorporation for doing a general electrical construction business and to deal in electric appliances. The capitalization is placed at $35,000.

The Cretan government has decided to raise a loan of 9,300,000 francs ($1,850,000) for paving, railway, harbor, telegraph and telephone works. Tenders will be called for. Crete is a Turkish island suzerainty, governed by a commissioner of the great powers. The capital is Candia.

The United Electric Company, which is a large jobber in electrical and telephone supplies in the Southwest and which serves many of the Independent telephone and electric-light stations in that territory, will put up a large building in Wichita, Kan., to meet the demands of growing trade. Homer Caldwell and A. S. Parks are officials of the company.

The Chicago Fuse Wire and Manufacturing Company announces that it has discontinued its St. Louis office, as Mr. G. A. Knoche, who has been its representative in the Southwest, has resigned to accept a position with the National Metal Molding Company in charge of the New York office. Mr. Knoche has been representing several companies in the Southwest and has met with marked success. Mr. W. W. Merrill, secretary of the Chicago Fuse Wire and Manufacturing Company, says that all territory formerly covered by Mr. Knoche will be taken over by the Chicago office. The company has also secured the services of Mr. J. J. Schaller to represent it as traveling representative through the western, southern and central states, with headquarters in Chicago. Mr. Schaller has had several years of valuable experience in the electrical field as salesman for large jobbing houses, such as Albert Smith, Milwaukee, Manhattan Electrical Supply Company, Chicago and American Electrical Supply Company, Chicago.

The fifth annual report of President J. W. Duntley to the shareholders of the Chicago Pneumatic Tool Company shows the gross earnings for 1906 to be $1,001,550.04, of which $686,468.61 was actual profits. A four per cent. dividend on the capital stock was declared and $442,117.20 was added to the surplus account. The excess current assets at December 31, 1906, $1,542,075.99, showed an increase of over $883,000 since the company was organized. Considerable additions to plants have been made during the last year. In addition to having acquired the Consolidated Pneumatic Tool Company, Ltd., of London, England, the company has organized a branch at Berlin, Germany, and has purchased the Canadian Pneumatic Tool Company, Ltd., of Montreal, all of these organizations showing increased volume of business and substantial gains in assets. Mr. Duntley, who recently returned from a business trip to Europe, reports that the pneumatic and electric tool business on the Continent is in a flourishing condition, a decided improvement having been observed in England over conditions there of a few months ago.

BUSINESS.

The W. C. Church Lumber and Coal Company, producer and wholesaler of northern and western white-cedar poles, Des Moines, Iowa, is preparing for a large business during the coming season. The company says that it produces only sound, stocky poles from choice cedar timber, in all sizes and lengths, for spring shipment. It has a large stock of the best quality of poles and six large cedar yards and a number of smaller ones, which enable it to give consumers the best of attention.

The Kellogg Switchboard and Supply Company of Chicago announces that in addition to its stocks of poles in its Michigan yards, it has concentrated a large stock of all sizes of white cedar poles along the Detroit and Mackinac Railroad in Southern Michigan. Besides the regular size of pole for telephone purposes, the Kellogg company says that it is in a position to offer poles of all sizes for lighting, power and traction purposes. This stock of poles is thoroughly seasoned and up to the standard in every respect. The company is constantly securing special lots of poles on which it is able to quote low figures.

The Buckeye Electric Company of Cleveland, Ohio, says that it is now manufacturing the Buckeye 50-watt Gem lamp and can make shipments with reasonable promptness. This lamp is sometimes referred to as the Gem metallized filament lamp. The filament is of carbon, treated at an extremely high temperature in an electric furnace, which gives it many of the characteristics of a metal filament, and its light-giving power and efficiency are materially increased. The lamp is equally practical on alternating or direct-current circuits. It is made in the same size bulb and is used for exactly the same purpose as the standard 16-candlepower carbon lamp. The highest efficiency Buckeye Gem lamp is of 2.5 watts per candle, whereas the highest efficiency carbon lamp is of 3.1 watts per candle.

The Haller Machine Company Sign Works has recently removed to a large new factory, especially prepared for its class of work, the removal being necessary on account of the growing demand for Haller signs and letters. The new plant is equipped with a full complement of tools and machinery for turning out its special, patented goods. The working force, both in shops and office, has been increased in order to take care of the increasing business. All correspondence should be addressed to 319 South Clinton Street, instead of to 129-147 Fulton Street, as formerly. The Haller Machine Company has just finished an electric roof sign for the Oliver Chilled Plow Works, South Bend, Ind. The height of letters is 18 feet and the trademark contains a letter "C" 40 feet high and 60 feet wide; also a plow 60 feet long. The entire sign will be 250 feet long. The construction is of Haller patent grooved type. This is the second order the Oliver works gave the Haller company for a large roof sign.

The growth of the H. W. Johns-Manville Company has been exceptional. From a small beginning, half a century ago, this has become one of the largest concerns in the world manufacturing asbestos, magnesia and electrical products. Within the last few months new branches have been opened at New Orleans, Dallas and Baltimore, so that the company now has 16 branches throughout the United States, besides many local representatives at various points. The business of the company in the city and vicinity of Buffalo has now reached such proportions that a new branch has just been opened at 214 Main Street, Buffalo. This branch consists of a large retail store, offices and warerooms, and will be under the management of Mr. George A. Schmidt, who for a number of years was connected with the Manville Covering Company, Milwaukee. Mr. B. F. Boscoe has been appointed assistant manager of this branch, and will make his headquarters in Rochester. Mr. Harry V. Patton, formerly manager for a local asbestos house, will also be associated with the new Buffalo branch.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 5, 1907.

843,616. Detinning Apparatus. Meredith Leitch, Elizabeth, N. J., assignor to the American Can Company, Jersey City, N. J. Application filed July 5, 1906.

Combined in an electrolytic detinning-bath are a vessel adapted to contain an electrolyte, a receptacle for tin-scrap having a metallic base provided with an insulating coating exposed to the electrolyte, and also an exposed metallic surface for making contact with its contents, a cathode, and a source of continuous current having its positive pole electrically connected to the base and its negative pole to the cathode.

843,621. Electric Timing Device. Hervey H. McIntire, South Bend, Ind. Application filed March 21, 1904.

A rotary disk having a series of contact pins arranged around it, is combined with a pivoted member having one end arranged to engage the contact pins and constituting one terminal of an electric circuit, and its other end formed into a pointer, a contact member permanently held in contact with the periphery of the disk and constituting the other terminal of the circuit, and an alarm included in the circuit.

843,625. Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Maine. Application filed November 19, 1904.

In the system described there are a shaft carrying brake-shoes, a magnetic clutch interposed between the spindle and the magnetic device for rotating the shaft to operate the brake mechanism, and a brake-shoe capable of engagement with or disengagement from the spindle.

843,703. Railway Signal System. Alfred L. Ruthven, Topeka, Kan. Application filed April 20, 1906.

In the system described there are a series of conductors, one of the conductors having offsets at intervals along the line, means for connecting with the conductors, signaling devices, batteries, manually-operable pole-changers, and automatically operable pole-changers.

843,730. Locking Device for Doors and Windows. Josef Wittmann, Munich, Germany. Application filed May 24, 1905.

The device consists of a bolting bar longer than the width of the door and pivoted thereto so as to turn to a vertical position from the horizontal by the action of gravity, retaining hooks for the bar on each door-post, one open downward and the other upward, an electromagnet on the door-post having a pivoted armature, the latter being provided with a projection adapted to keep the bar in a horizontal position and in engagement with the hooks, a prolongation of the armature acting as a handle and an electric current operating the electromagnet.

843,731. Arrangement for Regulation of Speed of Compensated Single-phase Motors. Engelbert Arnold, Karlsruhe, Germany, and Jens Lassen la Cour, Edinburgh, Scotland. Application filed June 1, 1905.

A single-phase compensated motor is combined with an induction regulator for starting and speed regulating, the motor having an auxiliary stator winding with a variable number of effective ampere turns and the induction regulator comprising a primary and a secondary coil movable with relation to one another, and a compensatory coil connected to the main line.

843,733. Electric Regulator. Augustus C. Carey, Boston, Mass. Application filed July 15, 1904.

Combined are an electrically non-conductive tube, a mass of loose particles of electrically conductive material arranged therein, and electromagnetic plungers arranged in the tube and between which the loose particles are more or less intimately confined.

843,735. Starting Rheostat. Lewis S. Chapman, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 9, 1906.

In conjunction with the starting rheostat having a no-voltage magnet are a reversing switch, and means controlled by the opening of the switch for short-circuiting the magnet.

843,739. Electric Insulator. Frederick A. Feigert, Shelbyville, Ind. Application filed March 19, 1906.

The insulator comprises an outer casing of metal provided at its upper edge with means for holding the casing in position and with a water drip at its lower edge, an insulating carrier formed with a water drip at its lower edge and having means for the attachment of the messenger wire to its top, the carrier being secured in the casing and extending therethrough, and means mounted on and projecting from the carrier for the attachment of the trolley wire.

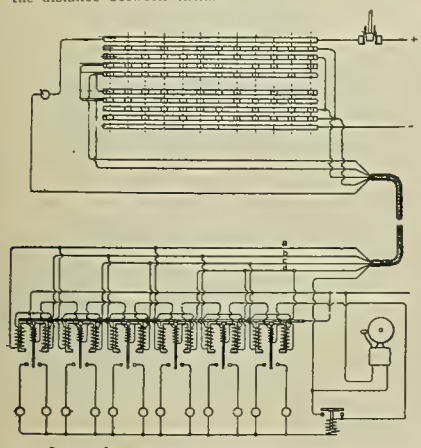
843,746. Selective Transmitting System. John L. Hall, Schenectady, N. Y., assignor to the Gen-

eral Electric Company, Schenectady, N. Y. Application filed December 9, 1901.

A selective signal-transmission system comprises a number of wires between the transmitting and receiving apparatus, a source of electric energy, transmitting apparatus for imposing the source on different pairs of wires taken a pair at a time, the several wires occurring in more than one pair, a number of receiving magnets connected respectively to the different pairs of wires, a return signal circuit actuated by each receiver, and an indicator in the circuit at the transmitting station. (See cut.)

843,747. Method of Producing Laminæ for Transformer Cores. Walter A. Hall, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 5, 1901.

The method described is that of producing from sheet metal, U-shaped laminæ having the space between their legs equal to twice the width of one leg, the difference between the lengths of the legs being equal to one-half the distance between them.



NO. 843,746.—SELECTIVE TRANSMITTING SYSTEM.

843,749. Brake-control System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 8, 1904.

In combination with a train of cars equipped with independent air-brake systems are valve mechanism on each car adapted to connect brake cylinder to reservoir or to atmosphere or to disconnect it from both and arranged to move automatically into position to connect it to reservoir, electrically operated controlling means for the valve mechanism, and a control circuit for the means extending through the train.

843,750. Machine for Making Stems of Incandescent Lamps. John W. Howell and William R. Burrows, Newark, N. J., assignors to the General Electric Company, Schenectady, N. Y. Application filed July 11, 1902.

The machine consists of a flare support adapted to be brought into co-operative relation to a blowpipe flame, rests for the leads below the edge of the flare, and means for squeezing together the walls of the flare when softened by the flame.

843,753. Starting Device for Electric Motors. Arthur C. King, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed June 9, 1906.

A starting rheostat comprises a controlling arm, a magnet responsive to predetermined decrease of excitation, and means controlled by the magnet for normally preventing the movement of the arm to running position. (See cut.)

843,761. Trolley Retriever. Francis M. Miller, Arcadia, Ind. Application filed April 22, 1905.

In the apparatus described are included a casing secured to the car, a continuously rotating shaft mounted therein and having a clutching face at one end, and a second shaft mounted within the frame and having a clutch face for engagement with the clutch face of the first shaft.

843,763. Connector or Terminal for Electrical Conductors. James McLaughlin, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 11, 1901.

Combined with a terminal having a hollow stud are conductor receptacles integral with the terminal, and a wedge arranged to be driven between the receptacles and into the hollow stud.

843,774. Alternating-current Dynamo-electric machine. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1905.

In this machine are relatively rotatable primary and secondary members, connections for supplying alternating current to the primary member, a commutator carried by the primary member and having its segments connected to points on the primary brushes bearing on the commutator connections for supplying current from the brushes to the secondary member, and means for breaking the connections and short-circuiting the secondary member.

843,775. Electric Heater. Samuel W. Taliaferro, San Francisco, Cal. Application filed July 31, 1905.

Combined with a suitable casing in the heater are a thermostatic circuit-breaker mounted in the casing, a freely removable heating tray in the upper part of the casing, heating coils in the tray, means whereby seating the tray in place connects the coils in series with the thermostatic circuit-breaker, and means for connecting the coils and circuit-breaker with a source of current.

843,776. Electric Furnace. Edward R. Taylor, Penn Yan, N. Y. Application filed May 15, 1902.

In the furnace patented are electrodes forming a central reaction zone, means for feeding portions of the charge through a surrounding body of the charge to the reaction zone, and condensing-flues arranged to traverse the charge, whereby the heat liberated by condensation of the volatile products is imparted to the incoming charge.

843,777. Metallurgical Process. Edward R. Taylor, Penn Yan, N. Y. Application filed May 27, 1902.

The process described consists in passing an electric current through a granular resistance body to establish a zone of reaction, and feeding a suitable charge along radial lines to such zone.

843,779. Sign. Aral G. Walin, Seattle, Wash. Application filed April 26, 1906.

In the sign described are a signboard consisting of a support and a facing secured to but spaced from the support, the facing being formed with openings, a letter arranged on the facing and being formed with openings registered therewith, and electric-light sockets mounted in the signboard and projecting through the openings thereof and of the letter, means being provided on the projecting portions of the sockets for securing the letter to the signboard.

843,788. Electric Locomotive. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 11, 1905.

The electric locomotive consists of a locomotive frame, a driving axle provided with wheels at its opposite ends, bearing members journaled on the axle and adapted to support the frame, a motor having an armature journaled in the bearing members, and intermeshing gears located respectively on the wheels and on opposite ends of the shaft of the armature.

843,789. Machine for Making Shells for Electric-lamp Sockets. Jacob Beck, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 21, 1904.

In the machine for making screw shells are combined means for cutting the shells to desired lengths, means for screw-threading the side walls of the shells, means for punching holes in the shell ends, and means for automatically positioning the shells with respect to the operating means.

843,805. Residence Mail Box. William H. Granger, Oklahoma, Okla., assignor of one-half to H. F. Stone, Oklahoma, Okla. Application filed February 26, 1906.

The device is connected to a battery and a bell. Details are described.

843,814. Means for Controlling Valves or Other Movable Devices from a Distant Station. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 29, 1906.

In the system of control there are a motor, a reversing switch, a polarized relay for operating the reversing switch, a control station, a single wire conductor and a return connection between the motor and relay and the control station, and means for causing current to flow in either direction through the conductor.

843,836. Attachment for Motor Armatures. Joseph W. McManiman, Washington, N. J. Application filed October 11, 1906.

In an electric car combined with the motor, its case, armature and shaft and the driving axle of the car are a driving gear loose on the armature shaft and operatively connected to the driving axle, a clutch collar mounted to slide on the shaft and held to turn therewith and arranged for engagement with the driving gear on the shaft, and means for operating the collar, the means including a lever provided with an upwardly projecting handle and means for locking the handle to the case of the motor, at the limit of movement of the lever.

843,844. Third-rail Insulator. Robert N. Redmayne, Newcastle-upon-Tyne, England. Application filed March 12, 1906.

The insulator comprises a body part and a supporting surface on and longitudinal grooves in the body part, the longitudinal grooves forming lateral limits to the surface.

843,852. Fuse or Electric Cut-out. Charles A. Steller, Jr., Jersey City, N. J. Application filed May 28, 1906.

A fuse wire has its ends detachably connected to the inwardly extending ends of the terminals.

843,871. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 19, 1902.

Combined with a trunk circuit extending between multiple switchboards, adapted for reciprocal operation, and provided with multiple switch connections at each switchboard are testing terminals for the connections connected with the talking circuit during conversation, and means when connection is established at any of the switch connections for placing the testing terminals at the other of the switch connections in condition to test busy.

843,890. Connection for Acousticons. Howell W. Haff, Babylon, N. Y., assignor to Kelley M. Turner, New York, N. Y. Application filed March 17, 1906.

An electric connection for receivers in an acousticon comprises a pair of metallic plates having arms integral therewith, an insulating disk between the plates, means for holding the plates in such relation, and means for connecting the receivers to the arms.

843,891. Telephone Receiver. Howell W. Haff, New York, N. Y., assignor to Kelley M. Turner, New York, N. Y. Application filed August 27, 1906.

In the telephone instrument there are a collar constituting a fixed electrical terminal, a switch element also constituting an electrical terminal and having means thereon whereby it may be moved to and fro by hand manipulation, and a plug having a tip contact adapted to enter the collar and having a sleeve contact adapted to fall into the path of the switch element.

843,900. Electric-light Bulb. Frank E. Lerberg, Newark, N. J. Application filed March 8, 1906.

The bulb described has a neck with a hollow glass stem in it, having its inner end sealed and supporting a filament, and a pin secured to the sealed outer end of the stem.

843,901. Electric Switch. Herman J. S. Lewis, New York, N. Y., assignor to John H. Dale, New York, N. Y. Application filed July 2, 1906.

In the switch are an insulating block having a number of metallic clips embedded therein, spring-impelled means for electrically connecting any desired pair of adjacent clips, and a spring-impelled button for releasing the means.

843,902. Multiple Electric Switch. Herman J. S. Lewis, New York, N. Y., assignor to John H. Dale, New York, N. Y. Application filed August 9, 1906.

In the multiple switch are a number of switch levers, a cam spring impelled in one direction and acting on the switch levers to move them into circuit-opening relation by such rotation, and means for rotating the cam in the other direction when desired, whereby the switch levers are successively tripped into circuit-closing relation.

843,904. Alarm. Charles Mahla, West Hoboken, N. J. Application filed August 21, 1906.

The alarm described consists of a carrier, a battery and an electric bell on the carrier, means for suspending the carrier from the top of a rotary part, the suspension means slipping off the rotary part on the rotation thereof, a circuit closer, and means for catching and suspending the carrier and closing the circuit of the bell after the release of the first-named suspension means.

843,919. Electromagnet. John E. Washburn, Egmont, Fla. Application filed July 28, 1906.

An electromagnet is described, the core of which is composed of a series of disks which are normally slightly out of contact with each other, resilient connecting devices along the edges of the series, a fixed support for the disk at one end of the series, and an armature adjacent to but disconnected from the disk at the other end. (See cut on next page.)

843,929. Alarm for Gauges, Clocks, etc. Adelard Charland, Lake Megantic, Quebec, Canada. Application filed December 30, 1905.

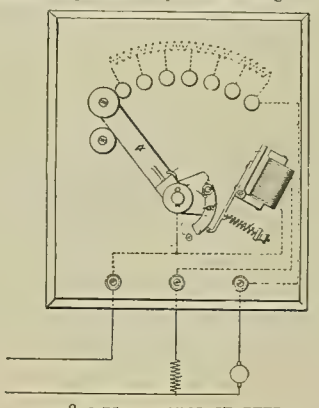
In combination with the dial and pointer are a number of contacts connected with the collar and disposed in the path of movement of the pointer, and wires forming a circuit between the contacts.

843,930. Non-arcing Muffled Fuse. Frank B. Cook, Chicago, Ill. Application filed June 12, 1905.

In an enclosed electric fuse there are a tubular casing, suitable terminals for the ends of the casing, and a fusible conductor and an asbestos string extending through the tube side by side and filling same, the asbestos being squeezed into the tube whereby the fusible conductor is embedded in the asbestos, the conductor being secured to the terminals.

843,940. Antiseptic Guard for Telephone Transmitters. Gerhardt E. Grimm, Camden, N. J. Application filed August 12, 1905.

In the device described there are a plate having an opening, means for securing the plate in position upon a mouthpiece, one edge portion of the plate being bent to constitute an open-ended cylinder housing.



NO. 843,753.—MOTOR STARTER.

843,962. Plaster Holder for Outlet Boxes. Adnah McMurtrie, New York, N. Y., assignor to the Thomas & Betts Company, New York, N. Y. Application filed June 14, 1906.

A plaster-retaining device for electrical outlet boxes and the like comprises a plaster-engaging portion, and an attaching portion having fastening means.

843,966. Floor-polishing Machine. Peter Sass, Vancouver, British Columbia, Canada. Application filed May 14, 1906.

An electric motor is mounted on the wheeled frame of the machine.

843,974. Lamp Shade. Frank Thiedig, Chicago, Ill. Application filed August 16, 1906.

The patent describes a shade for incandescent lamps.

843,979. Surgical Eye-magnet Appliance. Julius B. Wantz, Chicago, Ill., assignor to the Victor Electric Company, Chicago, Ill. Application filed November 24, 1906.

In the appliance there are in combination a standard, a threaded magnet carrier working in the standard, gear mechanism engaging with the threaded carrier for raising and lowering it, and an electromagnet adjustably supported on the carrier.

843,981. Induction Motor. Edward J. Willis, Richmond, Va. Application filed November 9, 1905.

The motor has a slotted stator running coils of relatively large wire disposed within the slots of the stator, starting coils of relatively small wire also disposed within the slots of the stator, and means for throwing

the starting coils into or out of series with the running coils. (See cut.)

843,998. Telephone Hook-switch. Charles C. Cadden, Cleveland, Ohio. Application filed March 15, 1905.

In an electric-switch mechanism there are combined an insulating base with a standard secured thereto, a U-shaped spring and a series of insulated spring switch-fingers secured upon the top of the base, and lever pivoted on the standard and engaged by the free end of the spring.

844,009. Electric Sympathetic or Secondary Clock for Induction Currents. Martin Fischer, Zürich, Switzerland, assignor to Actiengesellschaft "Magneta," Zürich, Switzerland. Application filed July 24, 1901.

Combined with the driving wheel of an electric clock are a shaft, spring driving and retaining pawls on the shaft to operate the wheel, an electromagnet and its armature, and a spring secured at one end to the shaft and at the other end to the armature, whereby the armature is yieldingly connected to the shaft.

844,010. Clock Controlled by Reversals of Electric Current. Martin Fischer, Zürich, Switzerland. Application filed September 1, 1904.

In the clock described there are means operated by electric-current impulses to alternately move one ratchet lever out of contact with the ratchet wheel against its spring action.

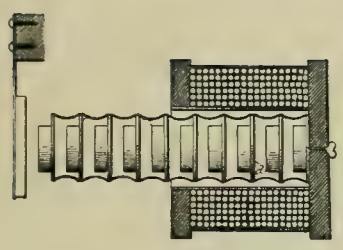
The apparatus for transmitting optical images comprises a dark chamber provided with an objective and a movable mirror, and containing numbers of rows of sensitive elements intended to receive the luminous rays reflected by the movable mirror on which fall the emergent rays of the objective, each row of elements corresponding to a proportional part of the image.

844,087. Illuminated Sign. Elmer E. Bellamy, Cleveland, Ohio. Application filed April 30, 1906.

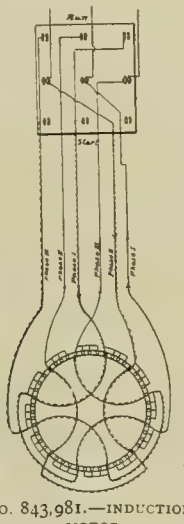
Combined with a casing or holder having an opening therein are a transparent plate covering the opening, guides within the casing or holder, a removable transparency behind the opening and slidably engaged with the guides, a reflector carried by the transparency, and an illuminating device supported within the reflector.

844,090. Automatic End-cell Switch. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed September 13, 1905.

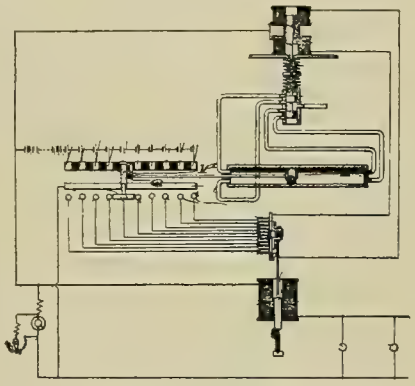
Combined with a supply circuit and end cells of a storage battery are an end-cell switch, a pressure cylinder and piston connected to operate the switch, means for continuously circulating the working fluid on each side of the piston, an electroresponsive device for controlling the piston and cylinder, and means including circuits and connections devised and arranged for controlling the electroresponsive device and thereby automatically changing the position of the switch to include more or less cells in series, according to changes in the current conditions of the supply circuit. (See cut.)



NO. 843,919.—ELECTROMAGNET.



NO. 843,981.—INDUCTION MOTOR.



NO. 844,090.—AUTOMATIC END-CELL SWITCH.

844,018. Process of Utilizing Marl, Making Carbide. Herman L. Hartenstein, Constantine, Mich. Application filed April 17, 1905.

The process described in the manufacture of carbid consists in mixing marl with carbonaceous material and subjecting the mixture to the fusing or melting action of an electric current.

844,034. Coin Collector for Telephone Lines. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed September 28, 1905.

In combination with a lever provided with a slot extending transverse to the direction of movement of the lever are contacts controlled by the lever, a coin-chute adapted to guide a coin in position to actuate the lever, an electromagnet, an armature therefor provided with means for controlling the disposal of the coin, and a pin on the armature in position to enter the slot and lock the lever against movement when the armature is in its attracted position.

844,044. Attachment Plug. Johann G. Peterson, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed January 7, 1907.

Combined are an insulating body carrying a terminal pin with a separate insulating body having a chamber containing a metallic socket cut away on one side, and a spring plate having a free end to engage the terminal pin, and at its other end a ring to go under and be clamped by the socket and a securing screw passing through the ring into the bottom of the socket.

844,045. Electric Switch. James C. Pinkerton, Philadelphia, Pa. Application filed May 9, 1906.

In the device are means for moving the piston in the cylinder and a pair of switch contacts having terminals.

844,074. Chronometric Culinary System. Robert S. Woodward, Jr., Washington, D. C. Application filed October 31, 1905.

The system comprises a combination of an electric alarm circuit including signaling means therein, a time shaft, a series of disks thereon each provided with a large and a relatively minute commutator bar and means for accurately adjusting all of the commutator bars peripherally of the time shaft.

844,080. Electrocapillary Apparatus. James T. Armstrong and Axel Orling, London, England. Application filed March 21, 1905.

The apparatus for observing or recording electrical phenomena consists of a capillary tube containing a conducting liquid, a bent tube containing mercury in one part and a conductor other than mercury in the other part, means for passing current through the conductors, a support for the tubes and means for adjusting the position of the tubes on the support.

844,083. Arm Support for Telephones. Louis Barrella, Syracuse, N. Y. Application filed October 31, 1906.

The device is described in detail.

844,086. Telegraphic Picture-transmitting Mechanism. Edouard Belin and Marcel Belin, Paris, France. Application filed December 6, 1904.

844,126. Socket Seal for Electric Lamps, etc. Llewellyn T. Hatfield, Sacramento, Cal. Application filed October 4, 1905.

The sealing device for electrical sockets comprises means to fit within the socket to prevent electrical connection of a current-consuming device with the socket contacts, and a seal securing the first-named means in place.

844,135. Photographic Printing Machine. John F. Jungkind, Little Rock, Ark. Application filed September 28, 1905.

The printing device has a casing having electrical connections.

844,165. Power Transmission. Morris Moskowitz, New York, N. Y., assignor to the United States Light and Heating Company, New York, N. Y. Application filed September 11, 1905.

Combined with a car truck are a dynamo suitably supported thereon, a frame connected to the field of the dynamo, a pulley revolubly supported thereon, operative connections between the pulley and the armature shaft, and connections for driving the pulley from the axle.

844,167. Water-purifying Apparatus. John M. Murphy, Danbury, Conn., assignor to the American Filtration Company, Phillipsburg, N. J. Application filed October 6, 1906.

An apparatus of the character described comprises an electrolyzing chamber having an inlet at one end and an outlet at the other end, a series of positive and negative electrodes detachably supported lengthwise in the chamber, an electric circuit in connection therewith, and a deflector over the inlet end adapted to distribute the inflow over the ends of all the plates.

844,183. Typewriter. Edgar B. Pierce, U. S. Navy, assignor to Wiley P. Sugg, Oakland, Cal. Application filed June 15, 1904.

In the typewriter described are an electromagnetic device intended to act upon the carriage so as to cause a reversal of the same, an energizing circuit for the electromagnetic device, a contact device comprising fixed and movable members included in the circuit and carried by the frame, means controlled by the carriage for closing the circuit and a spring movable by the carriage into coaction with the movable contact member to open the circuit.

844,208. Insulator for Leading-in Cables, etc. Louis Steinberger, New York, N. Y. Application filed February 21, 1906.

The insulator referred to comprises a member of insulating material provided with a threaded stem, and a nut engaging the stem for the purpose of locking the member to a partition or wall.

844,213. Illuminant for Incandescent Electric Lamps. Orlando M. Thowless, Newark, N. J. Application filed August 13, 1903.

The illuminant consists of a dense, non-porous current-carrying glower composed of a mixture of rare earths and flux vitrified therewith, the glower being practically an insulator at ordinary temperatures, but a relatively good conductor when properly heated.

844,240. Induction Coil. Clinton L. Bopp, Hawkeye, Iowa, assignor of one-fourth to John Beal, Whittier, Cal. Application filed October 21, 1905.

The coil comprises a primary and secondary winding, means for causing an electrical current to pass through the primary winding, and a vibrator connected in series with the means for producing pulsation in the primary winding for transmitting pulsating currents from the secondary winding.

844,257. Harmonic Signaling for Polystation Telephone Lines. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed August 8, 1906.

The method of harmonic signaling consists in tuning the signal-receiving devices to given frequencies, and preventing interference by regulating the amount of current of each frequency which may be effectively employed.

844,262. Water-purifying Apparatus. Albert E. Dieterich, Washington, D. C., assignor to William B. Shaffer, Nazareth, Pa. Application filed October 3, 1906.

The apparatus described comprises a combination with mechanical purifiers, of an electrolytic purifier, water conductors between the mechanical purifiers and the electrolytic purifier, and means controllable by the water pressure for controlling the electrolytic action of the electrolytic purifier before the water enters the same.

844,276. Cluster Fixture for Electric Lamps. Syles R. Fralick, Chicago, Ill., assignor of one-half to William P. Crockett, Chicago, Ill. Application filed October 26, 1905.

Combined are a base, outer and inner contact members carried by the base, a number of lamp sockets each provided with means for securing the same in position, and co-operating means upon the contact members for attaching a variable number of the sockets thereto, whereby the number of sockets in the cluster may be changed as desired.

844,278. Telegraph Key. John J. Ghegan, Newark, N. J. Application filed October 18, 1905.

In a telegraph instrument there are a base of plastic material having insulating properties, a conductor embedded therein between the top and bottom surfaces thereof, alined recesses exposing a portion of the conductor from the top and bottom of the base, a screw in the recesses having a portion in abutment with the conductor and establishing electrical contact therewith, the shank of the screw protruding above the conductor, and a binding post affixed to the protruding shank.

844,284. Electric-railway Gate for Grade Crossings. Charles E. Mendenhall, Dayton, Ohio, assignor of one-half to Louis P. Earnshaw, Dayton, Ohio. Application filed July 9, 1906.

In the gate described are a solenoid magnet in the upper portion of a hollow standard which supports the shaft upon which the gate-arm is mounted, and means for magnetizing and demagnetizing the magnet.

844,299. Attachment for Telephone Receivers. James R. Challen, Collegeville, Pa. Application filed May 12, 1906.

Combined are a receiver cap, an elastic dome with an inwardly projecting base flange, and means for securing the base flange to the apertured central portion of the cap.

844,300. Process of Neutralizing Static Electricity. William H. Chapman, Portland, Maine, assignor to the Chapman Electric Neutralizer Company, Portland, Maine. Application filed February 12, 1906.

The process of neutralizing static electricity in a body consists of blowing a current of air against the body and placing in the air current before it reaches the body a conductor charged with electricity of the opposite polarity to that contained in the body.

844,304. Method of Coating Lace with Metal. John A. Daly, Washington, D. C. Application filed October 15, 1901. Renewed December 5, 1904.

The method consists in covering the threads of lace with a conductor, then making a preliminary electro-deposit of metal thereon in a plating bath, then removing from the bath and solidifying this preliminary deposit on the threads by mechanical action, then adding further electro-deposited metal.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 18, 1907:

421,394. Railway Telegraph. James S. Foley, Toronto, Ontario, Canada.
421,396. Cut-out. Gustav A. Frei, Boston, Mass.
421,398. Conduit for Electric Railways. Patrick H. Griffin, Buffalo, N. Y.
421,449. Electromagnetic Valve Controller. John V. Stout, Easton, Pa.
421,464. Electric-railway Car. Herbert C. Wirt, Boston, Mass.
421,479. Dynamo-electric Machine. DeWitt B. Brace, Lincoln, Neb.
421,499. Art of Heating Water and Generating Steam by Electricity. John C. Hubinger, Keokuk, Iowa.
421,508. Electrical Annunciator. Albert F. Parks, Troy, N. Y.
421,535. Switch for Systems of Electric Locomotion. Frank Wheeler, Meriden, Conn.
421,539. Annunciator. Thomas H. Shipway and James R. Dowdell, Toronto, Ontario, Canada.
421,567. Electric Lock. William Grab, Jr., Toledo, Ohio.
421,666. Electrode for Secondary Batteries. Hiram H. Carpenter, New York, N. Y.
421,781. Electric Conductor. John A. Stoughton, East Hartford, Conn.
421,790. Electric Motor. Phillip B. Walsh, Philadelphia, Pa.
421,801. Electric Battery. Charles Willms and Gustav A. Liebig, Jr., Baltimore, Md.
421,802. Flexible Electric Connection. John F. Wollensak, Chicago, Ill.
421,851. Electrical Indicator. Leo Bock, Jr., New York, N. Y.
421,852. Thermostat. George F. Bulen, Tompkinsville, N. Y.
421,853. Automatic Fire-alarm System. George F. Bulen, Tompkinsville, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electrical Plant at Burbach Iron Works.

By Dr. Alfred Gradenwitz.

The use of electricity for the operation of iron and steel works has been furthered to a great extent by the adoption of large-size gas engines operated by exhaust gases from blast furnaces, thus cheaply producing electrical energy.

As the construction of blast-furnace gas engines has been improved by the aid of experience gained in practical operation the number of electric plants installed in iron and steel works and rolling mills has been continually increasing, it may be confidently expected that hereafter there will be hardly any large establishment of this kind in which electricity is not used as the most up-to-date and suitable power producer.

One of the most representative iron and steel works in Germany operated by electricity is that at Burbach. The following short description of this plant should, therefore, be timely and interesting.

Fig. 1 shows an interior view of the old electrical central-station plant, in which three blast-furnace Deutz gas engines have been installed, each of which is coupled to a direct-current dynamo. The output of each of the latter is about 420 kilowatts, with a potential of 240 volts, current strength of 1,740 amperes and a speed of 140 revolutions per minute.

The current is conveyed from the machines through cables laid out beneath the floor to a switchboard divided into four panels.

Owing to the continual increase in the use made of electric power at the Burbach works it became necessary to construct another electrical generating station. A newly erected engine hall which provides for further increase of the plant comprises a gas engine built by the Nuremberg Machine Works and operated by coke-oven gas, coupled to a direct-current dynamo made by the Siemens-Schuckert Company (which, in fact, installed the whole of the electrical equipment). The dynamo is a two-collector machine for 2 × 240 volts and 2 × 2,025 amperes, yielding 980 kilowatts at a speed of 100 revolutions per minute.

This station is to be further extended by the addition of a steam turbine of 1,250 horsepower, turning at 1,550 revolutions per minute, the order for which has been given to the Nuremberg Machine Works. The turbine is to be coupled directly to two Siemens-Schuckert generators for an output of 420 kilowatts each, which, like the two-collector dynamo referred to above, are connected to a three-wire system of 2 × 240 volts. This arrangement enables the electromotive force used in the old station to be maintained, while a higher pressure also seemed desirable, with the view of reducing the cost of constructing an extensive system of wiring. A general view of this new electrical plant is given in Fig. 2.

A large motor operated at 440 volts, with a normal capacity of 380 horsepower, regulated in shunt between 232 and 300 revolutions per minute, is coupled direct to the finishing train of the rolling mill. The universal mill, also, is driven by means of enclosed direct-current motors.

For transporting the coke barrows there is an electric locomotive (Fig. 3) equipped with two direct-current motors of an aggregate output of 25 horsepower at a pressure of 220 volts. Current is supplied through two single-pole rollers fixed to the overhead collector frame. The tramway is 1.8 kilometers in length, the gauge being 630 milimeters.

Fig. 4 shows a pair of shears and punch installed in the open air and which is operated by an enclosed ventilated direct-current motor yielding about 20 horsepower at a pressure of 220 volts.

Another interesting feature is an electrically operated roller straightening machine, which is actuated by a direct-current motor, controlled by a steering roller in both directions of rotation.

In order to give an idea of the extensive use made of electricity at the Burbach works it may be said that the aggregate number of motors installed there is 290, having a total capacity of 2,550 horsepower. Four thousand incandescent lamps and 300 arc lamps serve for lighting the plant.

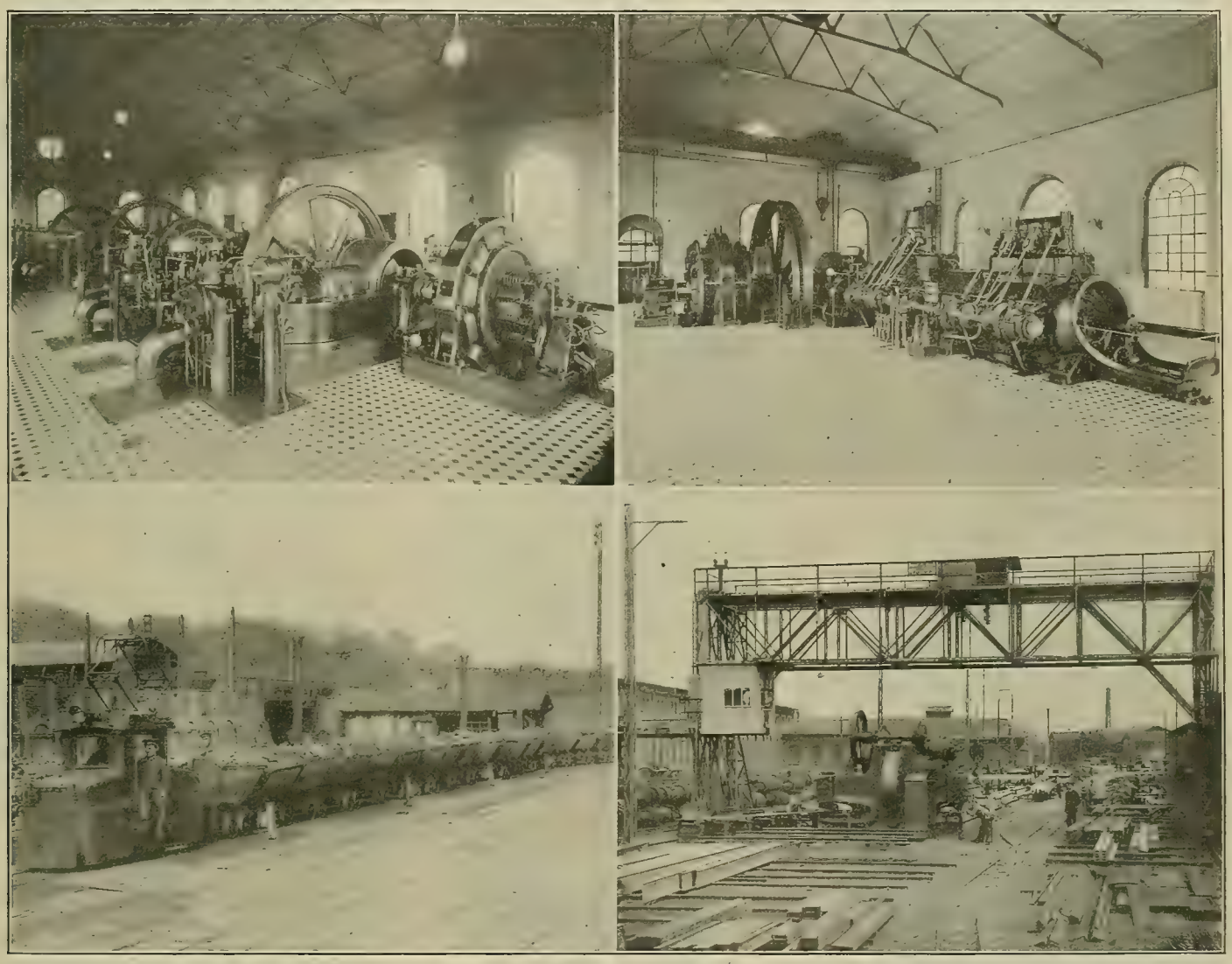

Fig. 1. Three Gas-engine-driven Direct-current Generating Units in Old Central Station.

Fig. 2. View in New Generating Plant, Showing Gas Engine Direct-coupled to 980 kilowatt Direct-current Generator.

Fig. 3. Electric Locomotive and Train of Coke Barrows.

Fig. 4. Electrically Operated Shears and Punch Installed in the Open.

ELECTRICAL PLANT AT BUREACH IRON WORKS.

Death of Prof. H. Moissan.

A Paris dispatch of February 20th gives the sad intelligence that Prof. Moissan, who last December received the Nobel prize for his experiments in the isolation of fluorine, his researches into its nature and his application of the electric furnace to scientific uses, died on that day after an operation for appendicitis. Moissan was professor of chemistry at the Sorbonne in Paris.

New Electric Smelting Furnaces.

Among the [illegible] designs of electric furnace for the production of iron and steel which have appeared in the Continent are the various types which are illustrated in the accompanying diagrams. The first two [illegible] were brought out in France by the [illegible] companies which have been engaged in electric furnace work, the Société Electro-Métallurgique Française.

The furnace which is represented in section in Fig. 1 is provided with a lining of refractory material and has a column of coke or similar combustible which conducts the current. The combustible is mixed with ore in a melted or pasty condition, coming from a second furnace placed next to the first one, and known as the preparatory furnace. As the carbon disappears during the process, owing to the reduction of the ore, the coke column is kept up by a continuous supply from the top of the furnace. In the present type of furnace the combustible is used to form one of the electrodes. It is employed mainly for cast-iron, ferro-silicon or ferro-manganese, and works in a very satisfactory manner for this production.

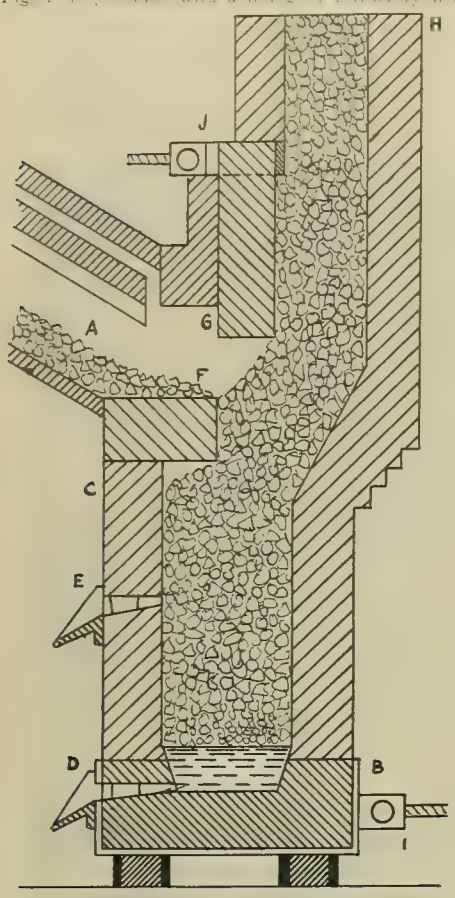

FIG. 1. NEW FRENCH ELECTRIC SMELTING FURNACE.

Referring to the sectional view of the furnace, the carbon crucible (B) at the bottom is surrounded by a chamber (C) built of refractory brick. The chamber is provided with two outlets for the melted material. First, the outlet (D), which is used for the melted metal, and a second outlet (E), placed higher up, and used for the slag. At (F), toward the middle of the furnace, is an auxiliary electrode of carbon. This piece is used as a hearth for the preparation furnace already mentioned, and carries out the heating of the ore before it is sent into the main furnace. In this way the ore is brought in a highly heated or a melted condition to the middle of the coke column.

Electrical connections are made from one pole to the carbon crucible (B) at the point (I), and from the other to the point (J) in carbon block (G), placed in the upper part of the furnace, with which the descending coke column makes the contact. The auxiliary carbon piece (F) and the carbon block (G) make a short-circuit at this point, and here there is a high heat developed which is designed to prevent the accumulation of pasty material. As it falls down, the ore is reduced by the carbon, and the melted metal coming from this reaction reaches the bottom and collects in the carbon crucible. The gases resulting from the action of the furnace are made to escape by the opening between (G) and (F). In place of using the carbon block (G) in the vertical position, as shown here, the construction of the furnace can be varied by placing it horizontally and entirely surrounding the coke column.

Fig. 2 shows a furnace which has been designed by the same company within a recent period and is intended to be used especially in the manufacture of steel. At the lower part of the furnace, as will be noticed in Fig. 2, is a graphite crucible (A) of some depth, which receives its current from a cast-iron plate fixed against the bottom. This is best carried out by a set of iron stay-bolts inserted in the graphite so as to obtain a good contact with the iron plate. Above the crucible is placed a cylindrical chamber (B) of refractory material, which forms the top of the furnace. It can be either fixed or movable, as desired. At (H) and (I) are placed the openings for the outlet of metal and slag, respectively. Above these opening is built a water-jacket (G), which cools the walls of the crucible at this point and protects it from the corrosive action of the non-reduced slag. The present furnace works by the combined action of the electric arc and a resistance heating of the mass. It allows of producing pig which is of either a phosphorous or a silicon character, and this is well adapted for use with the Bessemer process as the next stage. The resulting metal is found to answer very well for rails or beams. It can also be treated again, after the Bessemer process, by means of the electric furnace so as to obtain a high grade of steel product. The charge, consisting of ore and coke or other combustible, is made to descend in the column. It heats up and commences to be reduced when it comes in contact with the oxide of carbon. Under the influence of the arc between the two electrodes, the ore is melted and the reduction of the latter is finished by the action of the carbon. At the same time the melted matter is saturated with carbon. It is estimated that the present type of furnace can produce from 10 to 12 tons of metal a day, using ore which contains from 50 to 60 per cent. of iron. To carry this out it requires a voltage of about 50 volts, and takes 100 horsepower on the average.

But perhaps the best known of electric furnaces which are now operated in Europe is the Keller furnace. It is employed generally in the metallurgy of iron and steel. One of the largest electro-metallurgical works on the Continent, erected at Livett, near Grenoble, France, is using the Keller process for the manufacture of special steels as well as ferro-silicon, ferro-manganese and similar alloys. The Livett hydraulic station uses a 200-foot head of water and is equipped with a number of large turbine groups, thus giving all the current which is needed for the electro-metallurgical plant. This plant is erected in a separate building near the dynamo station. At last accounts there were two sets of Keller electric furnaces working constantly, and they are able to turn out about 50 tons of steel or alloy per day.

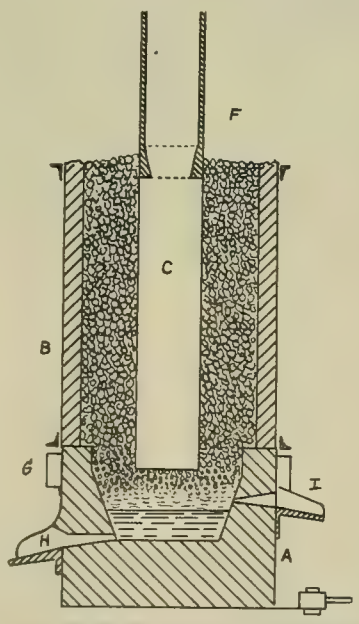

FIG. 2. ANOTHER FRENCH ELECTRIC SMELTING FURNACE.

A new furnace plant is being erected by the company which operates the Keller patents. It is located at Unieux and has some interesting features which will be briefly mentioned. The outfit which has been installed in this plant consists of a Dujardin engine, of French make, having 1,500-horsepower capacity. It is coupled to an alternator supplied by the French Westinghouse Company and built at the latter's works at Havre. The current, which is given by the present group at low voltage, will go as high as 2,000 amperes, and it is intended to use it in a single electric furnace which is built after the designs of Mr. Keller on an improved plan. The combined method or double heating of the metal will be used. The electric furnace will serve in this case only for the refining of the steel, and the latter will be prepared first in a Siemens-Martin furnace. A single heat in the above process will produce on an average eight or nine tons of metal, and there will be three or four heats in a day's run of 24 hours. It is intended to manufacture high-grade steel, and they will no doubt be employed for cannon and projectiles.

The total weight of the electric furnace which is built at the Unieux plant is 55 tons. As it rests upon a specially built steel frame it can be inclined as desired. All the electrical and mechanical maneuvers are carried out by hydraulic motors worked electrically. The Keller type of electric furnace is built in several different forms, one of which is illustrated in Fig. 3. In the former types of furnace the current enters by one electrode and comes out by another. The type which is shown here is of a more recent construction and is intended to be used specially in the manufacture of cast iron. What is to be distinguished in this case is the use of a certain number of hearths or melting chambers combined in the same furnace. The latter is formed of several chambers of square section which are connected at the lower part by a side canal. A modification of the present form is made by enlarging the canal which connects the melting chambers so that it forms a crucible in which the melted metal may collect. The bedplate of each melting chamber is formed of a carbon block (C'), which is connected with one of the poles of the circuit. The other electrodes (C) are inserted from the top, as will be noticed, and are made to enter the chamber for about two-thirds of their length. An extra electrode (C'') can be made to project into the central crucible, as is shown here.

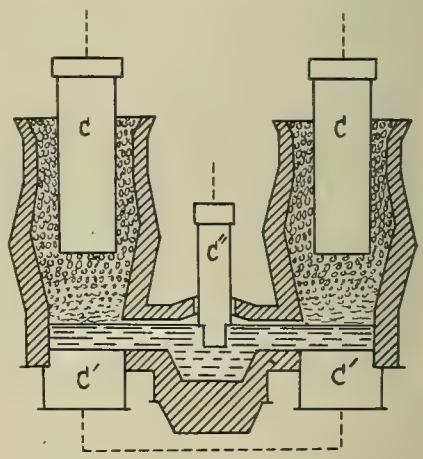

FIG. 3. KELLER ELECTRIC FURNACE.

Outside of the above construction the Keller furnace is distinguished by the method which is adopted of making the walls of the melting chambers. In the furnace is placed a wooden form which has the desired profile, but with space of about six inches between the mold and the outer envelope of the chamber. Into this is put a mixture of carbonized dolomite and tar. Sometimes between the envelope and the above-mentioned portion is put a refractory birch lining. The walls which are prepared in this way do not suffer much damage from the high heat, as the source of heat only produces the effect in the central part of the furnace, and the non-conductivity of the rest of the mass is enough to give the necessary protection for the furnace walls. This is also increased by the continual displacement of the mass of material.

The type of electric furnace which has been designed by M. Paul Girod is one of the leading furnaces now in use on the Continent. It is employed by the Société Electrométallurgique. This company is now operating three electric furnace plants upon the Girod system. One of these, which has the largest output, is erected at Ugine in the Savoie province of France, while the two others are established in Switzerland at Monthovon and Courtepin. Hydraulic power is used as the source of current in these different plants. Considering

the works at Ugine the present description will give a general idea of the plant and the construction of the Girod furnace.

Waterpower is utilized, and the output which is given at present by the water supply is about 8,500 horsepower. In the same building are the generating plant and the electric furnace plant, installed in separate rooms. In the furnace room are erected 18 electric furnaces. Another room is used for the rough work of cleaning the ingots,

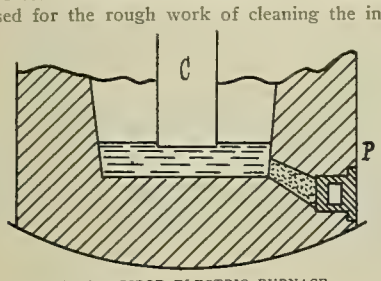

FIG. 4. GIROD ELECTRIC FURNACE.

etc., while one room serves for making the mixtures, for repairs, etc. Lastly there is a large room used for storage, and it contains bunkers for the supply ores and raw material of all kinds. A special building contains an electric steel plant for testing purposes.

In its essential parts the furnace is formed of a metallic casing lined with refractory material and magnesia. The whole furnace is allowed to swing about a horizontal axis. In the interior is a space which forms the crucible, and this is cylindrical in shape. Projecting into this space are the vertical electrodes which are placed parallel to the axis of the chamber. The number of the electrodes is variable acording to the dimensions of the furnace. The current enters by the electrodes, and after passing through the metal bath leaves the furnace by the electrodes (P), Fig. 4, whose number also varies with the size of the apparatus. These latter electrodes are placed at equal intervals around the circular chamber.

In the type of furnace used at Ugine, which measures about eight feet outside diameter, there is one electrode (C) at the center of the chamber and around it are eight outer electrodes (P). The latter pieces are not in direct contact with the melted metal of the bath, but are put in contact by means of conduits which are first filled up with previously melted metal and then solidified by the natural or artificial cooling of the electrodes, for these pieces are made hollow and are provided with a water circulation.

The company is at present doing a flourishing business and is looking for a fresh field of operations. It is now engaged in work upon a fall in the Bonnant River at St. Gervais, which will afford a head of water of some 320 feet and an output of 8,000 horsepower.

Electric furnaces which are now in operation at the Ugine works have a capacity of 300 to 350 horsepower. The average heat is about 1½ tons of metal. The resulting metal is in the form of an extra soft alloy, which is recarburetted afterward. In order to work the furnace properly it is necessary to be sure at the commencement of the operation that the conduits which give the connection between the pole masses and the metallic bath are filled with metal. Therefore, before putting a fresh furnace to work the operator causes to flow into the conduits the metal which is needed to assure the contact with the product either melted or to be melted. Or, during the construction of the furnace, iron or steel bars are placed in the conduits to give the connection. Once the furnace is put in operation there need be no more attention given to this point for each heat. Using the method of cold charging, the type of furnace used in the Ugine works will allow of obtaining a mass of 1.4 tons every four hours and a half on the average.

The Smoke Question in the District of Columbia.

The United States Senate Committee on the District of Columbia has decided to report favorably the bill applying the terms of the smoke law to the various steam railroads entering the District. The railroads fought the bill to the best of their ability, asserting that it would be impossible for them to meet its requirements. They have admitted that it is possible for them to use hard coal on yard engines and thus diminish the nuisance to a great extent, but they say that it will be necessary to equip to its entirety all the lines inside of the District with electricity if they are not allowed to use the ordinary engines. This, it is declared, would mean an expenditure of $5,000,000.

Underground Telephone Construction in Connection with Sewerage Installation.

By Frank C. Perkins.

The accompanying illustrations show the laying of cables for underground telephone service in connection with the municipal sewerage system of the city of Schöneburg, Germany. While the cable construction is more expensive than overhead lines when underground conduits are necessary, with special trenching and repaving, it is obvious that where this work can be carried on at the same time sewers are being built and water pipes are being laid, the cost is greatly reduced. The sewerage piping is often used abroad as a protection for the telephone cables, and no brick roofing is required.

With the Pupin load-coil system, it is pointed

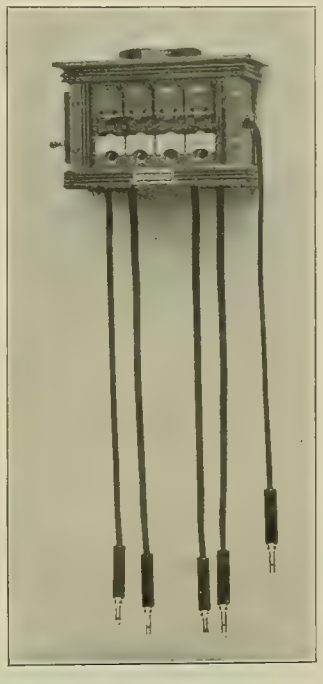

FIG. 1. TELEPHONE ALARM SWITCHBOARD IN SCHÖNEBURG SYSTEM.

out, further, that a smaller amount of copper is used, and that the cost is therefore less. In Germany telephone cables have been laid in many cases in the same trenches with the sewer pipes, taking advantage of this cheap construction, as one digging and one refilling is all that is required, and the repaving necessary is therefore chargeable to both telephone and sewer construction.

At Schöneburg, which is a thriving little city near Berlin, the municipality has sewage fields located not far from Ragow, the distance between these cities being about 26 kilometers. While the talking distance is about twice as great, the Pupin telephone system works to good advantage, even with copper conductors of only 0.7 millimeter in the cables.

There are five stations on a double line arranged in parallel, and other stations of importance are connected separately to a double line. A station is provided which allows intermediary connections to be made between the conductors, and a large alarm is arranged at the Standrohr station, which can be connected in circuit when necessary, this being switched into the local circuit

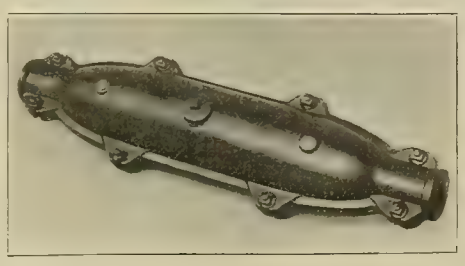

FIG. 2. ONE OF THE PUPIN LOAD-COIL BOXES IN SCHÖNEBURG UNDERGROUND SYSTEM.

FIG. 3. LAYING TELEPHONE CABLE IN SEWER TRENCH AT A PIPE CROSSING.

of an alternating-current relay, which is actuated by the induction coil for calling at the telephone station. The switchboard for this service is shown in the accompanying illustration (Fig. 1), while one of the Pupin-coil boxes of the Schöneburg underground telephone installation is represented by Fig. 2. This box is divided in halves and bolted together, as shown.

The laying of the cables in the sewer trenches at Schöneburg is shown in Figs. 3 and 4.

A Large Verdict for a Lineman.

The Illinois Supreme Court recently upheld a judgment for $25,000, rendered in the Circuit Court, against the Postal Telegraph-cable Company in be-

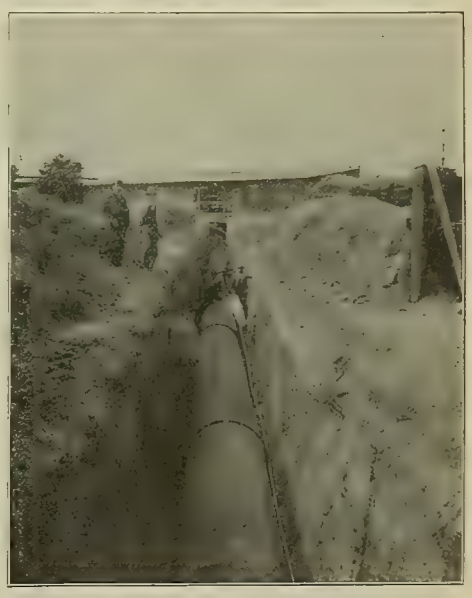

FIG. 4. LAYING TELEPHONE CABLE IN SEWER TRENCH.

half of William E. Likes, a lineman employed by the company, who was injured on November 4, 1901. The judgment is said to be one of the largest ever sustained by the court in a personal injury case.

Likes was stringing and attaching wires on poles on Waukegan Avenue near the guardhouse, Fort Sheridan, Ill., when he accidentally came in contact with an uninsulated transmission circuit of the Chicago and Milwaukee Electric Railway Company, said to be carrying 5,500 volts alternating current. He received a severe shock which resulted in his being severely burned and bruised and in sustaining permanent injuries to his eyes and ears, which have since prevented him from doing any work, and have also affected his mental condition, it is said.

Likes, one of whose arms was amputated, sued the company for $75,000. His attorney was John

F. Waters, Chicago, assisted by C. H. Johnson and Chase R. Rankin.

Prior to the judgment being sustained by the Supreme Court of Illinois, the Appellate Court had upheld the decision. The point seems to be that the defendant company did not warn the injured man that the high-voltage uninsulated wires were suspended on the pole on which he was required to work.

Some Novel Forms of Primary Batteries.

A French inventor, E. Buhot, has recently obtained a patent for a battery cell in which liquid chlorine is employed. The sectional view (Fig. 1) shows the construction of the apparatus. Liquid chlorine is contained in the reservoir (A) and it communicates by means of the valve (B) with the second chamber forming the battery proper. The latter is built of a long steel tube (C), which is closed at either end by the caps (D) (D'). By means of the trunnions (E) (E') and the pulley (F) the whole device can be rotated about its axis. The steel tube contains a second tube (G) made of insulating material, glass, for instance, and it is closed by two stoppers (H) (H'), one of which, (H), has in it the openings (I), in order to allow the gaseous chlorine to enter the inside of the tube. In the center is a metal rod (J) by which the end disks can be pressed together by means of a nut at the left-hand side; a tight joint is secured by the elastic washers (K), as will be observed. The rod (J) has mounted upon it the metal disks (P), these being made of a metal which cannot be attacked by the electrode, or of carbon. The disks constitute the positive electrode of the cell.

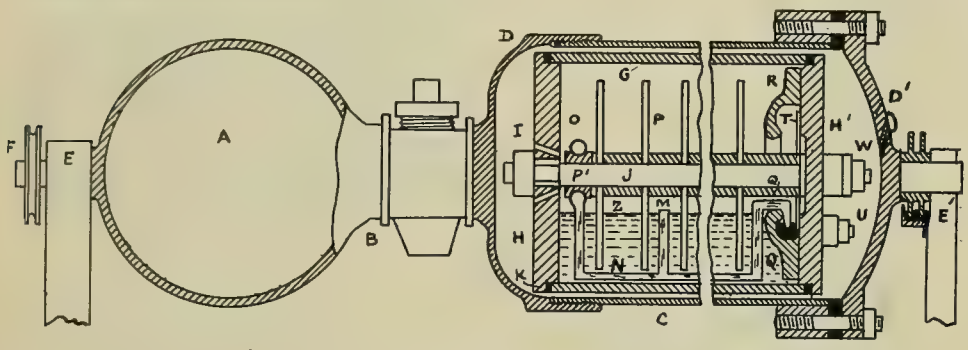

FIG. 1. BUHOT'S ROTATING BATTERY EMPLOYING LIQUID CHLORINE.—SECTIONAL VIEW.

As to the negative electrode, it is made up of the segments (M) of zinc or iron connected by the rod (N) of the same metal. One end of the rod is curved, as noticed at (O), and rests upon the pulley (P') of porcelain mounted on the central rod at the left. The other end of the zinc or iron rod at (Q) is curved about and rests upon the rim of a porcelain mercury basin, with the end dipping into the mercury, as shown. The mercury basin is fixed to the end stopper, and the latter carries also a small metal disk (T) which is always in contact with the mercury and is fixed to the end of a contact screw (U), passing to the outside, so as to give contact with the mercury and form the negative pole.

The positive pole is formed by the bolt (W) which passes into the central rod (J). A pair of wires connects these two poles with the ring collector mounted at the right upon the trunnion (E).

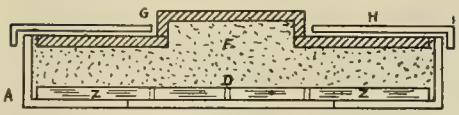

FIG. 2. A SMALL CELL THAT BECOMES ACTIVE AFTER BEING IMMERSED IN WATER.

The battery is operated in the following way: First, the valve (B) is opened and the whole apparatus rotated by means of the pulley. The electrolyte (Z), which is usually a solution of chloride of zinc, always remains in the lower part of the cell, as well as the negative electrode (M), as the latter is movable by means of the hooks (O) and (Q). But the positive electrode (P) is made to pass through the chlorine gas contained in the cell and coming from the vaporization of the liquid chlorine. This assures the depolarization of the positive electrode in a continuous way, owing to the action of the chlorine gas. At the same time the rotation of the disks causes the liquid to be agitated and gives a good working to the cell.

The same inventor has obtained a patent for a small form of cell. This type of battery, which is shown in section in the accompanying diagram (Fig. 2), is formed of a box (A) in celluloid having a large opening, preferably circular, in the bottom at the center. Upon the bottom of the box is placed a zinc disk (Z), which forms the cathode and is perforated with the holes (D) corresponding to the large opening in the box. Upon the zinc plate are laid a number of disks of blotting paper, or other porous material, while on top of this comes a layer of a mixture formed of powdered bisulphate of mercury and peroxide of lead (F), which forms the electrolyte and the depolarizer of the cell. The anode plate (G) comes over this layer. It is formed of an embossed disk of copper, carbon or platinum, and the top part of this goes through the opening of the circular cover (H), which is made of celluloid, and fits upon the top of the box. To make the battery work, it need only be plunged into water for a few minutes, when it is ready to furnish current. In order to keep it indefinitely before using it, the cell should be stored in a dry place. The above form is adopted so that a series of cells can be simply placed upon each other, when the metallic parts will come in contact without needing any other connections between them. Such a battery can be used to advantage in electromedical work.

The cell which is shown in Fig. 3, designed also by E. Buhot, is a hermetically closed battery, designed mainly to be used with pocket lamps or for other small applications. In the drawings is shown the general design of the cell. On the left it is in a state of rest, while the right-hand view shows it in the active state. The metal cylinder (A) is lined on the inside with a material (B) which is not attacked by the electrolyte, forming the positive pole. Fitted into it is a negative electrode, made of zinc preferably, and it carries an enlarged part (D), so that the cell can be closed by means of an inside insulating washer (E) and a second similar washer (F) placed at the outside. Upon the latter is applied a copper washer (G) which makes it easier to apply the end screw-cap (H). At the lower end of the battery is a second screw-cap (I), which closes this end by means of a lead piece (J). The latter piece serves for introducing the liquid into the cell, after which it is pressed together and soldered, so that there will be no leaks. As to the liquids of the cell, petroleum (K) or an inert liquid lighter than the electrolyte is introduced. Then comes the electrolyte (L), using for this purpose a solution of chloride of zinc of two or three per cent. strength, and, lastly, liquefied chlorine (M), which serves as the depolarizing agent. When the cell is in the position of rest, as seen on the left, the liquid chlorine occupies the lower part of the cylinder, and the electrolyte is above it and does not touch the zinc piece, this being only in contact with the petroleum. The portion of the zinc which lies above the oil is protected from the action of the gas by a protecting varnish (N). In the active position, seen on the right-hand side, the cell is reversed, and the zinc is now surrounded in part by the electrolyte, whereupon the battery gives current. The latter is taken off from the mass of the cell which forms the positive pole, and the zinc, acting as the negative pole, whose upper part projects at (O).

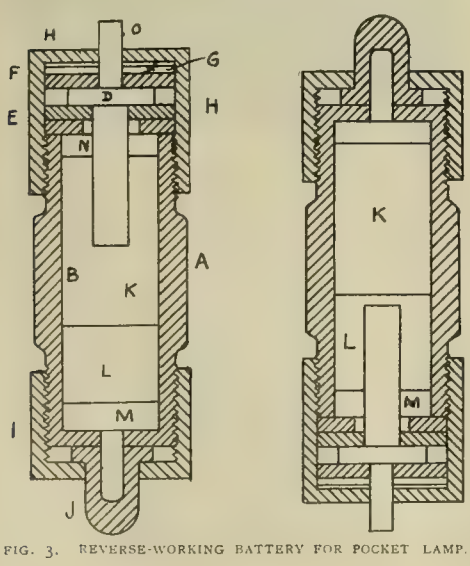

FIG. 3. REVERSE-WORKING BATTERY FOR POCKET LAMP.

Electrical Show at University of Illinois.

Announcement is made that the Electrical Engineering Society of the University of Illinois will give an electrical show in the electrical laboratory of the university at Urbana on March 1st and 2d. There will be demonstrations of radio-telegraphy, the speaking arc, electric welding, household uses of electricity, and the like, as well as more purely popular "stunts," as electrically lighted Indian clubs, an arc lamp burning under water, etc. It is believed that the exhibition will be of benefit both to the students and to the local public. The proceeds will be devoted to the Robert Fulton memorial fund. The students in charge of the technical installation are Lloyd Garrison, H. S. Hake, M. C. Maddox, I. E. Vity and James M. Bateman.

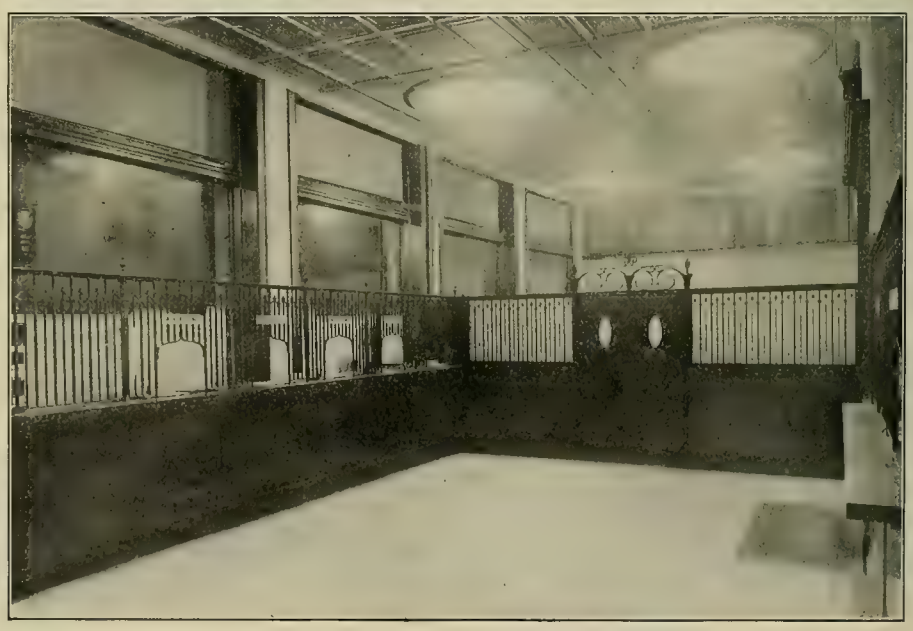

FIG. 1. ILLUMINATION OF BUSINESS OFFICE OF BOSTON HERALD.

Illumination in the Boston Herald Building.

By Geo. W. Martin.

The proper illumination of the plant is one of the important factors of success of a modern newspaper, especially as much of the work must be performed under artificial light. The recently completed installation of the Boston Herald Company is an excellent example of modern practice in such artificial illumination.

FIG. 2. ILLUMINATION OF COMPOSING (LINOTYPE) ROOM OF BOSTON HERALD.

Newspaper work presents four general classes of illumination: First, business offices; second, editorial and mailing rooms; third, type-setting and linotype department; fourth, press room.

The business office demands an ornamental installation, capable of producing a strong illumination free from dense shadows. In the case under consideration, this was obtained by the use of the high-current enclosed arc lamp, with the recessed type of light balancing selective diffuser ceiling. The appearance of the office at night as illuminated by this system is shown in the accompanying photograph, Fig. 1, which was taken without the use of any extraneous light.

The lamps consume 6½ amperes each at 110 volts (nominal), direct current. The room is flooded with a soft even light, so that there is no difficulty in reading in any part. As the light sources are large and of a low intrinsic brilliancy, no uncomfortable blinding effect is experienced, even when looking directly at the lamps.

In the editorial department news is received, classified and put in readable form. This is a large open office, well filled with desks. All the desks must be illuminated, so as to facilitate rapid work without eye-strain. In the mailing room newspapers are received from the press room, counted and marked for distribution. These rooms have about 11-foot studding and are lighted by five-ampere direct-current multiple enclosed arc lamps with concentric light diffusers. The lamps are hung as high as possible.

Type-setting and linotype operation require especially good light in order to permit the operators to ready type rapidly. The metal faces have dark dead surfaces without any color contrast, and the type is reversed, making it quite difficult to read, even under the best conditions. The illumination has been accomplished by the use of a large number of five-ampere enclosed arc lamps. Owing to the height of studding, inverted diffusers are used. With this combination it is possible to hang the lamps quite high, concentrating the light downward, producing a strong, even illumination, free from glare. The accompanying night photograph, Fig. 2, shows the arrangement of the room and the effective illumination produced.

Perhaps the most difficult department in which to obtain a satisfactory general illumination is the press room. While the general illumination is not required to be as strong as in the type-setting department, the presses extend up within about three feet of the ceiling, and the room is so filled with overhanging platforms, rolls and other machinery, that it is very difficult to avoid dense shadows. By the use of the enclosed arc and the inverted diffuser very good results have been obtained. The light has been projected into the machinery, so that the use of small incandescent lamps has practically been dispensed with. The illumination of this room is illustrated by the accompanying night photograph, Fig. 3.

Some 75 enclosed arc lamps are required to illuminate the various departments of the Herald plant. These, with incandescent lamps in the smaller offices, halls, etc., make the Boston Herald plant one of the best lighted in the United States. The installation was planned by the illuminating engineering department of the General Electric Company, in collaboration with the manager and engineer of the Herald company. It may be added that the pictures are not "retouched." With the inevitable losses of the photographic and halftone processes, they are intended to show the actual general effect of the illumination at night.

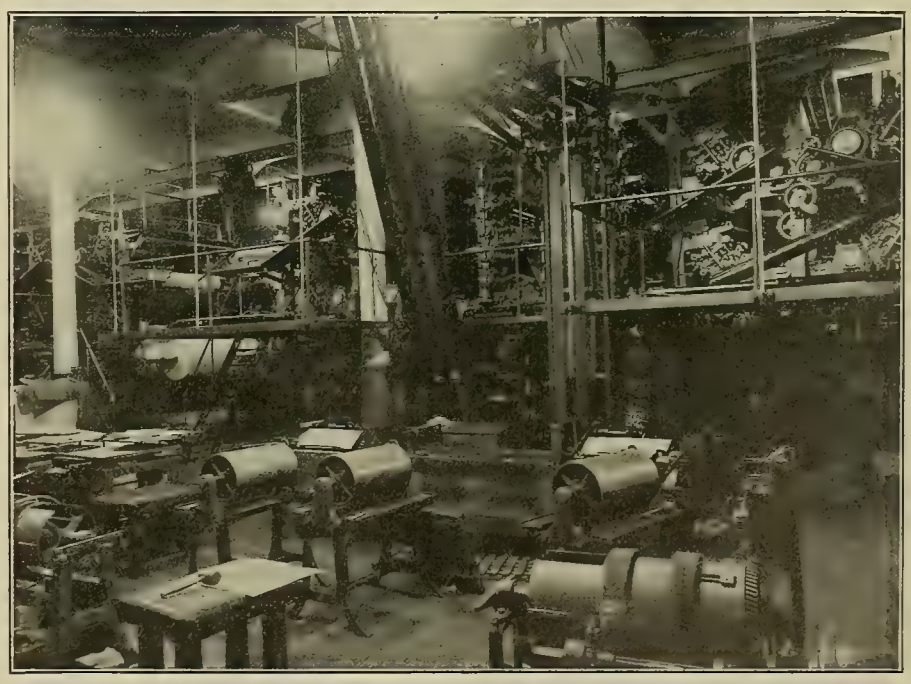

FIG. 3. ILLUMINATION OF PRESS ROOM OF BOSTON HERALD.

A bill is before the Kansas Legislature authorizing an issue of $100,000 in bonds to establish a municipal lighting plant at Topeka.

High-efficiency Incandescent Lamps.

[From the London correspondent of the Western Electrician.]

London, February 13.—The long series of discussions which have been taking place at the Institution of Electrical Engineers upon the question of incandescent-lamp efficiencies has now come to an end, but the effect will be apparent for a long time to come. The discussions have been instrumental in bringing prominently to the notice both of the lampmaker and the central-station engineer the advantages of just a little co-operation, and American ideas in this direction have, for the once, received commendation at the hands of their British critics.

Mr. Paterson of the National Physical Laboratory exhibited target diagrams of English and American lamps, much to the disadvantage of the former, but, as it was happily expressed in the discussion, the American central-station engineer supplies light, whereas his British prototype only supplies current. This was exemplified by the instances mentioned of the variations that do take place, although the Board of Trade regulations allow a four per cent. variation.

So keenly have the lampmakers felt their disadvantage that at last one trade secret has been divulged, viz., that when an order comes in for lamps the maker takes the trouble to find out the average conditions as to pressure regulation in the particular district, and although his lamps are stamped 200 volts, or anything else, yet they are, generally speaking, something different. Thus it is claimed that laboratory tests of lamps bought in the open market are no criterion as to the real qualities of the lamps on a commercial circuit. The formation of a society of illuminating engineers is strongly urged.

That these discussions will do a deal of good is already patent, for two voltage regulators have been devised—one by Mr. Paterson, mainly for his own use, and which regulates to within one-quarter per cent., and another by Mr. Haworth (who has also read a paper before the Institution) for commercial use, and which, he says, regulates to one-eighth per cent. under normal conditions and to one-quarter per cent. at other times.

Mention should be made of a remark by Professor Ayrton in the discussion referred to, viz., that carbide of silica lamps, despite statements to the contrary, have been made in large quantities in England at a factory near Liverpool, but that the experiments, in that neighborhood at any rate, had to be discontinued on account of the very bad voltage regulation of the municipal supply there.

The full papers and discussions will be available shortly to those who wish to follow the matter further. The lampmakers here assert that they could produce equal lamps to the American, given the same conditions of voltage regulation, and they have seized upon a remark made by Professor Spinney in the American electrical press last year to the effect that he had found varying percentages of American lamps up to 40 per cent. G.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

EVERY electrical man in Chicago will take pride in the showing made in the brief statement, entitled "Electricity Responsible for Few Fires in Chicago," which is given in this issue. It will be seen that the proportion of fire loss due to electricity is practically negligible, being, in fact, less than 0.01 of one per cent. of the total fire loss of 1906 in this city, or $300 contrasted with $4,179,235. This is really remarkable and highly gratifying. The reckless writers for the daily press, with their vague "crossed wires in the basement" or similar carelessly penned phrase in accounting for a big fire, will please take notice. In actual number of fires the proportion having an electrical origin is greater, although still very small, being two-thirds of one per cent. The figures are: Total fires in Chicago in 1906, 6,387; total fires caused by electricity, 43. The average loss at each Chicago electrical fire last year amounted to the trifling sum of $6.98.

Another pleasing feature of the table given is the steady decrease, both in number of electrical fires and the loss caused thereby, shown by considering the figures for the years 1903 to 1906, inclusive. It is to be remarked, also, that the statistics are made up from official records and must be considered as accurate. The figures are eloquent of the standard of electrical construction and inspection which has been attained in Chicago. We congratulate the electrical fraternity of Chicago, and more particularly the Department of Electricity and its efficient head, Mr. William Carroll, on this high grade of efficiency.

RATES of charging constitute one of the most perplexing subjects that engage the attention of men responsible for central-station management. To make the plant investment earn the money that it should earn; to fix prices for long-hour and short-hour service that shall be equitable to the company and the consumer in each case; to make proper allowance for the sale of current in wholesale quantities under the many varying conditions that arise—in short, to devise a schedule of rates that shall be fair and reasonable to all, and to convince a multitude of small customers that it is just and honest—this is a task which lays heavy demands on the judgment, skill and tact of the central-station manager.

Many methods of charging have been devised; there is great diversity of practice in this respect among American electric-light companies. But all, if they are really equitable and scientific, must embrace a "readiness-to-serve" or "stand-by" charge to the short-hour, peak-load consumer. And it is difficult to convince the average small consumer that this charge or rate is a just one. He does not understand that the company must be prepared, with expensive machinery in its plants and expensive copper conductors in the streets, to supply his small requirements just when the demand on the station is heaviest. If the electric-light company could keep its generating plant running at full load, or approximately full load, 24 hours or even 18 hours daily, it could make low rates. If, like the gas company, it could manufacture its product at a steady, economical rate and store it in a tank to be used as needed, the case would be different. But such is not the case, as all electrical men are of course well aware; and it is this peculiarity of the central-station business, taken in conjunction with the heavy simultaneous demand, which makes the subject of equitable rates such a troublesome one.

Numerous schedules of rates have been prepared, and in the case of nearly all companies these "rate cards" have been changed from time to time, with the progress of the art, greater enlightenment among electrical men and greater demand on the part of the public for electric light and power. A gratifying feature of the situation is that, in general, the constant tendency is toward cheaper rates, as greater economies are effected in the generation and distribution of electricity and in the efficiency of translating devices. Few of these schedules are, however, as complete and carefully and systematically worked out as the one of the Edison Electric Illuminating Company of Boston which we publish in this issue. Indeed this plan goes so minutely into details, with its several forms of contract, that objection may be raised that it is unduly complicated and that it will take a "Philadelphia lawyer" to understand it. The complication is not, however, so formidable as at first appears, as a careful study of the schedule will show. The rates cover all classes of service and are apparently devised to meet every contingency. While, in their entirety, it is obvious that they are refined to a degree practicable only in the larger cities, yet they are worthy of the careful attention of the managers of all central-station plants, small as well as large.

PURE SCIENCE—to use a loose but convenient term—sometimes finds itself in conflict with industrial development which scientific investigation has made possible. Such is the interesting case of the relation of the London County Council's electrical generating station at Greenwich and the famous astronomical and naval observatory at that place. The point in dispute was that the vibration from the reciprocating engines at the power house interfered with the accurate working of the observatory instruments, and also that the gases and smoke given off from the chimney were at such a height as to obscure the vision from the observatory for very important observations. Last summer, it will be remembered, a special committee was appointed by the Admiralty and the London County Council to inquire into the working of the Council's generating station. The special committee consisted of Lord Rosse, representing the Royal Observatory at Greenwich, Prof. J. A. Ewing, F. R. S., representing the Admiralty, and Sir Benjamin Baker, representing the London County Council. This committee has now issued its report, after an exhaustive inquiry. The full report is not available at this time, but a glance at the committee's conclusions will be instructive. These conclusions are:

(a) The question, both as regards the effects of vibration and obstruction through chimneys or discharge from chimneys, to be further reviewed, after, say, two years, by which time experience should be obtained with the second portion of the station at work.

(b) The generating plant for the second portion to be turbines, which, as well as the dynamos, must be of a perfectly balanced type, such as has been proved by trial not to cause vibration.

(c) An undertaking to be obtained that when the plant in the second portion is available for use, the reciprocating engines of the first portion shall not, in ordinary circumstances, be used after 10 p. m., and their use shall be restricted as far as possible after 8:30 p. m.

(d) The two chimneys of the second portion, at present incomplete, to be not higher than 204 feet above ordnance datum.

(e) The discharge of gases, both from these and from the existing chimneys, not to be materially hotter than the discharge is now from the existing chimneys, viz., about 250° F.

(f) No further extension of the station to be made beyond the 20,000 kilowatts now contemplated in the equipment of the second portion.

The highways committee of the County Council recommends that the Council co-operate as far as possible on the lines suggested, but it is thought that it may be desirable to have some modifications in certain details. The committee is advised that the difficulty in relation to the erection of the second two chimneys to their full height of 271.88 feet above ordnance datum, would be met if one of them were carried to the same height as the existing chimneys, and if the other, which is on the meridian of the altazimuth, were constructed to a less height, so as not to interfere with the observations on the meridian.

Altogether it is evident that a very sensible view of matters has been taken, and no question of compensation or removal is suggested. It is difficult to fix any blame; if at all it is upon the observatory authorities, who would never have allowed the station to have been erected without considerable protest had they shown a fraction of the activity in looking after their own interests that is evinced by the officers of the London County Council. The incident forms a further striking example of the expansion of London. Greenwich at one time was regarded as quite remote from London, and it would almost appear that the observatory authorities have just awakened to the expansion of the metropolis.

Sanitary District and City of Chicago Agree on Terms for Canal Power.

The Sanitary District of Chicago, as is well known, is developing a large electric power transmission plant, using water from the Drainage Canal, at Lockport, Ill. The city of Chicago intends to use this electric power for the lighting of the streets, and because of its close relation with the canal project the city has been negotiating with the board of trustees of the Sanitary District in the hope of getting especially favorable terms for the use of the canal power.

No contracts have been signed yet, but an agreement has been practically reached whereby the city is to pay $15 per horsepower per year for what current it uses, delivered to the switchboard in the sub-station at Western Avenue and the canal. This figure is on a basis of 11 hours use per day. Of course, the power is not yet available, but work on the plant is progressing rapidly.

Ultimately the Lockport plant is to furnish 40,000 horsepower for distribution to electric-light and power users between and in the vicinity of Chicago and Lockport, 20,000 of which will be available soon.

In Chicago the steam equipment at the three direct-current generating plants for street lighting now operated by the city is to be replaced by electric motors taking current from the Lockport plant. The new Fullerton Avenue alternating-current plant of the city will also be continued in operation. Future lighting extensions will then be made with alternating-current equipment supplied direct from canal power sub-stations to be placed in various localities as the demand warrants.

Generators for the Lockport plant are designed for three-phase 60-cycle alternating current at 6,600 volts, from which the current will be stepped up to 44,000 volts for transmission to the sub-station at Western Avenue. Here the current will again be transformed to 12,000 volts for distribution to local points of use, where another transformation may be made to the desired voltage and the power applied to any commercial use.

The transmission line to Chicago will consist of two circuits of aluminum wire, either circuit having ample capacity to transmit the full load. The lines will be carried upon galvanized steel poles 60 feet high, set in concrete foundations.

Electrical Salesmen's Association.

The Electrical Salesmen's Association held a special meeting at the Grand Pacific Hotel, Chicago, on February 26th, at which the members discussed and passed on the new constitution and by-laws. President C. A. S. Howlett read the various sections, which, with a few alterations, were accepted as presented.

The object of the association, according to Section I., Article II., is "the establishment of closer relations and affiliations among electrical salesmen, the elevation of the standard of salesmanship and the advancement of electrical interests."

All persons engaged in the sale of electrical apparatus, supplies, specialties, current or anything electrical are eligible to membership in the association, the membership being divided into two classes, known as members and associates. Members comprise those who have been engaged in selling anything electrical for a period of at least five years, associates comprising those who have sold electrical goods for less than five years, both classes being entitled to all voting privileges, associates, however, not being eligible to the offices of president and vice-president.

Section I., Article VII., of the constitution states that "in order to further the professional dignity and standing of the organization the use of intoxicating liquors at any function of the association is forbidden."

A unanimous viva voce vote of the executive board, which consists of the president, secretary and three other members, is necessary to the election of a member, whose application must be approved by a majority of the membership committee of three. The initiation fee is $3, and the annual dues, $2.

It is urged that the co-operative committee of the association unite with the Co-operative Electrical Development Association in the endeavor to promote the general welfare and prosperity of the electrical business.

Mr. L. A. Bartholomew of the Sheldon School was present at the meeting and spoke of the plans pursued by Mr. Sheldon in teaching his pupils how to become successful salesmen. He said that the school believed that the standard of salesmanship could not be too high.

Among others who presented their ideas on matters of salesmanship were Secretary Francis Raymond, P. R. Fisher and Thomas F. Clohesey.

Importation of Electric Power at Niagara.

On February 20th Captain Charles W. Kutz, representing the War Department, and Secretary Taft held a hearing in Niagara Falls on the question of the form of permit to be granted the companies that will be allowed to transmit electric power generated on the Canadian side of the river at Niagara into the United States.

It will be recalled that Secretary Taft recently rendered a decision that the Ontario Power Company be granted a permit to transmit 60,000 horsepower, the Canadian Niagara Power Company 52,500 horsepower, the Electrical Development Company of Ontario, Ltd., 46,000 horsepower, while 1,500 horsepower is held in reserve for the International Railway Company in case it be decided by the Dominion government that this traction company has the right to transmit power from one side of the river to the other, or through Victoria Park, this question or contention having arisen between the company and the commissioners of Victoria Park, Canadian side. The total amounts for which permits are to be granted is 160,000 horsepower.

It was to decide upon the form and wording of these permits that the hearing at Niagara was held. It took place in the Prospect House. The Canadian Niagara Power Company was represented by P. P. Barton, F. L. Lovelace, A. Monro Grier, A. H. Van Cleve, H. W. Buck, L. E. Imlay and E. C. Egbert. The Electrical Development Company of Ontario, Ltd., was represented by H. H. Macrea, attorney of Toronto, and Chief Engineer Walter Pearson, while the Niagara Falls Transmission Company, an allied concern, was represented by Hon. Frank A. Dudley of Niagara Falls. The Ontario Power Company and the Niagara, Lockport and Ontario Power Company were represented by Franklin D. Locke of Buffalo, Oliver S. Lyford, Jr., of Westinghouse, Church, Kerr & Co., of New York, and V. G. Converse, Niagara Falls. The Niagara Falls Hydraulic Power and Manufacturing Company was also represented at the hearing. Those who appeared in the interests of this company were George B. Mathews, president, Buffalo; W. J. Olmsted, vice-president, Buffalo; Attorney C. M. Harring, Buffalo; Arthur Schoellkopf and John L. Harper, Niagara Falls.

The hearing was held behind closed doors. The form of permits was discussed at length, each company presenting its views. Technical questions naturally arose, and the electrical engineers present elucidated the problems. As the questions involved are only those covering the situation between the generating or transmitting companies and the government to enforce compliance with the provisions of the permits as they will be prepared, Captain Kutz and the represented companies applied their thought and attention to these matters. The hearing was adjourned. The permits will be issued soon.

Automobiles for Radio-telegraphy in Military Operations.

The new automobile radio-telegraphic station which has been built at Milan for use in the Italian army service is now under trial. It is laid out on the Marconi system. Marquis Solari designed the automobile, and it contains all the necessary apparatus for the driving of the car and for the production of current needed for the radio-telegraphic apparatus. A special device is also used in order to raise the mast of the car instantly when needed for use. It is found that the station can be set in working order within 10 minutes. If desired the apparatus can be lowered in power and run at half speed. This portable plant has been built by the Italiana Company, which has patents for its system in all countries. It is installed upon a chassis built on the Aster system by an Italian automobile firm, and is arranged so as to contain within the car body a complete Marconi station which can be used to cover a distance of 100 miles, it is said. The new Marconi system for sending waves in only one direction is applied to the present case. The system has the advantage of transporting the mast, the atlernator, the apparatus and personnel upon a single automobile car and of not needing the use of balloons, which in case of wind and in general for military use offer great drawbacks. In cases where the ordinary commercial telegraph or telephone wires may be broken, the car can be used as an auxiliary station to help out the communication. The Italiana Company has also constructed a smaller car for the war and navy departments. This is a very light car and can be drawn either by hand or by horses, and is to be used especially for military operations in mountain service. The mast which it carries is about 75 feet high. The car can be taken apart and each section can be carried by one man, so as to make the transportation easy in the mountains.

Electricity Responsible for Few Fires in Chicago.

Statistics of fire losses in Chicago for four years ended with 1906 show that the fires due to electrical causes were very few, and the number due to electricity decreased considerably each year. The good showing may be attributed in a large degree to the efficiency and diligence of the Department of Electricity of the city of Chicago, which each year shows advancement in all its branches. The figures given below were supplied by William Carroll, city electrician, and were taken from city record and records of the fire-insurance companies.

In the year 1906 the total fires numbered 6,387. Of this number only 43 were caused by electricity. The monetary loss sustained from the fires in 1906 amounted to $4,179,235, and only $300 of this loss was attributed to fires caused by electricity. This is an excellent showing, the percentage due to electrical causes being hardly worth mentioning.

Following are comparative figures for the last four years:

	1003.	1904.	1905.	1906.
Total fires	6,054	6,661	6,522	6,387
Total fires caused by Electricity	102	79	53	43
Total loss	$3,062,931	$2,950,254	$3,303,929	$4,179,235
Total loss caused by Electricity	*$84,275	†$58,400	$2,110	$300

* Includes the Iroquois Theater fire; loss, $80,000.
† Includes one fire caused by lightning; loss, $50,000.

Whenever a fire alarm is turned in the electrical department immediately consults its records as to whether the building is wired for electric light or power. If so, a thorough inspection is made to determine if the fire is due to electrical causes. This plan of getting accurate data also affords an opportunity to learn of faults if any exist, and thus a similar occurrence may be prevented. Hence the few fires from electrical causes.

Chicago Meeting of the American Institute of Electrical Engineers.

The Chicago branch of the American Institute of Electrical Engineers held a meeting in the rooms of the Western Society of Engineers in the Monadnock Building on February 26th, at which Mr. S. P. Grace of Pittsburg, chief engineer of the Central District and Printing Telegraph Company, read a paper, illustrated with lantern slides, on "The Telephone Wire Plant." Mr. Grace touched briefly upon the studies of development, transmission and distribution. It was one of the best telephone papers delivered at any telephone meeting in many years.

Mr. Larned, general superintendent of the Chicago Telephone Company, who led the discussion, referred to conditions in Chicago, where it was necessary for his company frequently to work in harmony with the electric-lighting companies, as both were often obliged to use the same alleys in construction work. Such a course, he thought, would not have to be adopted in Pittsburg, where the number of alleys being comparatively small, most of the construction work is done on the streets.

E. F. Norton, engineer of the construction department of the Chicago Telephone Company, said that the plans of that company were very similar to those described by Mr. Grace in the matter of telephone distribution.

Others who took part in the discussion were Allard Smith, superintendent of construction of the Chicago Telephone Company, Ralph Pierce and Messrs. Humiston and Miller.

Welfare Work of Brooklyn Edison Company.

There has recently been instituted by Mr. W. W. Freeman, general manager and vice-president of the Edison Illuminating Company of Brooklyn, a far-reaching scheme of welfare work which is of unusual interest. In the clubrooms of the company there will be given an evening course in electrical engineering for the benefit of the male employes of all departments of the company. The course consists of high-grade experimental lectures, such as are given in technical institutions, covering the elements, and leading up to electrical measurements and direct and alternating currents. Mr. Sydney W. Ashe has been retained as professor in charge. Four lectures have so far been given, and the interest manifested has shown the great value of

the work. The course was made possible in a large measure by Mr. W. W. Freeman and Mr. W. T. Wells, general superintendent, and its success is due in a large measure to Mr. W. T. Fairburn, chairman, and Mr. G. N. Kibbe, member of the Edison Club committee.

Western Railway Club Discusses Electrification of Steam Railroads.

The regular meeting of the Western Railway Club was held at the Auditorium Hotel, Chicago, February 19th. Mr. James Lyman, western manager of the engineering department of the General Electric Company, read a paper illustrated with stereopticon views, entitled "The Anatomy of a Railway Motor and Control Equipment."

After giving some of the fundamental principles governing electricity and magnetism upon which motors depend, Mr. Lyman spoke, in part, as follows:

The electric-railway motor has reached a point of development where it can advantageously replace the steam locomotive for much suburban service, and in certain instances for through passenger and freight service where traffic conditions are especially congested. It offers all the reliability of the steam locomotive with many advantages. It provides from 50 to 100 per cent. increased train capacity with the same track facilities. The combined tractive effort of motor cars during acceleration is from three to four times as great as with steam, and the length of trains is only limited by the station facilities.

Being operated from either end, no time is lost in despatching trains.

A number of instances are now under consideration for the electrification of considerable sections of railroads in the West with a view of increasing their capacity for handling traffic without increasing the tracks. In one case with an investment of about 30 per cent. of the cost of double-tracking the road for the electrical equipment, including power plant, the capacity for handling trains will be doubled. Convenience, cleanliness and general comfort of passengers are characteristics of electric service. This has been demonstrated in the enormous growth of interurban railway systems.

The awakening of interest in the electrification of steam roads is due primarily to the successful development of suitable motors and control equipment for an improved railway service. The recent advances made in power-house economies and improved power transmission and distribution have also materially contributed to the advance. Today steam power houses are generating electric power from one-half the pounds of coal per horsepower required by the locomotive, and the coal used is of a much lower and cheaper grade. The power is transmitted many miles with exceedingly small losses, so that the saving alone in power largely offsets the interest and depreciation charges on the capital invested in the electrification. An electric locomotive will cover at least 25 per cent. more miles per month than the steam locomotive. From 15 to 25 per cent. of the total weight of the train is reduced by the use of an electric locomotive, due to the fact that all the weight is on the drivers. Indeed, with electric locomotives in many cases it is necessary to add ballast to obtain the desired adhesion.

In the electrification of steam roads the net earnings are increased by the increased capacity for handling passengers and freight—in other words, the gross receipts. The miles per hour at which a steam locomotive can maintain its maximum tractive effort is a function of the boiler capacity, namely, for freight locomotives from nine to 10 miles per hour. The electric freight locomotive can maintain its maximum tractive effort continuously at approximately double that speed, thus permitting of double the tonnage hauled in a given time. In a paper written by A. H. Armstrong on "Electricity versus Steam for Heavy Haulage," the following table is given, showing the haulage capacity at various speeds:

Miles per Hour.	Steam Tons.	Electric Tons.
10	1,450	1,380
15	1,140	1,380
20	850	1,380
25	650	1,380
30	530	1,380
35	430	1,380
40	360	620

The New York Central electric locomotives, which were not designed for switching purposes, handle four times the amount of switching in a given time of that of the steam locomotives now in use for this purpose. Electric locomotives can safely maintain higher speeds than are possible or safe with steam locomotives. The center of gravity of the electric locomotive is down close to the trucks. The applied torque is uniform as contrasted with the reciprocating motion of the steam locomotive parts, so that the hammer blow on the rails is eliminated and there is no tendency for the wheels to leave the track. Experimental motors are now being designed for express service with a maintained maximum speed of ninety miles per hour.

The great waterpowers of this country are now rapidly being developed and the cheap power thus produced will be a potent factor in the electrification of steam railroads. It is an interesting fact that today Niagara Falls power extends more than half way across New York state and meets the Hudson River waterpower in the trolley wires of the interurban railway paralleling the New York Central, a total distance of over 300 miles.

We have here in Chicago the highest development in steam power house. I refer to the Fisk Street [illegible] use of the Commonwealth Electric Company. At present it has a maximum capacity of over 100,000 electric horsepower in eight Curtis turbine units. When two additional units, soon to be installed, are in service its maximum capacity will be 140,000 horsepower, the largest power house in the world. From this power house current is delivered to all the elevated railroads in Chicago, with the exception of the South Side Elevated, to the Chicago Union Traction Company, Chicago City Railway Company, to the Illinois Tunnel Company, and to the lighting and power distribution throughout the city of Chicago over an area of 65 square miles. It is contracted to furnish power to two interurban railroads running more than 40 miles out of Chicago. From this same power house current might most economically be furnished for operating the suburban service of all the steam railroads entering Chicago.

Mr. C. F. Daly, passenger traffic manager of the New York Central Railroad, is authority for the statement that the New York Central Railroad has the most powerful locomotive using either steam or electricity in the world, its normal rating being 2,200 horsepower, but while accelerating it will easily develop the enormous amount of 4,000 horsepower. The control is of the Sprague-General Electric multiple-unit type, permitting two or more locomotives being coupled together and operated from the cab of either one in the same manner as a single locomotive and with the power of the two combined. For the purpose of testing these locomotives under actual service conditions the New York Central Railroad set aside a stretch of track on one of its main lines west of Schenectady. This was equipped with a third rail for a distance of approximately six miles. A 2,000-kilowatt Curtis turbine in the General Electric power house at Schenectady provides the necessary power. A locomotive was taken out on the experimental track on October 26, 1904, and since that time it has run over 50,000 miles in all sorts of weather. On one occasion a continuous run of 18 hours was made in a driving snowstorm with the locomotive hauling a 335-ton train, a schedule speed being maintained that would give results comparable with those required in actual service. Among the interesting features during the trials was a series of competitive runs with a steam locomotive having the same weight on drivers and hauling the same weight of train. In each case the electric locomotive beat its competitor. The results of all trials to which the electric locomotive has been subjected have proved it a great success from every standpoint. The record of maintenance for the entire period has been carefully kept and shows a cost of maintenance for the electric locomotive of less than two cents per locomotive-mile as compared with the cost of from five to seven cents per locomotive-mile for steam locomotives in similar service.

A general discussion followed the reading of Mr. Lyman's paper. Mr. C. F. Street thought that the subject of the use of electricity for handling railway projects was the most important ever presented to the engineering world. The question of a power plant had for many years been merely the question of what make of steam engines should be used. The speaker said that the most able engineers could not agree on the subject as to whether alternating current or direct current should be used. The impression of electrical engineers that the steam locomotive had seen its day was, however, probably incorrect. The use of electricity for handling railway problems was coming just as fast as the electrical engineer and the electrical manufacturer could take care of it, and just at the present time a little bit faster than they can take care of it.

Professor Woodworth of Lewis Institute, in referring to the idea that steam railroads would soon be a thing of the past, cited a case where a steam railroad was recently in the hands of operators who concluded that the proper thing was to electrify the railroads. They accordingly went to the manufacturers, who questioned them as to how many trains a day they operated. They told them, and the company said: "You just go right home and run your steam engines." They will be running steam engines for a great many years to come on that road, at least that was the opinion given by the electrical firm. The question was one of capacity more than any other one thing. Where a steam railroad has reached its capacity then the company is usually ready to electrify.

Mr. C. B. Weston thought that the problem of electrifying steam railroads was one that would be confined for a great many years to the electrification of terminals in large cities. The difficulty of handling a very large traffic in a small area, he said, becomes one which resolves itself into a problem of moving trains quickly into and out of that area.

A statement published that the Erie Railroad was about to electrify 200 miles of track running into New York city, Mr. Street said, was incorrect. The company figured on it and expect to do it just as soon as the money conditions are in shape.

Mr. J. C. Osmer thought that if the reciprocating engine was to remain in use the proper place to put it was in the power house. The economy in running and furnishing power in a suitable power plant leads him to believe that horsepower could be furnished at a much less figure than the present steam locomotive could produce it.

Mr. M. K. Barnum of the Chicago, Burlington and Quincy Railroad said that the question of locomotive failures was one ever present with the man who had to do with steam locomotives. There were probably upward of 200 possible different causes of engine failures, and it seemed as though a large percentage of these would be eliminated.

A feature of the electric locomotive which struck Mr. Barnum as being possible of proper adaptation to mountain apparatus was the possibility of generating electricity by water power. Throughout the mountainous countries the railroads largely followed the water courses, and it would seem possible there to utilize the electric locomotive more profitably and more efficiently than the steam locomotive.

Mr. Wallace said there was one important matter in regard to the operation of an electric locomotive that had not been touched upon, and that was the crew for the electric locomotive. It was a difficult matter to educate competent locomotive engineers for the service of today. If a man were asked to go out and employ 50 good locomotive engineers he (Mr. Wallace) did not know where he could get them. The electric locomotive engineer does not have exhausts to tell him how fast he is going; he does not get the rocking of the engine, and he is going faster than he really thinks he is.

Mr. Symons thought that the question of electrifying railroads resolved itself into this—that electricity, while it is a marked move in modern methods of transportation, was, one might say, one of the higher branches of engineering, and the two would travel along together for many years, although the steam locomotives would undoubtedly be greatly reduced in number.

Mr. A. E. Manchester of the Chicago, Milwaukee and St. Paul Railway said that one of the reasons why he did not take part in the discussion was that he felt and thought very much like a conductor who once had a wreck under circumstances in which it was quite plain and evident to him that he was going to get into trouble, and it happened to be Mr. Manchester's misfortune to have to help pick up the wreck, and in doing so he asked the conductor to give him some assistance in the matter of holding lights and moving the engine around. The conductor replied that it was "—— when a man had to be pallbearer at his own funeral."

Mr. Lyman, in closing the discussion, said that in most cases of steam roads the time was not ripe for electrification. Referring to the reliability of service of the electric locomotives and electrically operated trains, he said the Manhattan Elevated Railroad of New York since changing over from steam to electric power had found that from losses due to delays of any kind the time lost in the movement of trains was less than half the time lost in the movement of trains operated by the steam locomotives, and it covered a period during the winter season when there was more or less trouble from ice, snow and sleet on the unprotected third rails. The question of the education of engineers for electric locomotives, Mr. Lyman said, had been solved by the New York Central by putting out every electrical locomotive some two years or a considerable period before the regular service should go into effect. The New York Central had taken their steam locomotive engineers, who are familiar with all the train movements, road, right-of-way, signaling, etc., and had put them on the electric locomotives and made splendid motormen out of them. Mr. Lyman rode on the first electric locomotive that was built for the New York Central on one of the trial trips, and he was disappointed that they were not making some speed. He asked one of the gentlemen near him if they were not going to give some real good speed up to at least 60 miles an hour, and he said: "We are going almost 60 miles an hour now, don't you see? Look at the speed recorder." Such was the case. Mr. Lyman stated he was indirectly informed that there were no instruments showing the exact speed of the two locomotives that drew the train which was wrecked in the Bronx in New York recently. If they were allowed to run at full speed the probability was that they were attaining quite a high speed, which might account for the terrible accident which happened. It was a very simple matter to attach either a power speed recorder or some electric instrument that would show very accurately and exactly what speed was made. The speaker said that the speed control was perfect and that an acceleration of a mile and a half per hour per second could be attained, which was about double the speed acceleration of that of a good steam locomotive.

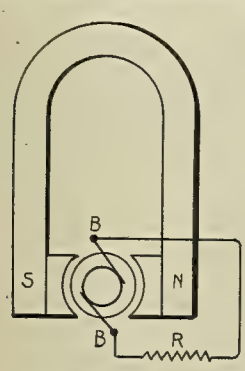
ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

V.—Dynamo-electric Machinery.

The Magneto-generator.

The simplest type of generator which will illustrate the general principles of alternating-current machines is the magneto-generator. Small magneto-generators were used in connection with the older styles of telephones to ring up the central exchange. They were also made of considerable size in the early forms of dynamos, but as the perma-



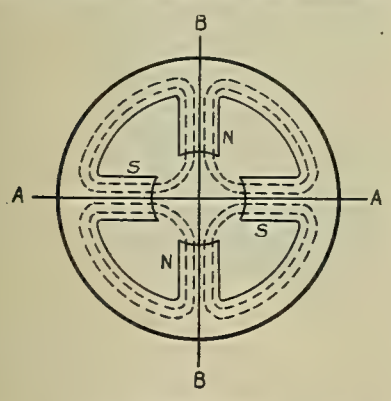
MAGNETO-GENERATOR.

nent magnets which formed their field were extremely large and heavy, and also because their magnetism gradually grew weaker and could not be controlled, this type of generator soon gave way to one having electromagnets for its field.

The magneto is a generator having for its field a permanent horseshoe magnet, and for its armature a large number of turns of insulated copper wires of very small size wound in the form of a shuttle. A diagrammatic view of a magneto is illustrated herewith. The field magnet will be readily recognized from its horseshoe shape, and the poles of the magnet have pieces attached to them known as pole-pieces, which are bored out slightly larger than the diameter of the armature, which revolves between them. The two ends of the armature coil are connected to rings on the armature shaft, and brushes (B) (B) collect the current generated in the armature. The current generated passes from the positive brush through the outside circuit to the negative brush.

Small magnetos usually have a number of horseshoe magnets fastened together to form the field, and the armature is provided with a pinion, which is driven by a gear which meshes with it and has a handle for turning it by hand. Larger machines of this type are also built for driving by means of mechanical power, but their use is limited to a very few special applications.

Such a machine generates an alternating current of electricity, or one which changes its direction twice for every revolution of the armature. The



FOUR-POLE FIELD.

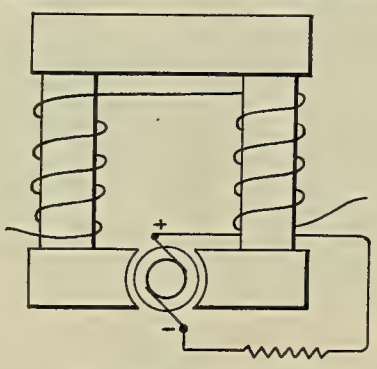
reason for this is that the armature coils through which the lines of force pass change their relative position to the field twice in the course of a revolution.

Generator Fields.

The next step in the evolution of the modern generator was the substitution of electromagnets for permanent magnets. This was a very great advance in generator design, as, in addition to securing fields which could be readily controlled as to their magnetic strength, a very much stronger field was obtainable with electromagnets than with permanent magnets. This permitted the weight of metal in the field to be greatly decreased, while the magnetic strength of the field was increased, the result being that a machine having electromagnet fields produced a much more powerful current than one with permanent-magnet fields, and, moreover, the weight of metal in the machine per unit of current produced was very noticeably smaller in the electromagnetic machine.

The present-day generators use three varieties of iron for field magnets, the choice of which depends generally upon the size of the generator. These materials are iron, wrought-iron and mild steel. Wrought-iron has the greatest magnetic strength; that is to say, a greater number of lines of force can be developed in a given section of wrought-iron than in the same section of cast-steel or cast-iron. The mechanical difficulty of forging large frames of wrought-iron, however, prevents its use for field frames in any but the smallest sized generators. The second best material from a magnetic standpoint is mild steel, in which the density of the lines of force is about 80 per cent. of that of wrought-iron. This material is very largely used at the present time for field frames of both generators and motors.

Cast-iron comes next in magnetic value, its lines of force having a density of about 60 per cent. of that of wrought-iron. Cast-iron is produced considerably cheaper than either steel or wrought-iron and is also very largely used for field frames in



SEPARATELY EXCITED DYNAMO.

the case of generators where the weight is not of special importance.

In speaking of the density of the lines of force, the ultimate number of lines of force which can be passed through a given section of metal is referred to. When all of the lines of force have been passed through the metal which can be passed through it, it is said to be saturated. Therefore, in order to build a generator of the least possible weight, it is necessary to operate the fields as close as possible to the point of saturation, or to keep the density of the lines of force near their maximum limit.

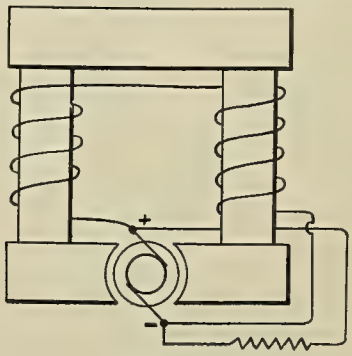
Multipolar Types.

So far we have only considered a field in the form of a horseshoe having only one north and one south pole. A machine with such a field is known as a two-pole machine. Only machines of quite small capacity are now built of the two-pole type, and generators of more than one or two horsepower capacity are usually built with four, six, eight or more poles, running up to 20 or more poles in machines of large capacity. These poles are always in multiples of two, and such fields are known as the multipolar type. All of these multipolar types, however, may be considered as combinations of two or more two-pole machines.

The four-pole frame is illustrated in the accompanying diagram, in which the four poles radiate inwardly from an outer ring. The poles are spaced evenly about the circumference of the outer ring, and the north and south poles alternate. The lines of force pass through this frame in directions indicated by the dotted lines, and if this frame were to be cut through on the lines (AA) and (BB) the result would be four separate magnets of the horseshoe type. Every multipolar frame, therefore, of whatever number of poles, may be considered as a combination of the same number of two-pole magnets fastened together.

In order to generate the magnetism in the field of a dynamo, a current of electricity is passed through coils of wire surrounding the poles. These coils of wire are known as field coils, and the amount of magnetism generated in the field depends upon the number of turns of wire in the field coils, and the amount of current passing through them.

The unity of quantity of electric current is called the ampere and the unit of magnetizing force is the ampere-turn, or one ampere passing through one coil of wire about the pole. The total magnetizing force is represented by the product of the number of turns in the field coils and the number



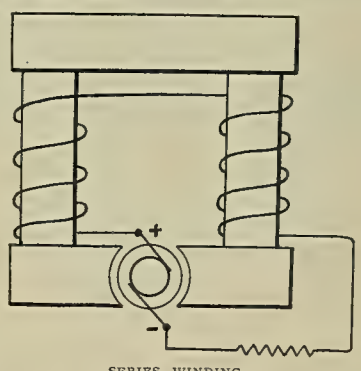
SHUNT WINDING.

of amperes passing through them. The same number of lines of force may be generated by one ampere and 100 turns, five amperes and 20 turns, or 100 amperes and one turn. It is the product of the amperes and the turns which determines the total amount of magnetism, and these two factors may bear any relation to each other. So long as their product is equal, the total amount of magnetism will be the same.

Field Excitation.

The current used to excite the fields of electric generators may be derived from several different sources. Primary batteries or accumulators may be used for this purpose, and also the current from separate small generators. In another class of generator a small portion of its own current is led through the field coils; in still other types of machines, the whole of its own current passes through the field coils. Those generators whose fields are supplied from an independent source of current are known as separately excited machines, and those in which the current of the generator itself is used for field excitation are known as self-excited machines.

Except for a very special class of motors, a direct current is always necessary for field excitation, as an alternating current would tend to change the direction or polarity of the magnetic field each time the alternating current reversed its direction. For this reason alternating-current machines are always separately excited, while direct-current machines are always self-excited.



SERIES WINDING.

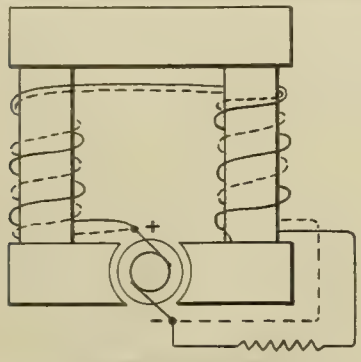
For large alternating-current machines the field circuit is usually provided from a small direct-current generator of just sufficient capacity to supply the necessary amount of current for the excitation of the large generator.

The self-excited machines may be either shunt-wound, series-wound or compound-wound. The shunt winding is shown in the accompanying diagrammatic drawing. From the brushes of the dynamo the main circuit is taken off, and there is also a small side circuit, or shunt, led off from the main circuit. This shunt is made of comparatively fine wire, and has a high resistance, so that but a small portion of the current of the machine passes through it. From the positive brush the

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

shunt is wound around the fields a large number of times, and is then connected to the negative brush.

In the series-wound self-exciting dynamo the whole of the main current leaving the positive brush passes around the fields a number of times, then out through the external circuit, and back to



COMPOUND WINDING

the negative brush. The compound-wound machine is a combination of both the shunt and series machine, and has both the shunt and series windings upon its field. Diagrams of these different windings are shown in the accompanying illustrations, and the effects produced by them will be discussed in a later chapter.

[*To be continued.*]

Some Aspects of Modern Switchboard Engineering.[1]

By C. W. Stone

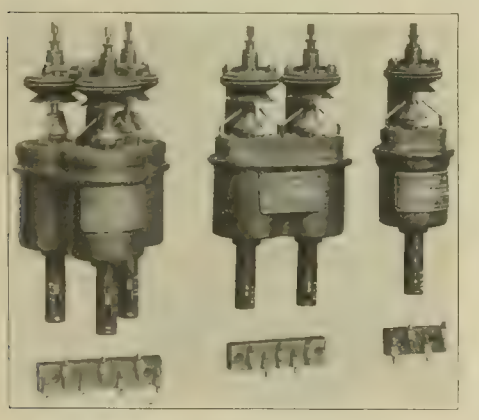
Part I.

There is no branch of the electrical profession which is more important than that of designing switchboards and switchboard apparatus.

The switchboard must be as near fool-proof as possible. It must be so arranged that it will make it possible to operate the system at all times, and in case of trouble its relay devices must act in such a manner as to cut off the particular part which is defective with as little disturbance to the system as a whole as possible.

Too often an engineer in making his plans for a new generating station thinks he can place the switchboard in most any place, and arranges the rest of the apparatus in the best way without regard to the switchboard. This often results in making a very undesirable and special switchboard arrangement, involving long and complicated runs of cables from the machines.

What I am going to attempt to do tonight is to try to point out some of the undesirable features to avoid, and also explain why some of the things are done as they are. I will also try to bring out



TIME-LIMIT RELAYS.

some of the principles entering into the design of the different devices used on a modern switchboard.

Instruments

Direct-current Switchboards.—For direct-current work the problem of what instruments to use and what not to use is comparatively simple.

For generators, ammeters are always necessary, and voltmeters can either be furnished for the entire group of machines using plug switches to connect them to any machines or the bus-bars, or one can be furnished for each machine.

Ammeters are usually furnished for each machine, and are used to indicate that the load is properly divided between them.

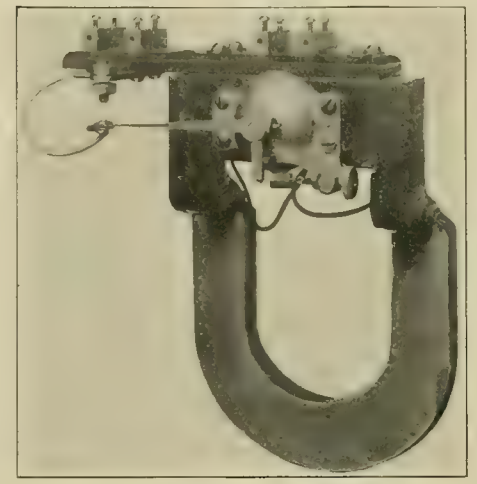
It is desirable to locate the shunts used with the ammeters as near the instruments as possible, thus avoiding the use of long leads, which have to be made of large size.

Balance indicators, which are simply galvanometers with scales marked "high" and "low" with a central zero, are sometimes used to indicate whether the voltage is too high or too low when machines are being paralleled. These instruments are small and inexpensive, and are a very useful addition to the switchboard.

Recording wattmeters are desirable, but not necessary. If used, the best place is on the generator panels, as they are thus always run with a better load factor. An accurate record can also be kept of the work done by each unit.

Total-output instruments are always bad practice, although often recommended. If any increase in the capacity of the plant is made, all total-output instruments must be changed and all the connections thereto. They must also operate under the most adverse conditions, as they are obliged to work under such a great range in load.

For the feeder circuits the question of what instruments to use is always determined by the existing conditions, but in general where any instru-



REVERSE-CURRENT RELAY.

ments are used, ammeters will answer all requirements.

Alternating-current Instruments.—The question of instruments for alternating-current work is much larger than that in direct-current work.

In the first place, as all alternating-current generators are rated on their current output in amperes, it is necessary to use ammeters to indicate the current output. The question of the number to use is determined by whether the system is a balanced one or not. In general, it can be assumed that where generators are supplying a load made up entirely of rotating apparatus, such as rotary converters or motor-generators, the load will be balanced sufficiently well so that one ammeter will do. If the system is partly or entirely a lighting one, then three ammeters are needed for a three-phase generator and two for a two-phase generator.

Unlike direct-current instruments, alternating-current ammeters do not indicate the division of load between machines at all, and it is therefore necessary to use some instrument which will. Indicating wattmeters are most commonly used for this purpose, and they are practically indispensable.

Voltmeters can be used with each machine, or one can serve for the entire group, using plug switches to connect them to any machine. Another way would be to use two voltmeters, one connected permanently to the bus-bars, and the other used for the machine. This is a very good arrangement, as it makes it possible to compare the readings of the two, thus serving as a check on their calibration.

Field ammeters, while not absolutely necessary are most valuable as a check in case of any trouble with the apparatus, and should generally be recommended.

Power-factor indicators used with generators serve no useful purpose, and may be very misleading. They are so constructed that any unbalancing of the circuit would be indicated as a change in power factor, where no such change had taken place. Indicating wattmeters are so constructed that if a power-factor indicator is wanted a reversing switch in the potential circuit of the indicating wattmeter can be used, and the wattless component can be read, thus serving all practical purposes of a power-factor indicator.

There has been developed recently an instrument which is simply a polyphase indicating wattmeter; the scale is calibrated with a central zero, and indicates the wattless component, either lagging or leading.

Frequency indicators are unnecessary, as after the plant is started and the governors of the prime movers once set, the frequency is kept constant enough by them. If any are deemed advisable, one can be supplied connected to each set of bus-bars.

Since the introduction of turbine-driven machines frequency indicators calibrated to indicate speed have been used quite extensively. These instruments are used in place of tachometers, and are mounted on the steam-gauge board adjacent to the machine. On this same head-board, in large stations, an indicating wattmeter is sometimes mounted, serving as a very useful guide to the steam engineer.

Integrating wattmeters are optional, and their use is determined by the local conditions. If it is desired to keep a record of the output of the station, it is better to use them on the generators

Many different forms of synchronizers have been brought out. Synchronizing lamps were used for a long time, but are not as accurate as is desirable in large plants. If lamps are used alone it seems better to have them bright when machines are in synchronism. If they are so connected that they are dark, it is possible that in case of a broken filament in a lamp, synchronism may be indicated when machines are not in phase, with more or less disastrous results.

Dial synchronizers are now available which will indicate not only how far apart in phase machines are, but will also indicate whether the incoming machine is running too fast or too slow. These instruments should always be recommended.

Automatic synchronizers are desirable in theory, but I have always felt that as they are more or less delicate in their construction and that it is unsafe to place entire reliance on them, as, if there is any trouble, it may mean a complete shutdown and possible injury to the apparatus.

With any form of automatic device there is a tendency to rely on it more and more, particularly if it works well most of the time. This engenders carelessness on the part of the operators, and when the device does not operate correctly serious trouble may result, particularly with the new high-speed apparatus.

For synchronous apparatus, ammeters should always be used, as they serve as the best means of keeping the current input at normal. Power-factor indicators are sometimes used for this purpose, but it is not safe to place entire dependence on them, as with any unbalancing of the circuits, wrong indications will result without the knowledge of the operators, and in the attempt to keep the power factor at unity, the apparatus may be dangerously overloaded in current.

Lighting or power circuits can be taken care of by ammeters, unless feeder regulators are used, when voltmeters must also be used, connected on the feeder side of the regulators. The compensated type of instrument is preferable, as, by its use, proper indication of the voltage of the feeder can be had without the necessity of any pressure wires.

Curve-drawing instruments of different kinds have

EXPULSION FUSE FOR 100 AMPERES AND 2,300 VOLTS.

been developed, and are a very valuable asset where it is desired to keep a very accurate record of the output of any particular feeder or piece of apparatus.

There is one point that should always be remembered in connection with instruments, and that is that they should be so located that they are not subjected to the influence of any external magnetic fields, although modern instruments are shielded so as not to be affected greatly by stray fields.

Direct-current Switches and Circuit-breakers.

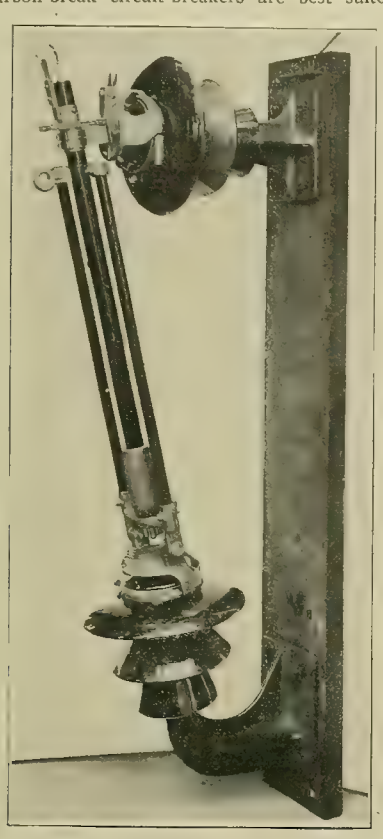
Lever switches for direct-current work are most commonly used for currents which are not of great magnitude, but are unwieldy and hard to operate when made of large capacity, such as 6,000 amperes and above. Laminated brush toggle switches are better suited to this work.

Direct-current circuit-breakers have been devel-

1. A paper read before the New York Electrical Society, November 27, 1906. The author is an electrical engineer of the General Electric Company.

oped of many types, to suit many different conditions of service. Magnetic blow-out circuit-breakers are very commonly used, and I presume most of you are familiar with their construction. Some of the troubles which have been experienced with their operation proved on investigation to be rather ludicrous. For instance, a large number were at one time furnished to the United States Navy for some of the ships, and were reported defective. On investigation it was found that the chute at the top of the breakers had been used as storage places for old waste, nuts, nails, etc.

Carbon-break circuit-breakers are best suited to



EXPULSION FUSE FOR 100 AMPERES AND 60,000 VOLTS.

large currents, and have been developed in many forms. They usually consist of a large brush to carry the main current, and some auxiliary contacts to take the burning at the time of opening. Circuit-breakers should always be placed at the top of the board, so that they will be out of the way of the operator. Too often I have seen such breakers mounted low down on the panels; sometimes at the bottom, and when their location was criticized, the statement would be made that they were perfectly safe, as they had opened repeatedly without dangerous arcs. But some time a bad short-circuit may take place, and the arc on the circuit-breaker may be very severe, and thus do considerable damage to the board and possibly to the operator.

Enclosed fuses are often used, and while all right in small plants with small generator capacity back of them, are a source of considerable danger when used in large plants. There are many other places where enclosed fuses could be safely used, such as at the end of long feeders at a considerable distance away from the source of power, small branch circuits, etc. Circuit-breakers are slightly more expensive in first cost, and, of course, the renewal expense is much less. They occupy very little more space, and, of course, can be reset much quicker than a new fuse can be put in place, and, if properly located, cause no trouble when opened under short-circuits.

Oil Switches.

Oil switches were designed to meet the demand which was created by the advent of the alternating-current systems of high voltage. The first attempts were more or less crude, and the theory of their operation was very imperfectly understood. Since their introduction, however, tremendous strides have been made, and the oil switches of today are a very necessary piece of apparatus, and have made possible the successful operation of long high-tension systems for the distribution of power.

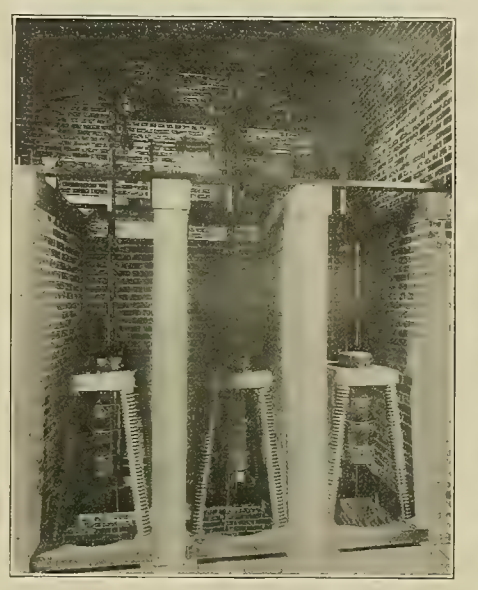
The first oil switches were nothing more or less than a small knife switch enclosed in a tank containing oil. How much oil to use, the distance beneath the oil that the contacts should be placed, the amount of air space, if any, to allow above the oil, have all been figured out by a long system of careful tests, so that the best proportions for the switch and the best form of contacts, etc., are now pretty well settled.

It is not safe to depend on any type of oil switch, the design of which seems theoretically correct, unless it has been subjected to very exhaustive tests, repeated many times.

A switch which is designed to occupy small space, and to be comparatively cheap, cannot safely be used in stations of large capacity and at high voltages.

I will not take up your time by entering into a description of all the forms of oil switches which are now used, but will simply try and describe two types.

The K-3 switch is made single, double, triple and four-pole, single and double throw, in different capacities. The operating mechanism and the contacts and the contact rods, etc., are all carried on a top casting. Through this casting the contact rods are carried through porcelain insulators. These contacts are enclosed in an outside tank which is filled with oil, barriers being placed between the different poles. Contact yokes are carried on the end of wooden rods, which are attached to the operating mechanism. The movement of the handle raises or lowers these contact pieces, bringing them, when raised, into contact



OIL SWITCH OF 60,000 VOLTS IN TIGER-POORMAN SUBSTATION, SPOKANE, WASH.

with the contact blocks, and when lowered are separated therefrom.

Most of the oil switches, with the exception of those of very large capacity, are nothing more or less than modifications of this design, and the general theory of their construction and operation is exactly the same. As explained above, the proportion of the parts, the amount of oil to use, etc., have been determined by a long series of experiments, carried to the point of breakdown of the switch. These tests are made by using large-capacity alternating-current generators, and short-circuiting them, and opening this short-circuit instantaneously by means of the oil switch. At the time of opening, oscillograph records are taken to show the amount of current and the potential of the circuit when opened. No tests which are made using small-capacity generators with transformers in circuit can be relied on. Nor is it possible to fix the limit of the switch by a single test, as I have seen repeated short-circuits opened successfully by means of a switch, and then one other test under exactly similar conditions destroying the switch.

Indications tend to show that the oil switch when opening opens on the low point of the wave, or practically zero current, and for this reason has a tremendous advantage over any switch opening in the air.

The opening of an arc in the air of an alternating-current system is apt to cause dangerous rises in voltage, by causing surging of the system. The oil switch, however, opening on the low point of the wave, as a rule, can be depended upon to cause no such disturbance.

The K-3 double-throw switch is made by having practically two switches complete inside of one oil vessel, the center contact rod having two contacts at its lower extremity, and the two outside rods having a single contact. The contact yoke pieces make contact across one of the middle contacts and one of the outer contacts, according to which handle of the switch is operated. The two handles are interlocked, so that it is impossible to operate both of them at once.

When large systems, employing a large number of machines of great capacity were first being discussed, it was felt that switches of the character just described would not be safe to open the circuit in cases of overloads and short-circuits. A switch of totally different design was therefore developed. This switch was operated by means of compressed air. Each pole of the switch was made up of two cylindrical oil vessels, in the bottom of which was placed a contact. These oil vessels were carried on large insulators placed in the base of a switch compartment. The two elements of each phase were separated from the other phases by means of brick or soapstone barriers. Passing through the top of the two oil vessels of each phase were two contact rods, which were carried on a yoke. This yoke was fastened to the operating mechanism by means of a long wooden rod. The connections to and from this switch are made to studs passing through the insulators which support the oil vessels. You will thus see that the operation of this switch is exactly opposite to that which was used with the K type of switch, as in this case the contact rods are pulled up from the contacts, while in the K type of switch the contact rods are dropped away from the contacts.

Since the development of this switch, the operating mechanism has been changed a number of times, and the latest development is a motor mechanism, with which you are probaly all more or less acquainted.

The contact arrangement is essentially the same, although many improvements have been made in the small details. One of the latest and best improvements is in making the oil vessels of pressed steel. The original vessel was made of a seamless brass pipe. In the bottom of this pipe a bottom carrying the contact was soldered, and the top was threaded to receive the cap. The new type of vessel is made of steel, the top being put on in the same way as on the brass pipe.

The motor mechanism has very many advantages. It, of course, is simpler than the compressed-air switches, in that it is not necessary to use any air compressors, and there is not the trouble due to sticking valves and similar troubles. It is much better than any solenoid arrangement, as a motor can be worked through a much greater range of voltage, and the currents necessary to be carried on the controlling circuits are very much less than they would be if a solenoid were used. The tripping of the switch is entirely independent of the motor, as the action of the switch is such that the motor carries the crank of the mechanism slightly past center, where it is held in position by a small toggle. This toggle is opened by means of a small electric magnet. There is a still further advantage in that the operation of the switch is much quicker.

There is one very distinct advantage in using a switch of this kind for stations of large capacity, and that is on account of the design of the oil vessels, etc., it is possible to use the minimum amount of oil, and it is also possible to use what we call bafflers, which are placed inside the oil tank around the contact rod. These bafflers consist of small plates of pressed board with different size apertures, according to the capacity of the switch. Their action is as follows: On the opening of a contact under oil a great pressure is generated, which tends to throw the entire body of oil above the contacts in an upward direction. If the vessel were oil tight and no air chamber existed above, it would be practically impossible to build a tank which would not burst at such a time. The top of the oil vessel is therefore made more or less open and a considerable space is allowed above the level of the oil inside the oil vessel which acts as an air cushion. The bafflers tend to break up the oil, so that it is not thrown up as a solid mass. Repeated experiments with accurate measuring instruments have indicated the proper size of aperture in these bafflers.

Oil switches such as just described are in use by all the large operating companies all over the world and are made in all capacities and are in successful use on voltages up to and including 60,000 volts.

The 60,000-volt switch is made on the same general lines as the lower voltage switches, the method of making the oil pots and their mounting and the space occupied being the only difference. The oil pots in these switches instead of being of metal are made of wooden staves something like a barrel, and are held together by wrappings of cord. These pots are mounted on insulating standards.

With large switches of this type it is advisable to use knife disconnecting switches in series, thus making it possible to isolate the switch for inspection and repair.

The smaller type, or K type of oil switch as we call it, is operated in a number of different ways. Unlike the large H switch, the moving member is small and light and only has to move through a very small distance, and therefore can be successfully handled by means of a solenoid. The solenoid mechanisms have therefore been developed for all.

[To be concluded.]

Fire destroyed the barns and contents of the Warren (Pa.) Street Railway Company on February 24th, causing a loss of $125,000. Only four cars were saved. Arrangements have been made to borrow cars from Jamestown, N. Y., to operate the local line.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

A Modern Schedule of Light and Power Rates.

A modern example of a central-station "rate card," and one which contains many suggestions for the guidance of those who are struggling with the rate question, is found in the new and complete schedule of commercial rates in use by the Edison Electric Illuminating Company of Boston. The schedule, as given here, practically in full, was adopted by the Boston company on July 1, 1906, and revised to December 1, 1906. It gives the price for electricity to commercial customers, not including municipalities.

LIGHTING RATES—COMMERCIAL. (SCHEDULE A.)

Electricity for any use will be sold, under the following schedule, to any commercial customer who has signed the regular agreement, embodying the Terms and Conditions of the company. [These Terms and Conditions are given at the end of this article.]

A price of 15 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, with the following deductions, and the minimum charge will be $1 per month per meter:

First Deduction.—A price of 12 cents per kilowatt-hour will be charged for all electricity furnished in excess of 60 hours' use of the demand[1] for January, 50 hours for February, 40 hours for March, 40 hours for April, 30 hours for May, 30 hours for June, 30 hours for July, 30 hours for August, 40 hours for September, 50 hours for October, 60 hours for November and 60 hours for December.

Second Deduction.—Whenever a customer's bill for any one month, calculated at the above prices, amounts to a total of over $150, a discount of 40 per cent. will be allowed on all in excess of $150 and not exceeding $550, and a discount of 50 per cent. on all in excess of $550 per month.

CHURCH RATES. (SCHEDULE A 1.)

Electricity for use in church property will be sold, under the following schedule, to any customer who has signed the regular agreement, embodying the Terms and Conditions of the company. "Church" property is defined as being property used for church purposes and free from taxation under the general statutes.

A price of 13 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, and the minimum charge will be $1 per month per meter.

POWER RATES—COMMERCIAL. (SCHEDULE B.)

Electricity for power use will be sold, under the following schedule, to any commercial customer, who has signed the regular agreement, embodying the Terms and Conditions of the company. "Power" is defined as general motor service, cooking, heating, electroplating, charging storage batteries and similar service, but does not include the running of dynamos for electric-lighting purposes.

A price of 15 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, with the following deductions, and the minimum charge will be $1 per month per meter:

First Deduction.—A price of nine cents per kilowatt-hour will be charged for all electricity furnished in excess of 18 hours' use of the demand[2] for each month.

Second Deduction.—Whenever that portion of a customer's bill which is calculated at the nine-cent rate, exceeds $10 per month, a discount of 70 per cent. will be allowed on all in excess of $10.

Third Deduction.—Whenever a customer's bill, after first and second deductions have been made, exceeds $100 per month, a discount of 30 per cent. will be allowed on all in excess of $100.

ELEVATOR RATES—COMMERCIAL. (SCHEDULE B 1.)

Electricity for direct-connected elevator use will be sold, under the following schedule, to any commercial customer who has signed the regular agreement, embodying the Terms and Conditions of the company. A "direct-connected" elevator is defined as being an elevator running in guides, and in which the car starts at the same time as the motor.

A price of 15 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, with the following deductions, and the minimum charge will be $1 per month per meter:

First Deduction.—A price of six cents per kilowatt-hour will be charged for all electricity furnished in excess of 200 kilowatt-hours and not exceeding 300 kilowatt-hours per month.

Second Deduction.—A price of five cents per kilowatt-hour will be charged for all electricity furnished in excess of 300 kilowatt-hours and not exceeding 600 kilowatt-hours per month.

Third Deduction.—A price of three cents per kilowatt-hour will be charged for all electricity furnished in excess of 600 kilowatt-hours and not exceeding 4,000 kilowatt-hours per month.

Fourth Deduction.—A price of 2½ cents per kilowatt-hour will be charged for all electricity furnished in excess of 4,000 kilowatt-hours per month.

YEARLY LIGHTING RATES—COMMERCIAL.
(SCHEDULE C 1.)

Electricity for any use will be sold, under the following schedule, to any commercial customer who has signed a yearly lighting agreement, embodying the Terms and Conditions of the company.

A price of 20 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, with the following deductions:

First Deduction.—A price of five cents per kilowatt-hour will be charged for all electricity furnished in excess of 50 hours' use of the demand[1] for January, 40 hours for February, 30 hours for March, 30 hours for April, 20 hours for May, 20 hours for June, 20 hours for July, 20 hours for August, 30 hours for September, 40 hours for October, 50 hours for November and 50 hours for December.

The customer agrees to use the demand for the hours mentioned above for each month; although the privilege is given to the customer, at time of signing agreement, to change the number of hours guaranteed for each month, or week, provided the total number for the year is not changed and that not over 50 hours are put in any one month.

Second Deduction.—Whenever a customer's bill for any one month, calculated at the above prices, amounts to a total of over $150, a discount of 40 per cent. will be allowed on all in excess of $150 and not exceeding $550, and a discount of 50 per cent. on all in excess of $550 per month.

YEARLY LIGHTING RATES—COMMERCIAL.
(SCHEDULE C 2.[2])

Electricity for any use will be sold, under the following schedule, to any commercial customer who has signed a yearly lighting agreement, embodying the Terms and Conditions of the company.

A price of $60 per year, payable in equal monthly amounts, will be charged per kilowatt of the demand.[1] This price does not include the supply of electricity.

First Deduction.—A price of five cents per kilowatt-hour will be charged for all electricity furnished under this agreement.

Second Deduction.—Whenever a customer's bill for any one month, calculated at the above prices, amounts to a total of over $150, a discount of 40 per cent. will be allowed on all in excess of $150 and not exceeding $550, and a discount of 50 per cent. on all in excess of $550 per month.

YEARLY LIGHTING RATES—COMMERCIAL.
(SCHEDULE C 3.)
WITHOUT LAMPS AND CARE.

Electricity for any use will be sold, under the following schedule, to any commercial customer who has signed a yearly lighting agreement, embodying the Terms and Conditions of the company.

A price of 20 cents per kilowatt-hour will be charged for all electricity furnished under this schedule, with the following deductions:

First Deduction.—A price of five cents per kilowatt-hour will be charged for all electricity furnished in excess of 50 hours' use of the demand[1] for January, 40 hours for February, 30 hours for March, 30 hours for April, 20 hours for May, 20 hours for June, 20 hours for July, 20 hours for August, 30 hours for September, 40 hours for October, 50 hours for November and 50 hours for December.

The customer agrees to use the demand for the hours mentioned above for each month; although the privilege is given to the customer, at time of signing agreement, to change the number of hours guaranteed for each month, or week, provided the total number for the year is not changed and that not over 50 hours are put in any one month.

Second Deduction.—Whenever a customer's bill for any one month, calculated at the above prices, amounts to a total of over $150, a discount of 40 per cent. will be allowed on all in excess of $150 and not exceeding $550, and a discount of 50 per cent. on all in excess of $550 per month.

Third Deduction.—The company will deliver its electricity at the customer's premises, and, in consideration of not supplying lamps and care, will deduct from the net amount of the bill, as otherwise rendered, one-half cent per kilowatt-hour, provided the customer guarantees a demand of at least 100 kilowatts during the continuance of the agreement.

YEARLY LIGHTING RATES—COMMERCIAL.
(SCHEDULE C 4.[2])
WITHOUT LAMPS AND CARE.

Electricity for any use will be sold, under the following schedule, to any commercial customer who has signed a yearly lighting agreement, embodying the Terms and Conditions of the company.

A price of $60 per year, payable in equal monthly amounts, will be charged per kilowatt of the demand.[1] This price does not include the supply of electricity.

First Deduction.—A price of five cents per kilowatt-hour will be charged for all electricity furnished under this agreement.

Second Deduction.—Whenever a customer's bill for any one month, calculated at the above prices, amounts to a total of over $150, a discount of 40 per cent. will be allowed on all in excess of $150 and not exceeding $550, and a discount of 50 per cent. on all in excess of $550 per month.

Third Deduction.—The company will deliver its electricity at the customer's premises, and, in consideration of not supplying lamps and care, will deduct from the net amount of the bill, as otherwise rendered, one-half cent per kilowatt-hour, provided the customer guarantees a demand of at least 100 kilowatts during the continuance of the agreement.

TERMS AND CONDITIONS.

For the purpose of determining the amount of electricity used, a meter shall be installed by the company upon the customer's premises, at a point most convenient for the company's service, upon the reading of which meter all bills shall be calculated, with the condition that if more than one meter is installed, unless for the company's convenience, each meter is to be considered by itself in calculating the amount of the bill. When more than one meter or discount indicator is installed under this agreement, for the company's convenience, the sums of the consumptions and demands shall, in all cases, be taken as the total consumption and demand.

All bills shall be rendered monthly and shall be due and payable at the company's office within 10 days of their presentation, unless either the customer or company desires bills rendered weekly instead of monthly, in which case it may be done by adjusting all the monthly figures to a weekly basis, and bills so rendered will be due and payable upon presentation.

A minimum charge will be made of $1 per month per meter, unless otherwise provided in the schedule of rates.

The customer will be responsible for all charges for electricity furnished under this agreement until 10 days after written notice to discontinue has been given the company, except as otherwise pro-

1. The "demand" is defined as being the greatest amount of electricity used by the customer at any one time. When the installation consists of less than one-half kilowatt in a residence or less than three-quarter kilowatt in other premises, the connected load shall be considered the demand. When the installation consists of more than as defined above, the demand shall be estimated by the company until such time as it installs one or more indicators, automatically to determine the demand, either in whole or in part. The demand on that circuit, when an indicator is installed, will be the greatest reading of the indicator during any month. The customer has the privilege of having the indicator cut out one night in each month, provided a 48-hour written notice is given to the company. The demand for each month is to be used only for calculating the bill for that month.

2. The "demand" is defined as being the greatest amount of electricity used by the customer at any one time. When the installation consists of less than one kilowatt, one kilowatt shall be considered the demand; when the installation consists of one kilowatt or more, the demand shall be estimated by the company until such time as it installs one or more indicators, automatically to determine the demand either in whole or in part. The demand on that circuit, when an indicator is installed, will be the average of the regular monthly readings of the indicator, between October 1st and the following February 1st of each year. The demand so determined, beginning February 1st of each year, shall be the demand for the next 12 months, except that the demand in no case shall be less than one-third of the highest reading during the previous twelve months, and provided that if any direct connected elevator (as defined elsewhere) be installed the demand shall not be taken at less than 10 kilowatts. The customer has the privilege of having the indicator cut out one night in each month, provided a 48-hour written notice is given to the company.

1. The "demand" is defined as being the greatest amount of electricity used by the customer at any one time. When the installation consists of less than one-fourth kilowatt the connected load shall be considered the demand; when the installation consists of one-fourth kilowatt or more, the demand shall be estimated by the company until such time as it installs one or more indicators, automatically to determine the demand either in whole or in part. The demand on that circuit, when an indicator is installed, will be the greatest reading of the indicator between November 1st and the following February 1st of each year, and the demand so determined, beginning February 1st of each year, shall be the demand called for by the agreement for the next 12 months. The customer has the privilege of having the indicator cut out one night in each month, provided a 48-hour written notice is given to the company.

2. Electricity sold under Schedule C 2 gives the same net bill to the customer as that sold under Schedule C 1; the difference between the two schedules being merely in the method of calculating the bill.

1. The "demand" is defined as being the greatest amount of electricity used by the customer at any one time. The demand shall be estimated by the company until such time as it installs one or more indicators, automatically to determine the demand, either in whole or in part. The demand on that circuit, when an indicator is installed, will be the greatest reading of the indicator between November 1st and the following February 1st of each year, and the demand so determined, beginning February 1st of each year, shall be the demand called for by the agreement for the next 12 months. The customer has the privilege of having the indicator cut out one night in each month, provided a 48-hour written notice is given to the company.

2. Electricity sold under Schedule C 4 gives the same net bill to the customer as that sold under Schedule C 3; the difference between the two schedules being merely in the method of calculating the bill.

vided, and will be responsible for all damage to, or loss of, company's property located upon his premises, unless occasioned by the company's negligence.

The company shall not be responsible for any failure to supply electricity if such failure is without wilful default or neglect on its part.

If the customer desires to use the electric service as auxiliary to any other source of power, he may do so by providing lamps and care and paying a minimum charge of $2 per month per kilowatt for as many kilowatts as it is possible for him to connect to the company's service at any one time, for at least 12 months, and as long thereafter as he uses the service.

It is agreed that all lamps, plugs, meters and such other appliances furnished by the company shall remain its property.

Permission is given the company to enter the customer's premises, at all reasonable times, for the purpose of inspecting and keeping in repair or removing any or all of its apparatus used in connection with the supply of electricity.

New-business Methods for Central Stations in the Smaller Cities.

In a long paper submitted in the prize contest on the subject, "Organization and Conduct of a New-business Department for Central Stations in Cities of 50,000 Population and Under," Mr. R. Borlase Matthews has covered in detail many points in connection with the establishment of such a department and has treated in an interesting way the commercial activities of the central station during the last year or so. The following extracts are taken from the paper:

It is now rapidly becoming an accepted fact that the incorporation of a new-business department into the organization of a central station is an absolute necessity. Only a short time ago managers considered it as possibly a good thing for the large cities, but thought it to be sheer waste of good money and valuable time in the case of cities under 50,000 inhabitants. In time, however, comparisons of the kilowatt-hour consumption per capita in various cities indicated that where an aggressive new-business-getting policy was put into operation the figures soon increased in a very acceptable manner and likewise the profits, owing to the additional output and the increased load factor, or, as it is sometimes expressed, the smoothing out of the load curve.

Some enterprising managers in the smaller cities who adapted to their circumstances some of the schemes that were operating successfully in the larger cities have found that they were well repaid for their efforts. Others, noting their achievements, have followed their example, until now there is a wave of enthusiasm spreading over the country for an energetic new-business-getting campaign.

This movement is no ephemeral change, but rather the evolution which is taking place consequent on the settling down, or rather standardization of the methods of generating and distributing electricity, together with the improved appliances suitable for the consumers' use which are at present available, and the confidence that has now been established in the mind of the general public in regard to the reliability and economy of electric lighting and power.

In the smaller cities the staff is generally reduced to the point of absolute necessity, owing to the feeling that expenses should be cut down as much as possible, for the profits of a central-station business, at their best, are not great. It will, however, generally be found a paying proposition to take on one or more solicitors who can devote their entire time to canvassing. These canvassers need not necessarily be men who require high salaries, as the manager or his assistant can usually give the time required to close the more important transactions.

There is a very close comparison between the art of selling goods and selling "juice." The keynote of modern successful business is system, and in these days of keen competition, the more perfect the system, the more prosperous the business. In starting a new-business department it is very essential that a good system be employed, for, intelligently handled, it will become a great labor and time-saving device. Advantage should be taken of those modern office methods of keeping records —the vertical file with a separate numbered folder for each name, and the card index. One standard size of card should be used. The first thing that should be done in the actual work of the department is the compilation of a card index of existing customers, as it is essential that accurate information should be on hand ready for the time when the question of an increase in the lighting or power load has to be considered, and also to satisfy the queries usually put by a prospective customer as to what his neighbor is doing.

The solicitor must be provided with a certain amount of ammunition before he makes his call; he may or may not be a technical man, but he must be thoroughly coached and posted in those matters which he has to deal with, for it is fatal if the prospective customer realizes that he is talking to someone who does not know much more about electrical business than he does. In residence canvassing it is well to endeavor to at least arrange to be allowed to present an estimate on wiring the house. The estimate should be prepared in two ways—one with the wiring done in the way that best suits the convenience of the householder, and the other in such a manner that the figure is cut as much as possible, by omitting all lights but those which are absolutely necessary, and also leaving out as many wall switches as possible—thus giving an idea of the minimum price the work could be done for; the lower figure also shows up the difference between necessity and convenience, and puts in a somewhat better light what at first appears to the average householder to be a very high figure. Chandeliers and other fixtures should always be figured upon as extras, as taste varies so much in the selection of these fittings, and their price, added to the cost of wiring, makes the latter appear excessive.

Among the information the solicitor has at his disposal should be data as to the average bills of customers, their current consumption per 16-candlepower lamp connected, the cost of lighting various size lamps per hour, and the cost per hour of operating various heating and cooking devices.

In canvassing stores, the data as to the average, the maximum and the minimum consumption per lamp connected, are very valuable, since in the case of any proposed lighting scheme, the monthly bill can be fairly accurately estimated for stores doing the same class of business.

Power soliciting is much more difficult than the canvassing in residences and stores. It requires, if it is to be handled successfully, the services of a trained technical man. In the power business is to be found the most paying load of the station, for, though the rates obtainable are not high, the demand is spread over a large part of the day. The best method of dealing with the power situation is to investigate the conditions in each factory by turn, making tests where possible. The owners are usually quite willing to grant permission for this. Some factory is certain to be reaching the point of overload of its own power plant; this affords the opportunity for the central station. A motor is installed on trial—the inevitable result follows, another motor goes in, until at last, after much expenditure of time and trouble, the whole plant is motor driven, and affords an example for other factories.

Personal solicitation as here illustrated is much, but it is not all; it needs to be allied with that powerful assistant, newspaper and direct-by-mail advertising. One of the most important and live advertisements a central station can have is a store (part of which may be used as an office) on the main business thoroughfare, and on the right side of the street. Everyone comes down the main street at more or less frequent intervals, and the store window will become to the passers-by a silent, yet speaking, reminder of the existence of the electric-light company, and also an important educational factor.

The so-called "free-sign," really "rented-sign" system should be carefully looked into, as it possesses many valuable features, and is an excellent means for increasing profits. In this connection also should be considered the merits of the controlled flat rate, that is, a flat rate based on the turning on and off of lights at a stipulated time by the light company's patrolman.

A solicitor usually receives a salary of $60 to $75 per month, which is assumed to be sufficient to cover his living expenses, and then a commission is paid on all new business secured. A modified commission scale should be open to employes other than the solicitors, to encourage them in persuading their acquaintances to become customers. At the same time, it should be clearly pointed out that when someone is interested in this way assistance should be sought to close the deal.

Usually the most difficult case to deal with is that of the man who only rents, and does not own or lease the house he is in. As more and more houses in the city become wired, the landlords find that they have increased difficulty in letting the unwired houses. If the landlord is obdurate, it is often advisable for the central station to effect some arrangement with a local contractor to install the wiring and fixtures, the central station absorbing the cost of the installation and arranging with the tenant to pay for the wiring, etc., at a fixed sum monthly in addition to the charge for current consumed, this fixed sum being based on the interest and depreciation on the investment.

By the adoption of a peristent and systematic new-business-getting campaign, 75 per cent. of the houses in a city can be placed on the customer's list, and the amount spent on electricity raised from the present average of about $2.50 to nearly $8 per capita per annum.

By the adoption of a direct-by-mail advertising system, several stations have increased their consumers over 30 per cent. What has been done once or twice can surely be done again with the assistance of systematic methods, efficiency and push, backed by courtesy, good service and prompt attention—all in the superlative degree.

Central-station Business in New York.

Some interesting figures showing the magnitude of the central-station business in New York city are given in the February Bulletin of the New York Edison Company. To a considerable extent they demonstrate the value of the application of modern methods of solicitation, exploitation and advertising.

At the close of 1906 the system of the New York Edison Company supplied electric current through 66,033 meters to 2,461,261 incandescent lamps, 32,320 arc lamps and 139,168 horsepower in motors. Additional installations in storage batteries, heating appliances and other devices bring the total installation of Manhattan Island alone to 4,762,218 equivalents of 16 candles.

The net increase for the year of 1906 was 10,618 customers, 477,590 incandescent lamps, 7,978 arc lamps, 31,483 horsepower in electric motors and other equipment, which brought the total increase of the year to 1,007,383 16-candlepower equivalents. The corresponding increase for 1905 was 525,670 equivalents.

The varied applications of the Edison service on Manhattan Island are in excess of 300. It would be difficult, if not impossible, to name a single industry conducted on the island in which the Edison system does not enter for either light, power, heat, refrigeration or some other purpose.

"Electric lighting today is not what it was even 10 years ago," says the Bulletin. "Then it meant simply the replacing of existing forms of illumination, of which a material percentage was oil and candles. Today illumination means something more. It is expressed in cheerfulness and attractiveness of public places and homes, and the advertising of the great commercial establishments. The latter is not confined to show windows and cases, but to that higher degree of brilliancy which characterizes the illumination of the larger stores of the city. Probably 50 per cent. of the bills for electric light are in these days properly chargeable to something other than mere illumination."

New Ideas in Lighting and Power.

An important development in the use of electric current for heating purposes is shown by various forms of laundry machinery employing electrically heated rolls. Electrically heated embossing presses are also proving their advantages and are being adopted in the printing trade, with electrically heated glue pots and other well known apparatus. Several important stores selling ladies' garments, millinery, etc., have adopted the well known electric flatiron as the most convenient article for use in their manufacturing and alteration departments.

The Chicago Edison and Commonwealth Electric companies have secured excellent results in popularizing this important household convenience, says The Electric City, by offering to deliver an electric iron to any user of current, permitting him to keep it for a short trial, and at the end of that time either purchase the iron or return it to the company. Very few have been returned and a large number are now in general use. The popular size is the six-pound iron, which uses approximately as much current as nine ordinary incandescent lamps, although, owing to the fact that the current may be turned off during a large portion of the time that the iron is in use on anything except heavy material, such as walking skirts, etc., or bed linen, the cost of operation is reduced to approximately two or three cents per hour only.

Another development of central-station business which is becoming pronounced is the use of electric light and electric power from the central station as indispensable to modern building construction. As an illustration of this the George A. Fuller Company has recently signed a contract with the Chicago Edison Company to supply the necessary service for a large building to be erected at Chicago Avenue and the River, where it will use something like 700 horsepower and a large number of arc lights and incandescents.

Arc Lamps for Railway Cars.

The Chicago and Northwestern Railway on February 19th put to a successful test an innovation in practical car lighting. The lighting system tested with such success was an arc-light system operated from a battery of 50 cells weighing 1,300 pounds. A coach on a suburban train was fitted with three lights. The battery used, it is said, will suffice for a run of 50 hours without being recharged. The idea originated, it is reported, with A. F. Callahan, president of the Universal Electric Storage Battery Company.

Public improvements are being rapidly carried out by the Tyron (N. C.) Electric Light and Power Company, which is developing waterpower on the Pacolet River, between Tryon and Melrose, which will afford about 3,000 electrical horsepower. The company is operating in Tryon and Saluda, under town franchises to furnish light and power to both places. Todd Russell is general manager of the company.

Suggestions for Changes in the National Electrical Code.

A long list of committee reports and suggestions for changes in the National Electrical Code will be considered at the meeting of the electrical committee of the Underwriters' National Electric Association, to be held at 32 Nassau Street, New York city, on March 27th and 28th. The committee reports cover matters brought up at the last meeting, since which time they have been considered by sub-committees, which will now report to the full committee, whose action will be brought before the general meeting to be held later in New York.

Aside from the committee reports, there are many suggested changes in rules and miscellaneous suggestions which have been sent to the secretary, 90 per cent. of them from single individuals. The electrical committee, to avoid confusion, endeavors to make only such changes in the Code as are necessary by progress in the art or such as are shown to be necessary to safeguard against hazard. Therefore, individuals who have suggested changes without giving reasons should be present to support their recommendations.

A bulletin containing the committee reports and suggestions for changes is being sent out from the office of C. M. Goddard, secretary of the electrical committee, 55 Kilby Street, Boston. A few extracts from the various committee reports, in which changes are suggested, are given herewith.

Signal System.—Outside wires should be run in underground ducts or strung on poles, and, as far as practicable, kept off of the roofs of buildings, and must not be placed on the same cross-arm with electric-light or power wires.

The ground wire of a protective device shall be run in accordance with the following requirements: 1. Shall be of copper and not smaller than No. 18 B. & S. gauge. 2. Must have an approved rubber insulating covering as described in No. 41, for voltages between 600 and 3,500, except that the thickness of the insulating wall must not be less than one-sixteenth of an inch, and that the preservative compound specified in No. 41, section h, may be omitted.

Slow-burning Weatherproof Wire.—The insulation must consist of three braids of cotton or other thread, all the interstices of which must be filled with the fireproofing compound or with material having equivalent resisting and insulating properties. The outer braid must be specially designed to withstand abrasion, and its surface must be finished smooth and hard. The completed covering must be of a thickness not less than that given in the following table:

B. & S. Gauge.	Thickness.
14 to 8	3-64 inch.
7 to 2	1-16 "
1 to 0000	5-64 "
Circular Mils.	
250,000 to 500,000	"
500,000 to 1,000,000	3-32 "
Over 1,000,000	7-64 "
	1-8 "

Measurements of insulating wall are to be made at the thinnest portion of the dielectric.

Wiring and Equipment of Street-railway Property, Including Rolling Stock.—All lamps and stationary motors covered by rule 33, section d, must be installed in such a way that one main switch can control the whole of each installation, lighting and power, independently of the main cut-out switch called for in section c.

Where current for lighting and stationary motors is from a grounded trolley circuit the following special rules to apply: 1. Cut-outs must be placed between non-grounded side and lights or motors they are to protect. 2. Cut-outs must be so placed that no group of incandescent lamps requiring more than 2,000 watts will be dependent upon one cut-out. 3. Switches must be placed between non-grounded side and lights and motors they are to protect. 4. Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gauge annealed copper wire. All rails and all lighting and stationary motor circuits must be connected to the outside ground return circuit by a No. 00 B. & S. gauge copper wire, or by equivalent bonding through the track.

Double and Single-pole Switches.—As the rules are at present, if it is desired to install a switch other than the service switch, to control lamps requiring over 660 watts of energy, it is necessary for this switch to be double-pole. An installation for lighting, however, may be made of any capacity without any switch other than the main service switch; that is, each lamp may be controlled independently at the key socket. In knob and tube work, where wiring for flush switches, the space is often limited, and if the switch is to control circuits supplying devices requiring over 660 watts of energy, both sides of the circuit must be brought to the switch, which to properly install is oftentimes difficult. Single-pole switches, of the rotary and knife pattern, have been used on street-railway work for years with good success. There seems to be no reason why a single-pole switch should not be permitted when installed where under the rules no switch would be required. The changes which the committee then offers do not modify the rules pertaining to switches for service, or for motor or heating devices.

Variable-speed Motors.—All variable or varying-speed, alternating-current motors must be marked with the maximum current which they can safely carry for five minutes and 30 minutes, respectively, starting cold.

Varying-speed motors are motors in which the speed varies automatically with the load, decreasing when the load increases, and vice versa. It does not mean motors in which the speed is varied by the use of different windings or groupings of windings, or motors in which the speed is varied by external means, and in which, after adjusting to a certain speed, the speed remains practically constant.

From these two "time and current" ratings the safe allowable current for any other length of time between five and 30 minutes can be determined by interpolation. The amount of current which a motor can safely carry for any given length of time is limited by the maximum allowable heating of the motor. This maximum temperature may be due to a certain current for a given continuous length of time, or may be reached as the result of different currents for various times, including periods of shutdown, during which the motor has a chance to cool somewhat.

Therefore, for any given set of conditions the final temperature is the same as that due to a certain current carried for a given length of time. Hence, for any particular service the problem for purposes of rating the motor is to estimate the time thus represented by the conditions, and from the five-minute and 30-minute ratings of the motor in question to determine the current corresponding to this time. This current is then to be considered as the rated current, and the leads or branch wires selected as required under rule 8, b.

The following classification of the more common services will serve as a guide in determining the "time" represented by any given condition: Five-minute class, (a) operating valves; (b) raising or lowering rolls, tool heads, etc. Ten-minute class, (a) hoists; (b) rolls; (c) ore and coal-handling machines. Fifteen-minute class, (a) freight elevators; (b) shop cranes. Twenty-minute class, (a) passenger elevators. Thirty-minute class, (a) rolling tables; (b) pumps.

For example, according to the above classification, a motor operating a shop crane would be considered to come in the 15-minute class, and if it had a five-minute and 30-minute rating of 110 amperes and 50 amperes, respectively, the rating for this particular service would be 86 amperes. Add to this the 25 per cent. required in rule 8, b, giving 107 amperes, which, according to the table of safe carrying capacity, rule 16, would require No. 1 wire if rubber-covered, or No. 3 wire if of other insulations.

Theater Wiring.—A long list of admirable requirements governing the installation of wires and apparatus for electric light, heat and power in theaters is offered. The committee suggests that the advisability of promulgating a separate code for theater wiring which shall apply to the whole country be given careful consideration. This subject was referred to editorially in the Western Electrician of February 2d.

Construction and Installation of Rheostats.—Rheostats must be placed on a switchboard, or, if not thereon, at a distance of at least one foot from combustible material, or separated therefrom by a non-combustible, non-absorptive insulating material, such as slate or marble. If resistance devices are installed in rooms where dust or combustible flyings would be liable to accumulate on them, they should be equipped with a dustproof face plate.

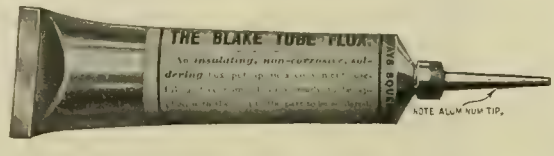
Variable-speed motors, unless of special and appropriate design, if controlled by means of field regulation, shall be so arranged and connected that they cannot be started under weakened field. Resistance boxes are used for the express purpose of opposing the passage of current, and are, therefore, very liable to get exceedingly hot; hence they should have no combustible material in their construction.

It is recommended that the circuit-breaking contacts be so constructed as to "break" with a quick snap, independently of the slowness of movement of the operator's hand, or that a magnetic blow-out or equivalent device be used. For dial-type rheostats the movable contact should be flexible in a plane at right angles to the plane of its movement, and for medium and larger sizes the stationary contacts should be readily renewable.

The other subjects which have been considered by sub-committees and in which changes of more or less importance are recommended are as follows: Series lamps; insulating joints; outlet boxes; metal moldings; condulets; frequency of ground connections; fuses in neutral of three-wire systems, and electric signs. Then there is a long list of individual suggestions for changes which have not been considered by any committee, also some miscellaneous suggestions.

Blake Tube Flux.

The accompanying illustrations show the method of packing and applying the soldering flux manufactured by the Blake Signal and Manufacturing Company of Boston. The aluminum spout may be stuck into the soldering without danger of clogging. In the workshop this tube keeps the soldering flux free from dust and dirt so that there is no waste from this cause. Just the required quantity can be put on the spot desired, again reducing waste. The arrangement saves time in that both hands do not have to be used in order to get the soldering flux on a splint and then on the work. The aluminum spout also allows the repair man to get the flux just where needed; there is no danger of dropping it where not wanted. The outside wireman can carry it in his pocket like a screwdriver and can apply it with one hand. It can be used on intricate switchboard work because there is no danger of dropping flux where it is not wanted and damaging some switchboard connection. For the armature room it allows one to get the flux just where needed for soldering armature leads to commutator bar. Again it is useful for the railway repair shop, soldering light-circuit connections, car wiring, cable splices, controller connections, etc., and for all kinds of railway overhead line work.

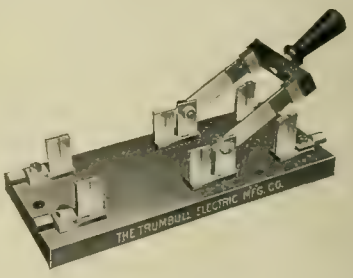


TUBE CONTAINING BLAKE SOLDERING FLUX.

APPLYING BLAKE TUBE FLUX.

Trumbull Switches.

The accompanying cut illustrates the type A switch made by the Trumbull Electric Manufacturing Company of Plainville, Conn. This switch in recent tests at the Electrical Testing Laboratories of New York is said to have show rise of temperature of from 25 to 50 per cent. below that allowed on both full load and overload. The company says the design and workmanship of the Trumbull switches are first class, conforming in all points of detail to the requirements of the underwriters. Special attention is given to the points of contact, each switch being tested by experts. The material used in these switches is of the best.



TRUMBULL TYPE "A" SWITCH.

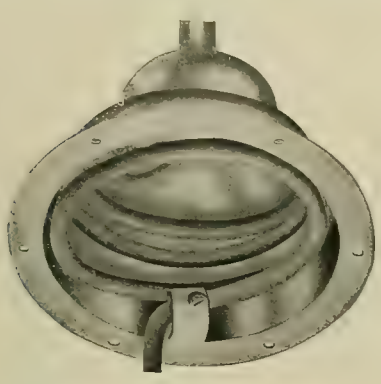
Changes and rulings on the fusing of knife switches and the increasing demand for alternating current add new complications in switch building, and different lines must be made. To meet this demand the Trumbull company announces that it will soon publish its new catalogue showing the most complete line of switches ever offered. About 45,000 separate switches are to be priced in this new catalogue, and every possible combination is to appear—front and back connected, quick-break, double-break, quick-break and double-break, fused and unfused, plain and polished, direct current and alternating current, 110, 250, 440 and 600 volts, ranging from 15 to 2,500 amperes and covering, in their respective classes, both type A, as shown in cut, and type C switches. In fact, the company says, there is no knife switch which it cannot supply. Its special department is said to be especially well equipped to turn out work in the shortest possible time, and the company says that this is in part true, because it carries in stock more knife-switch material than anyone in the country. This company advertises that it makes more individual switches than any other manufacturer in the country.

The Stayright Fixture.

The fixture shown here is manufactured by the Stayright Electric Fixture Company, 96 Warren Street, New York city. It derives its name from the fact that it always stays at the angle at which it is placed. Being held in position by the company's new friction tension in the universal joint, it cannot slip or jar loose. The fixture has a finished appearance and general attractiveness, being made of seamless steel tubing finished in oxidized copper, the one tubing telescoping into the other, so that the standard size can be extended from four feet, the normal length, to six feet six inches.

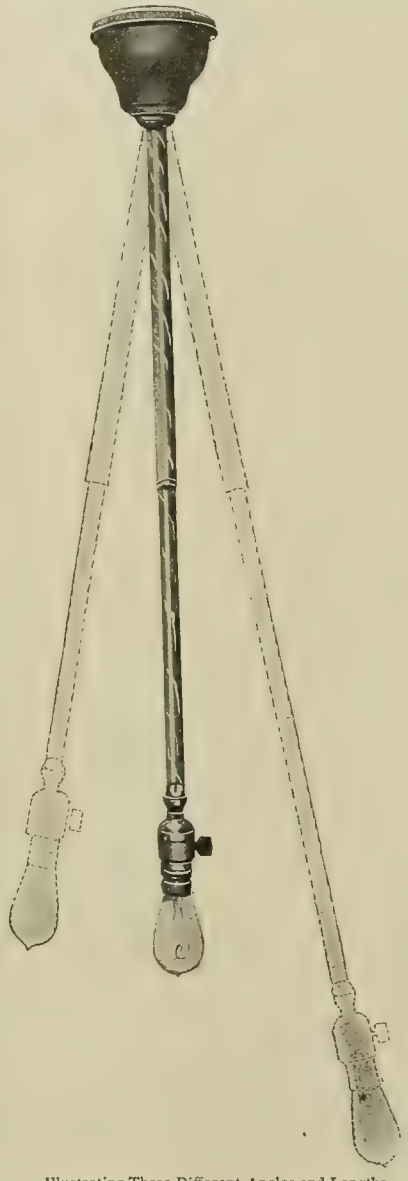
The Stayright fixture has ball-bearing joints both at the canopy and the socket itself, enabling the fixture to be placed at any angle. The universal joints are controlled by friction tension holding the fixture where put without the means of any set-screw or other device. The cord is entirely concealed and a natural coil forms itself in the canopy, as shown, taking up the surplus wire when the fixture is telescoped. The rosette is connected with this coil, so that the fixture when installed has a direct electrical contact with the main current without any wires being visible. New Code cord is used in the equipment.

This fixture can be furnished in any length desired. The standard size has a radius of eight feet in any direction. It is made for hard usage and is applicable to machine shops, hospitals, architects, automobile garages, factories, drafting rooms, kitchens, etc.



Lamp-cord Coiled Naturally in Canopy.

Fixture and Light at Different Angles.



Illustrating Three Different Angles and Lengths.

STAYRIGHT ELECTRIC FIXTURE.

Although unable to get the Senate committee on commerce to recommend the authorization of a 14-foot waterway to connect the Great Lakes and the Gulf of Mexico, Senator Hopkins was induced to add an amendment to the House provision for a survey of the project, which is of great importance to the Chicago Drainage Canal. It requires a board of engineers to report as early as possible on the salient points of the deep waterway project. It is expected that the board's report will supply valuable data not only in behalf of the projected waterway but of the Drainage Canal.

Extensive System of the Mexican Light and Power Company.

Mexico City, Mexico, February 20.—Some idea of the magnitude of the electric power plant and system which has been installed in this city and four adjacent states by a syndicate of Canadian capitalists may be obtained from the annual report of George A. Drummond, president of the Mexican Light and Power Company, which is the name of the concern. This report shows that the gross earnings of the company during 1906 were nearly $4,000,000. According to this report, at the close of last year the works of the company at Necaxa had progressed so near to completion that it was possible to effect reductions in the construction staff and to reorganize upon a more economical operating basis.

The power house at Necaxa is very nearly completed, the remainder of the construction work being placed in charge of the permanent operating staff at that station, and there now remains at Necaxa, in the way of construction work, only the second large dam, which is ready for sluicing and upon which work will proceed during the whole of this year. Dam No. 1, at Tenango, is entirely completed, and the Laguna dam, which was commenced last May, is now constructed to a height of nine meters above the river bottom. At its present height it has a storage capacity of 22,000,000 cubic meters of water. Owing to the unavoidable delay in the completion of the Carmen canal and tunnel for the diversion of the Upper Necaxa River into the Laguna storage basin, the amount of water stored at the Laguna is now only 11,000,000 cubic meters. It is believed that this will be sufficient, with other available supplies of water, to carry all peak loads during the coming dry season with the use of very little steam power.

The Carmen canal is fixe kilometers in length and the Carmen tunnel is 880 meters long. Both of these works are completed. The Los Reyes canal and tunnel, which were constructed to divert the upper waters of Los Reyes River into the Necaxa basin, have also been completed. It is estimated that the diversion of this river will procure an additional monthly supply of 1,000,000 to 3,000,000 cubic meters of water during the dry season. The report states that the franchises of the company are now consolidated and ratified by decrees of the Federal Congress of Mexico, on a basis both equitable and satisfactory.

On January 1, 1907, the installations connected in the Federal District and at El Oro were approximately as follows, in horsepower: Public lighting, 1,370; private lighting, 19,770; small motor units, 9,050; large motor units, 6,570; tramway, 670; total in Federal district, 37,430; total in El Oro mines, 9,225; total now connected in Federal District and El Oro, 46,655 horsepower. All these installations were not supplied simultaneously, but during the month of December last the power generated for peak loads, between 6 and 7 o'clock p. m., was 20,000 kilowatts.

The report states that the outlook for the present year is very encouraging. Owing to the large number of residences and business houses in course of construction in Mexico City, it is expected that the private lighting will be increased during the year by the addition of the equivalent of 45,000 lamps of 16 candlepower, or approximately 3,000 horsepower. The company has already executed contracts for the supply of 4,000 horsepower for motive power in the Federal District, for the largest proportion of which the installations will be connected during the year, and a number of additional contracts are now being negotiated.

The Mexico Electric Tramways, Ltd., which was under contract to receive electric power on October 1, 1906, for the operation of its lines in the Federal District, has been delayed in receiving deliveries of machinery from the manufacturers, but it is believed that the tramways company will be ready to take additional power under its contract before March 1, 1907, and the demand will increase as rapidly as the tramway's machinery can be erected, up to a maximum load of 6,000 horsepower, before the end of the year.

The company has at present three steam plants, with a total steam-generating capacity as follows: At Nonoalco station, six engines and four turbines, 7,500 kilowatts; at San Lazano station, three engines, 3,000 kilowatts; at Veronica station, 1,000 kilowatts; total, 11,500 kilowatts, or nearly 16,000 horsepower.

After mentioning the available water supply of the Necaxa, Laguna and Los Reyes reservoirs, with the usual flow of the Necaxa, Tenango and Los Reyes rivers, which are already diverted into the Necaxa Valley, the report concludes as follows:

"Your directors again have the pleasure to acknowledge the uniform courtesy and consideration which the company and its officials have received from the federal, state and municipal authorities in Mexico. The works and lines of the company are located in four states, as well as in the Federal District of Mexico, and in the construction and operation of works of great magnitude, such as those of this company, its officials are necessarily in almost daily intercourse with the various departments of government, and these departments have given every reasonable assistance in carrying forward to completion an undertaking which is destined to promote, in a manner quite unprecedented, the industrial and commercial prosperity of the districts which it supplies with electric power.

"On the other hand, realizing that the industrial development of the Federal District of Mexico, its public and private lighting, its supply of portable waters, its sanitation and its tramways will depend, in the future, upon the efficiency of the electric service, provided by this company, your directors have spared no reasonable expense or effort to fulfill the requirements of the Mexican government and to insure the stability of its supply of electric energy for all these public purposes." H.

A Test of Arc-lamp Carbons.

Fabius Henrion of Nancy, France, whose battery products are sold in this country by the French Battery and Carbon Company of Madison, Wis., is manufacturing carbons for enclosed arc lamps which are of the highest grade. These carbons insure a steady white light and clean globes and are guaranteed to be absolutely uniform in diameter and straightness. Owing to their great tensity and consequent small consumption of carbon per hour, their life is considerably increased. Henrion carbons leave only a trace of residuum. The inner globes keep remarkably clean.

A test of Henrion carbons which was made a short time ago by one of the best university authorities in America (says the French Battery and Carbon Company) showed the following results:

First—General Observation.—

Rods straight and of uniform diameter throughout length.

Second—Rate of Combustion.—

Original weight of upper and lower carbons	63.233 gr.
Final weight after five hours' burning	61.959 gr.
Final weight after six hours' burning	
Amount burned	1.274 gr.
Amount burned per hour	0.212 gr.

Diameter of upper carbons, "solid"	0.515 in.
Diameter of lower carbons, "cored"	0.505 in.
Third—Resistance Test—	
Average diameter of cored carbons used	0.525 in.
Length between terminals	7.09 in.
Resistance	0.182 ohm
Resistance per mil-foot	74890 ohms
Fourth—Residue Test—	
Total amount burned	17.44 gr.
Residue	0.09 gr.
Ratio	0.51 %
Fifth—Range—	
Hissing point "alternating current"	42 volts
Jumping point	85 volts
Arc flaring point extinguished at	85 volts

The Witmer Case at Niagara Falls.

The Court of Appeals of the state of New York has affirmed the decision of the Appellate Division in the suit brought by Mary L. Witmer, as administrator of the estate of her husband, the late Loren T. Witmer, against the Buffalo and Niagara Falls Electric Light and Power Company of Niagara Falls, the decision carrying with it a verdict of about $6,700 damages and costs.

The case was of unusual interest. Loren T. Witmer resided with his family on Linwood Avenue, Niagara Falls. He was 34 years old, and employed by the Carter-Crume Company at a salary of $50 a month. On the night of September 27, 1903, between 2 and 3 a. m., Mrs. Witmer was awakened by a humming and a buzzing sound, and saw the reflection of a light in the locality of the dining room. Realizing something was wrong, she aroused Mr. Witmer. He got up, and she followed him to the dining room. The humming and buzzing came on again, and they saw the light. They went upstairs to where the electric wires entered the building, and Mr. Witmer turned off the switch to shut the current out of the house. Still, the sound came on again. Then Mrs. Witmer called her husband's attention to a light in the cellar. He opened the door and went down, striking a match as he did so. Near the bottom of the stairs was a covered or insulated wire connected with the electric-lighting system of the house. This hung down so that about three feet of it lay on the cement floor, and then ran up to a lamp hanging on a hook. This was an extension arrangement, so that the lamp could be carried about the basement.

As Mr. Witmer went downstairs he took hold of this wire with his left hand, lifting it off from the floor and drawing it toward him, away from litter and shavings on the floor. Mrs. Witmer started back for a light, and as she did so the humming and buzzing came on again. In a moment she heard her husband groan and fall. Mrs. Witmer aroused the rest of the household. They could not turn on the electric lights, but lighted a lamp and went to the cellar, where they found Mr. Witmer on the floor, unconscious and limp. The unfortunate man was carried upstairs, and a doctor summoned. Mr. Witmer was dead. While they were in the cellar trying to get Mr. Witmer up the buzzing and humming came on twice. Mr. Witmer had a burn on his left forefinger, also a burn on his left ankle and a blister on the second finger of the left hand, while there was a slight burn on his left wrist.

The plaintiff asserted that Witmer's death was caused by a heavy current of electricity, far in excess of that normally carried on the wires in that house, through and by the improper, imperfect and negligent construction and condition of the poles, wires, fixtures and appliances of said defendant.

The testimony showed that the night was a windy one, and it was contended that the wind had brought the 7,500-volt wires of the company's street arc system in contact with the secondary system of the incandescent-lighting system, so that the heavier voltage had entered the Witmer house, leaping a switch, above noted as having been turned by Mr. Witmer. The frequent buzzing and humming on the light circuit in the Witmer house that night was alleged to have been the result of the wire contacts outside, as the wires came in contact in trees by the influence of the wind, raising the voltage on the secondary line to the voltage of the arc system. The defense tried to make it appear that a fire-alarm wire and a telephone wire were responsible in making the connection. One strong point made by the plaintiff was that the transformer between the primary and the secondary wires of the incandescent system was not grounded, and it is believed that this fact had much to do with influencing the verdict in the Appellate Division, which judgment was affirmed.

Indiana Telephone Items.

The Shilo Telephone Company has filed articles of incorporation, proposing to build in the southern part of Hancock County, headquarters in Greenfield. N. T. Foster, O. F. Addison and George Hargrave are the directors.

The Browns-Valley Co-operative Telephone Company has incorporated to operate in Browns Valley and vicinity. The company is in the market for material and equipment. G. W. Rusk, W. D. Lee, Samuel Grimes and William C. Caldwell are directors.

The Lyons Co-operative Telephone Company of Lyons is in the market for material and equipment for the construction of a first-class plant. John Davidson is chairman of the board of directors.

The stockholders and directors of the Delaware and Madison Counties Telephone Company have elected officers, with George W. Beers of Muncie as president. The company is operating exchanges at Muncie, Anderson, Elwood and Alexandria.

A large number of service men of the Central Union Telephone Company from various parts of Indiana held a meeting in Indianapolis February 17th to study the rules of the service, in order to obtain uniformity throughout the state. The members of the engineering department held a joint session with the service men, and many things in common were explained.

The Richmond Telephone Company has issued mortgage bonds to cover the cost of a new exchange building, an automatic system and other extensive improvements. A. C. Lindermuth is president.

The Greenfork Co-operative Telephone Company was organized five years ago, with 40 stockholders. The average cost to each stockholder will not be more than $40. There are now 112 boxes in use. The company places the batteries and does the repairing at a cost of $2.50 a year. The rental a month for each box is $1, which makes a profit of $9.50 a year on each box. The company has a line to Centerville and Modoc and has obtained a 10-cent rate to Richmond. The company is one of the most successful in the state.

The press notice sent out from Fort Wayne to the effect that the Central Union Telephone Company had secured control of the Wabash and the Peru Independent telephone companies, is emphatically denied by the officials of these companies. They declare there is absolutely no truth in the notice, and that the companies are not for sale at any price. S.

Annual Meeting of the Bell Telephone Company of Philadelphia.

The annual meeting of the Bell Telephone Company of Philadelphia was held in that city on February 19th. Senator H. A. Richardson of Delaware was chosen a director to succeed Edward P. Meany of New York.

The following officers of the company were reelected: U. N. Bethell, president; F. H. Bethell, vice-president; W. S. Peirsol, secretary and treasurer; W. J. McLaughlin, auditor; P. L. Spalding, general manager.

The annual report showed that the company has 95,914 stations in Philadelphia and 68,297 stations at various points on its lines, representing a net gain of 25.6 per cent. in the city and 41.1 per cent. elsewhere since January 1, 1906. The net earnings for 1906 showed an increase of $390,111.86 over 1905, while the increase in dividends was $342,352.50. The total receipts were $5,501,313, and the expenses $3,721,625, making a gross income of $1,779,687. The surplus account now amounts to $1,268,493.

During the year the directors appropriated $3,600,000 for extensions and additions.

GENERAL TELEPHONE NEWS.

The People's Mutual Telephone Company of Marshall, Iowa, has been incorporated with a capital stock of $5,000.

The Wabash Home Telephone Company of Monroe City, Ind., has been incorporated with a capital stock of $15,000. J. M. Goldman is president of the company.

The Police Fire Alarm Telephone Company of Rochester, N. Y., has been incorporated with a capital stock of $500,000 for the purpose of making various extensions and improvements in its plant.

The Southern Bell Telephone Company is putting a large part of its system underground in Charlotte, N. C., in addition to the portion in the business section placed in underground cables some years ago.

The annual convention of the Michigan Independent Telephone Association will be held in Coldwater, Mich., at Armory Hall, on March 7th and 8th. The programme includes a long list of papers by well-informed men, and it is thought the reports of companies will prove interesting. E. B. Fisher is president and J. B. Ware, secretary of the association. Both are Grand Rapids men.

CORRESPONDENCE.

Continental Europe.

Paris, February 12.—It is proposed to construct a mountain-climbing electric road which will connect the village of Zermatt, Switzerland, with the summit of Mt. Cervin. The concession for the line has been asked from the Federal Council by Mr. Golliez, and an engineer, X. Imfeld of Zurich. The present project for the line calls for two sections—first, a rack electric line starting from the railroad station of Zermatt and passing to the west toward the valley of the Zmutt, crossing the Zmuttbach and ending at the high plateau of Lac Noir at 2,508 meters altitude. From here the line will continue up the mountain, passing through a tunnel under the Hörnli Peak and ending at the Mt. Cervin cabin (3,052 meters altitude). The second section, which is 2,330 meters long, comprises two electric cable roads. Starting from the cabin, the line reaches the summit of Mt. Cervin by a tunnel of about 40 degrees slope. At the top of the mountain is a level space which will be sufficient for the different buildings. It is estimated that the total project will cost about $1,300,000 for the construction of the line, or $2,000,000 for the complete road in running order. At present tourists need about 24 hours to make the climb and return, while the electric road will make the ascent in less than two hours.

An electric-railroad project of some importance is now being considered by the Department of Public Works and Railroads of the Berne Canton. The Swiss government proposes to take over some of the local railroad lines which have hitherto been running at a disadvantage, owing to bad management. Among these are the Saignelégier-Glovelier line, which is to be changed to double track, and the through Berne-Neuchatel line. A new road is in construction, the Moutier-Granges road, which will be included in the above series. On all these different roads electric traction is to be used. For this purpose a number of large hydraulic plants are to be erected, using the power of the Doubs and the Kander streams. In this way it is expected to secure several thousand horsepower.

Turning to power projects in France, one of the most recent is the work which a new electric company proposes to carry out in the Audincourt region. It will utilize the hydraulic power of several streams, with a hydraulic plant at Ronchamp, in the Upper Saone district. Electric lighting will be carried out by the company in the latter district and also the Upper Rhine and the Doubs regions. It is also expected to utilize considerable current, and most of the factories in these regions can be operated by motors. The construction work for these plants has been begun. The electric plant at Longenes, which distributes current in the Vosges district, will make a considerable extension of its lines during the present year. It is proposed to supply lighting current for the town of Gerardmer, the valleys of the Moselotte and the Moselle and other places, and the lines are to be erected by next winter.

In Italy the question of electric traction upon the government railroad lines is under consideration. The State Railroad Department has now finished the preliminary projects for the use of electric traction upon several lines, among these being the Pontedecimo-Bussala, the Gallarate-Arona, Gallarate-Luino, Milan-Lecco and Bardoneche-Modane. Upon the Adda River it is proposed to undertake some extensive hydraulic work, so as to give a source of current, which is to be utilized for the Usmate-Seveso electric railroad. As regards electric tramways in Italy, I may mention two important projects. The first of these is a tramway line which is to run from Ivrea to Cuorgne, and it is to be built on a special system by the Turin Electric Traction Company. About 25 kilometers is the length of the line, and it will carry both freight and passenger traffic. Another tramway line is to be built between Marese and Bizzozzero, and the construction will begin very shortly, as the capital has been obtained. The work will be carried out under the direction of the Italian engineer, Luzzati.

Hydraulic work in Italy is making some progress. The Genoa Electric Company, which has recently purchased the gas and electric plants of Recco and Camogli, is to begin shortly the construction of an electric transmission line for heavy current between Genoa and Chiavari. Light and power will be used in all the localities lying along the line, and it is expected to finish the work before the end of the year.

A new central telephone station is being erected in the city of Hamburg, and it will no doubt be the largest in Europe. It is to consolidate the six stations which have been in use for the city, and is laid out for 80,000 subscribers. At first there will be about half this number of subscribers actually using the lines. There will be about 400 telephone employes in the station. Inside the building the telephone wires will have a total length of 270 miles. A. DE C.

Great Britain.

London, February 13.—The Central London Railway, hitherto looked upon as the perfect tube railway, in that it was a self-contained line running directly under a main thoroughfare for the whole of its length, will in all probability soon come to the level of all others, for the directors are seriously considering, in view of the motor bus competition, the abolition of the uniform fare of four cents. Thus will disappear the only example of this nature in Great Britain, a sufficient testimony to the inapplicability of American ideas to British conditions, for the Central London is American to the backbone. Another point of interest in connection with this line is that it started operation with electric locomotives but had to abandon them for multiple-unit train control on the score of vibration. An effort to sell the locomotives failed and they have had to be dismantled and sold as old metal.

Along one portion of the newly opened electric tramway lines of the London County Council in the north of London is used the side slot conduit system as an experiment. The system, which is in use at Bournemouth, is the invention of Mr. J. G. White, and considerably reduces the cost of construction.

A new theory has been evolved for explaining the depressed condition of the electrical industry at the present time. This is not German or American competition, but it is said that, owing to large extensions of their works, the large makers have got ahead of the demand, and in order to keep their works as fully occupied as possible, low prices are being accepted. But the curious fact is that the firms who have extended their works in this manner to the greatest extent are those with an American or German origin.

The admiralty and the meteorological office have come to an arrangement whereby weather reports are to be furnished by radio-telegraphy by ships of the navy twice a day, morning and evening, when the ships are within signaling distance of Scilly Islands and Roche Point.

A 900-horsepower Pelton waterwheel has just been constructed by an English firm for use in connection with the government waterpower scheme in the Nilgori Hills, India. This machine will be placed alongside the original waterwheels, but it is of an improved tangential type, having a single round nozzle, the area of which is diminished according to the power required. This waterwheel is probably the most powerful yet made in England. It will be coupled to a General Electric three-phase alternator. G.

Dominion of Canada.

Winnipeg, Man., February 23.—At Edmonton, Alberta, a few days ago, Hon. W. H. Cushing of the Alberta Legislature said that the government is going into the long-distance telephone business on a large scale and will also supply all cities, towns, villages, municipalities and local-improvement districts that want telephones with systems at the lowest possible cost, the province undertaking the installation, operation and maintenance of telephones all over the province. Although he did not state the cost of telephones to farmers, other members said they believed the government would be able to furnish them for $10 or $12 a year and supply long-distance connections for little more than the cost of a postage stamp.

The town of Indian Head, Saskatchewan, is preparing to spend some $25,000 on improvements to the electric-lighting system there. T. E. Donnelly is mayor.

The Middedosa Board of Trade has recommended to the Town Council that the waterpower in the Little Saskatchewan River be developed. E. O. Dennison is interested.

The Town Council of Fort William, Western Ontario, has decided to spend $26,000 this summer in improving and extending the electric-lighting plant owned by the town. Some 12,000 pounds of wire of various sizes will be required, as well as 500 feet of 5,000-volt and 200 feet of encased cable wire. Particulars may be obtained from Mayor Routledge.

The Fort Electric Company has been incorporated under the laws of the province of Saskatchewan. The headquarters of the company are at Fort Saskatchewan.

Negotiations are in progress for an electric railway to run east from Innisfail to Mayton and the Goose Pine coal mines, Alberta. A. Kremer, Innisfail, Alberta, can give information.

Improvements to the municipal telephone plant at Fort William, Western Ontario, will be made during the present year at a cost of $32,000. A quantity of supplies will be advertised for during the next few weeks.

The ratepayers of Vegreville, Alberta, have formed the Northern and Vegreville Telephone Company and will at once commence the construction of a municipal telephone system. They have applied to the Alberta government for long-distance connections. Those interested are William Parker, William Clements, Thomas Watt, S. A. Richardson, T. W. Shipley and F. W. Irwin, all of Vegreville, Alberta. R. R.

New England.

Boston, February 23.—The Hartford Electric Light Company of Hartford, Conn., has voted to adopt the directors' recommendation that the capital be increased from $1,800,000 to $2,000,000, the proceeds to be used for refunding bonds and for construction.

The Waltham, the Newton, and the Lexington and Boston street railway companies have had their franchises approved to carry freight in Waltham, Mass.

The New England Security and Investment Company—the "holding" company for the New York, New Haven and Hartford Railroad Company's Massachusetts properties—has obtained control of the Central Massachusetts Electric Company which furnishes electric lights to the towns of Palmer, Monson, Warren, West Brookfield and North Wilbraham, and electric power for the Springfield and Eastern Street Railway. The Central Massachusetts Company was organized 15 years ago. It bought out the General Electric Company of Palmer and it has gradually extended its field to several towns. It owns a water privilege at Blanchardville where its power plant is located.

The Mackay Companies' stockholders held their annual meeting in Boston last Friday, at which they re-elected the five trustees, viz., Clarence H. Mackay, William W. Cook, George G. Ward, Dumont Clarke and Edward C. Platt. Pliny Fisk, of New York, and R. A. Smith, of Toronto, Ont., were also elected trustees. The Mackay Companies control the Commercial Cable Company and the Postal Telegraph Company. The corporation is the largest shareholder in the American Telephone and Telegraph Company. It has no debts. During the past year, preferred stock amounting to $9,354,400 has been issued in exchange for the stock of corporations which strengthen the Mackay Companies and pay as much or more dividends as are paid by the preferred stock. The entire authorized preferred stock has now been issued. The trustees have decided to lay a cable between New York and Havana, the cost of which will be paid from current profits. During the year ended February 1, the income from investments was $3,310,328, of which the sum of $2,985,874 was paid in dividends, expenses took $24,625, and the sum of $299,829 was carried forward as a balance. The balance sheet shows a surplus of $727,547.

The Worcester (Mass.) Polytechnic Institute has received standards of self-induction and universal shunts for galvanometers from England. Prof. H. B. Smith of the Institute's Electrical Engineering Department will deliver the dedicatory address at the New York Electrical Society's first meeting in its new building on February 27th. His subject will be "Power Transmission Voltages of Today and Tomorrow." Professor Smith has devoted much time to the consideration of the subject of high voltage.

Dr. Louis Bell, vice-president of the Illuminating Engineering Society, talked to the Harvard University Electrical Club, Tuesday night; his subject being "The Principles of Illuminating Engineering."

After investigating several accidents on electric railways, the Massachusetts railroad commissioners have issued a notice recommending the carrying of a light on the rear end of interurban cars and a telephone train dispatching system on such roads. B.

New York.

New York City, February 25.—All of the electric car-building companies controlled by the Brill interests, it is announced, have been merged in a new holding company, capitalized at $10,000,000. The new company assumes all the obligations and contracts of the old concerns and takes over the entire capital stock of the American Car Company of St. Louis, the G. C. Kuhlman Car Company of Cleveland, and the John Stephenson Company of Elizabeth, N. J. Its principal officers are: President, James Rawle; vice-president, John A. Brill; second vice-president and general manager, Samuel M. Curwen.

President E. P. Bryan of the Interborough Rapid Transit Company announces that additional equipment has been ordered for the subway and elevated systems. The cars for the subway will be absolutely fireproof and all-steel and of the very latest type of construction. On the Elevated 200 additional cars will be put into use as soon as delivered.

At a meeting of the special committee of the Newark Common Council arrangements were completed for the installation of an independent municipal lighting plant for the big new city hall. This decision is the outcome of a long and bitter fight between the advocates of the independent city hall plant proposition and the Public Service Corporation, which was against the city doing its own lighting at the hall.

For the purpose of experimenting in wireless telephony as their principal object and wireless telegraphy as a secondary object, F. H. Kruger, instructor in the department of electrical engineering at Cornell University, and H. G. Kouyoumdjian, a graduate of that department, have raised an aerial wire on the roof of the Sibley shops in Ithaca. For the present they will limit their efforts to sending wireless telephone messages to nearby cities.

Last week the New York City Railroad Company, controlling the surface lines, made a proposition to pay $1,500,000 on account of back taxes. This follows within three weeks the payment of $3,170,000 by the Interborough Company.

Justice Gregerich of the Supreme Court has denied the application of Attorney-general Jackson for the appointment of a receiver for the New York Electrical Workers' Union upon the allegation that certain officers of the union had wasted the funds of the association.

The Long Acre Electric Light and Power Company has filed with the Metropolitan Trust Company, as trustee, an indenture covering a mortgage for $1,000,000 on the franchises, patents and machinery of the company. It is understood that the company is preparing to issue $1,000,000 50-year four per cent. bonds.

The mortgage of $100,000,000 filed by the Hudson and Manhattan Railroad Company is a record breaker, according to the state tax commissioner. The company is familiarly known as the McAdoo Tunnel Company and is to operate between Manhattan Island and New Jersey. The property covered is partly in New York and partly in New Jersey.

The annual motorboat show which opened at Madison Square Garden on February 19th showed a marked improvement in the different classes of boats of this description. The electrics attracted much attention.

The display of accessories is the most complete ever shown at any exhibition, particularly in the ignition-device line. Batteries, cells, magnetos, plugs, wiring and new methods of testing voltage and amperage are shown in operation all over the building, an interesting thing being the showing of batteries totally submerged in water. There is also a new magneto that can be readily attached by means of a flexible shaft or pulley to any automobile or motorboat that uses jump-spark ignition, and working demonstrations showed the adaptability of the "Jackson test" to headlights, binnacle, port and starboard lights, search lights and portable lights. A number of electric-lighting plants consisting of a small gasoline engine coupled direct to a dynamo were exhibited. No point in modern motorboats is so important as ignition. One of the new devices to render this sure and free from breakdown is a dry battery put up in glass cases, which render it absolutely waterproof. Another important new device is a magneto used in connection with a coil, by means of which the motor can be started direct and without the intervention of batteries. The attendance at the show has been unusually large, far exceeding that of last year, when the motorboats were combined with the sportsman features. The committee having the show in charge is highly gratified at the success of its first attempt to hold a show of motorboats exclusively. P.

Southeastern States.

Charlotte, N. C., February 23.—The proposed Winston-Salem and High Point Interurban electric railway will cost $1,000,000, according to Mr. D. H. Blair, one of the promoters, and towns on the route will be asked to vote bonds for the road construction.

The big plant of the Southern Power Company at Great Falls, S. C., is to be started up about March 1st. There will be a development of 32,000 horsepower normally, with a possible development of 40,000 horsepower. The expenditure represented is $1,500,000 approximately.

The City Council of Americus, Ga., has granted a franchise to the Macon, Americus and Albany Electric Railway Company for a period of 50 years.

The Georgia Railway and Electric Company of Atlanta proposes to put in commission 47 new cars, doubling the service on more than one-third of the lines, the increase to be perfected by June 1st.

The Columbus (Ga.) Power Company has completed an auxiliary steam plant at a cost of $500,000, and the power from the new plant has been turned on. The cost of electric power in Columbus is estimated at $15 per horsepower a year, which is considered very cheap.

The Elizabeth City Light and Power Company has been awarded a 10-year contract by the town of Elizabeth City, N. C., for furnishing lights. The contract calls for equipment, etc., costing $5,000.

H. L. McKee has been granted a franchise in the town of Opelika, Ala., to build a gas and electric-lighting plant and a street-railway system.

In honor of the occasion, the opening of the new transportation building of the Georgia Railway and Electric Company in Atlanta was celebrated by a ball given in the interests of the employes, and there were over 1,500 people present. The new building is for the employes largely, and is furnished with many conveniences, restaurant, baths, etc.

The Huntsville (Ala.) Railway, Light and Power Company will, within the next few months, double

its present plant. President T. C. DuPont has approved the plan, which calls for $30,000 to $40,000 to be invested in new machinery.

The Roanoke (Va.) Railway and Electric Company will begin at once the construction of a new $225,000 plant on a recently purchased site.

The town of Alexandria, La., has voted a bond issue, $2,000 of which will be used for extensions to the electric-lighting plant. L.

Michigan.

Grand Rapids, February 23.—Hancock, in the Upper Peninsula, is now considering the building of a municipal lighting plant, and the Marquette Journal says: "There should be a good field for the proposed plant at the city, and if it falls into good hands and receives a businesslike management from the beginning perhaps it will prove a profitable enterprise, as well as a means of giving the people cheaper light than they can get at present. At the same time, it does not appear that municipal ownership of lighting plants in Upper Peninsula towns has as yet been attended with any remarkably successful results, outside of Marquette. Escanaba's plant has been a constant source of dissension. For many years the Negaunee plant has been losing money, and only lately, under the management of the Board of Public Works, has it been put on a business-like basis. The Marquette plant has the advantage of a waterpower, and is now a big money-maker. But the dangers of public ownership were illustrated here some 10 years ago, when $40,000 to $50,000 was frittered away to no purpose on badly planned alleged improvements. If Hancock wants to make even an approximate success of her proposed plant, she cannot be too strongly urged to establish at the beginning an adequate system of accounts and shop bookkeeping, so that she will know just where she stands in regard to it at every stage of development.

William Gifford of Thompsonville has invented a lightning arrester which promises well. He has contracted with the Boardman River Electric Light and Power Company to place the arrester at each of the power houses of that company on Boardman River, and has already contracted with lighting plants in several cities for the introduction of his new device.

A deal has just been consummated by which the Marquette County Gas Light and Traction Company secures the whole property of the Marquette car system at Ishpeming and Negaunee. The properties brought $280,000.

St. Johns is to have day service from its electric-light plant. The Board of Public Works and council have authorized the starting of another dynamo this spring.

The Clark Electrical Company of Detroit has filed articles of association, capital $35,000.

Mason officials are planning the abandonment of the outgrown municipal lighting plant, and have opened negotiations with the Commonwealth Power Company, whose Jackson-Lansing lines run just outside the city limits. The company offers street and residence lighting and power at a rate far below the present running expenses of the city plant.

South Range is to have a lighting plant. The cost of the plant will be about $22,300. Bert Sellers, who is after the franchise, has announced the names of his two partners in the company. They are M. B. York and J. C. Jarvey of Chicago. L. W. B.

Indiana.

Indianapolis, February 23.—The Craighead Electric Company of Richmond has filed articles of incorporation and proposes to carry on a general electrical contracting business, and also to contract to install steam and hot-water heating plants. Edward W. Craighead is president and W. J. Jeffries is secretary.

The trustees of the Crawfordsville Electric Light and Power Company have announced that plans have been ordered for extensive improvements in the plant. J. R. Thomas, superintendent, stated that new engines and dynamos would be installed and the lines overhauled and some extensions made.

Earl Clevenger, an electrical contractor of Muncie, has secured a contract to install an electric-light plant at the new Children's Home Building in Muncie.

The trustees of the municipal electric-light plant of Goshen, Ind., have decided to change the street-lighting system to enclosed arc lamps. Superintendent Shaffer states that other improvements are also contemplated.

The New Castle Heat, Light and Power Company of New Castle has been completely reorganized. The new officials and management have many improvements in view and will make an announcement soon.

The citizens of Elkhart are demanding from the heads of the city government the promulgation of municipal ownership of water and electric-light service. A new water contract is about to be let and the citizens are demanding that a purchase clause with a view to the city's ultimate control of the water system be inserted in the contract with whatever company secures the franchise. A like clause will be insisted upon when a new lighting contract is to be let.

A bill has passed the lower branch of the Indiana Legislature which gives city councils the right to fix the price of gas, water, electric light and other public utilities by ordinance, from time to time. If the rate is not satisfactory to the company furnishing the service it may go into court and ask for a hearing.

Interurban traction development along the Wabash valley in Southwestern Indiana promises to outrival other parts of the state during the coming year. Among the roads promised are the building of the connecting link between Terre Haute and Evansville, a line between Terre Haute and Paris, Ill., an east and west line between Sullivan, Ind., and Robison, Ill., and the extension of the McKinley system from Danville, Ill., to connect with the Terre Haute line to Paris. The owners of the Evansville roads, known as the Murdock system, say they are arranging with Gibson and Knox counties to construct a joint bridge over White River to extend their line from Princeton to Vincennes. The Terre Haute Traction Company is preparing to build an extension from Sullivan to Vincennes.

The Chicago, Lake Shore and South Bend Electric Railway Company is rushing its line between South Bend and Chicago with a view of getting in operation before the Murdock people have their line to the west completed. The Lake Shore Company has just ordered of the Westinghouse company the equipment and rolling stock, including 20 new cars, for its line. The rails have been laid for about half the distance of the line, and the power house is being rushed to completion in Michigan City.

The freight shipment over the Evansville and Booneville traction line has reached a high point. The officials claim that by far the most freight is now being sent out of Evansville over the electric railways.

The American Engineering Company of Indianapolis has secured a contract for the engineering work for building 26 miles of electric railways in the city of Dallas, Tex., and for 47 miles of electric road from Greenville to Dallas for the Dallas Interurban Electric Railway Company. S. S.

Illinois.

Peoria, February 23.—The Northwestern Telephone and Telegraph Company of Freeport has been incorporated with a capital of $30,000 to operate telephone lines. Incorporators are C. B. Cheadle, Frank Zinnel and B. A. Henrick.

Following the Western Union, the Postal Telegraph-cable Company has raised the salaries of all operators, traffic chiefs, wire chiefs, assistant chief operators, chief operators and managers 10 per cent. in all offices of the company.

That the new interurban sleepers put on between St. Louis and Springfield by the Illinois Traction Company are what the traveling public has been waiting for is shown by the fact that there are more applicants than can be accommodated.

The long-talked-of Chicago-St. Louis electric railway will soon be a reality. Congressman McKinley, head of the Illinois Traction Company, says that the proposed lines will be built and the work done as soon as possible. Only about 120 miles will have to be built to connect the various lines now owned by the Traction company. The route will be from St. Louis to Springfield, which is now operating, thence over the new line to Lincoln, and building a short line to Mackinaw to meet the Peoria-Bloomington line. The road from Peoria north will be built this summer, and connect at Ottawa with the line now operating. Building a line from Seneca to Yorkville will make a through line between the two cities. The company will build a $100,000 depot in Decatur on a lot 120 by 340 feet. President McKinley went to St. Louis this week to aid in securing the right-of-way in that city. V. N.

Northwestern States.

Minneapolis, February 23.—The Minneapolis City Council is considering a new proposed franchise for the Minneapolis General Electric Company in special committee. H. G. Bradlee of Boston, vice-president of the company, is in the city in charge of the company's efforts to secure the franchise.

The council at Winona, Minn., is considering applications from two companies for trolley lines, and it seems sure that one will be granted very shortly.

There is a rumor that a trolley line is being planned from the Twin Cities to the head of the Lakes, and that the Great Northern Railway Company is interested. A company known as the Western Promotion and Improvement Company is looking up a right-of-way.

Emerson, Iowa, will be lighted by electricity, a line being run from Red Oak for that purpose.

The Chicago and Milwaukee Railway Company has secured a site at Second and Weil streets, Milwaukee, on which it proposes to erect its terminal buildings, and has applied for a franchise for an entrance into that city.

Bonds for $10,000 will be voted for the purpose of installing a municipal electric-light plant at Tekamah, Neb.

The Municipal League of Sioux City, Iowa, is urging the council to establish a municipal electric-light plant.

An election will be held March 11th at Mt. Ayr, Iowa, to vote bonds for an electric-light plant. R.

PERSONAL.

It is understood that Mr. John J. Carty of New York has declined to allow his name to be used as a candidate for the presidency of the American Institute of Electrical Engineers at the forthcoming election.

James S. Roberts, engineer of the electric-light plant at Del Rio, Texas, was killed on February 12th. His body was found on the flume to the turbine wheel, the neck and right arm being broken. Just how Mr. Roberts met his death is not known.

A. F. Gillette, an eastern electrician, will be appointed general manager of the Fort Smith (Ark.) Light and Traction Company. R. L. Rand, the retiring manager, has been given a position with H. M. Byllesby & Co., Chicago, which owns the Fort Smith plant.

W. J. Martin of Detroit, Mich., who was formerly connected with the People's Telephone Company in that city, has been appointed manager of the Clark Electrical Company of Detroit, which has recently been reorganized. The company will handle electrical supplies.

Mr. Charles H. Coar, a well-known contributor to the technical press, has resigned his position with the engineering department of the Tri-State Telephone and Telegraph Company to become general superintendent of the Northern Telephone Company of North Dakota, with headquarters at Bottineau, N. D.

Ralph D. Mershon of New York sailed on Saturday, February 16th, for London, England, to take up there matters relative to the Victoria Falls power scheme, in connection with which he has been retained as a consulting engineer for some time past. Mr. Mershon does not contemplate visiting South Africa at this time in connection with this work. His present trip will not extend beyond London, Paris and Berlin, and his absence from this country will be limited to about 30 days.

Stephen G. Clarke, a pioneer resident of Chicago, died last week at the residence of his daughter, Mrs. T. H. Sheppard, 2811 Prairie Avenue. Mr. Clarke, who was born in Herkimer County, N. Y., in 1822, had charge of the first Chicago telegraph office, sending and receiving the first messages in and out of the city. He was best known later as a railroad contractor and was active and successful in this business from the early '50's to 1869, when he started a wholesale tobacco house in South Water Street.

Among the injured in the recent wreck of the New York-Chicago 18-hour Pennsylvania Railroad train near Johnstown, Pa., were several gentlemen well known to the electrical fraternity, including W. W. Freeman, general manager Edison Electric Illuminating Company, Brooklyn, N. Y.; Charles S. Knight, Jr., American Steel and Wire Company, Chicago; W. O. Duntley, Sherman W. Prince, Charles Alcorn and Charles B. Coates of the Chicago Pneumatic Tool Company, Chicago. It is gratifying to know that none of these is seriously injured.

James Blake Cahoon, consulting engineer, and former president of the National Electric Light Association, died at his home in New Rochelle, N. Y., on February 17th, at the age of 48 years. Mr. Cahoon was born in Lyndon, Vt., and was a graduate of the United States Naval Academy of Annapolis, and of the United States Torpedo School at Newport, R. I., taking at the latter institution a post-graduate course in electricity. He was connected with the Thomson-Houston Electric Company of Lynn, Mass., for several years, and in 1895 he became general manager of the electric-light, street-railway and other municipal departments of the city of Elmira, N. Y., which position he held until 1899. Mr. Cahoon was the designer and builder of the new electric-light station at Syracuse, N. Y., and was at one time vice-president of the Oneida (N. Y.) Light and Power Company. He wrote with much force on the subject of improved methods of accounting for central-station companies.

ELECTRIC LIGHTING.

The city of Kaukauna, Wis., may build a municipal electric-light plant. The Kaukauna Gas and Electric Light and Power Company, whose franchise is about to expire for lighting the city, has applied for a new contract, but it is known that some of the aldermen are desirous of the city

building a plant of its own, in which case a new franchise may not be given the company.

The city of Mount Ayr, Iowa, contemplates installing a municipal electric-light plant.

The City Council of Athens, Ohio, will spend $6,000 for improvements to the municipal light and power plant.

Corporation papers for the Vermont Power and Lighting Company of Montpelier have been filed. The capital stock is $1,000,000.

The city of Detroit, Mich., has appropriated for 1907 $22,000 for installing overhead wires and lights and $25,000 for arc lights to replace the gas lights now in use.

The Erie Railroad Company is about to install an electric plant at Susquehanna, Pa., for its own lighting purposes and for the running of various machines by electricity.

The electric-light and gas plant of Baton Rouge, La., was recently sold for $150,000 to the Stone & Webster syndicate. Mr. Gottlieb, representing the company, stated that the purchase of the plant had no connection with the proposed electric line between New Orleans and Baton Rouge. The price paid for the plant includes all franchises.

ELECTRIC RAILWAYS.

The Lake Superior Railway Construction Company is the name of an organization that proposes to build an interurban line between Marquette and Negaunee, Mich.

The South Carolina Public Service corporation has been chartered in that state to construct electric railways, connecting many important points in the state and reaching to Augusta, Ga.

The City Council of Waco, Tex., has granted a franchise to Dr. T. M. Barnes and associates for an interurban railway to connect with the proposed line that will run from Waco to Temple and Marlin.

The management of the Benton Harbor and St. Joseph (Mich.) Railway and Light Company has announced that Paw Paw Lake will this summer be connected with the Graham & Morton docks in St. Joseph by an interurban line.

The Danville (Ill.) Car Company, which is erecting a new plant in that city, has been awarded a contract by the Illinois Traction System for $200,000 worth of new equipment. This is said to be the first order obtained by the new car company.

The directors of the Cleveland (Ohio) and Southwestern Traction Company have voted to change the name of the company to the Cleveland, Southwestern and Columbus Railway Company. President Pomeroy has said that it is the intention to build the line through to Columbus, Ohio.

The lengthy litigation over the sale of the Bay Shore Terminal Company at Norfolk, Va., has been closed by the formal transfer of the property to Norfolk and Ocean View Railroad Company. It is said that the real owner is the Norfolk and Portsmouth Traction Company. The purchase price was $715,000.

The Grand Rapids (Mich.) Electric Railway Company has applied for a franchise through the city of Grand Rapids for the interurban line projected between Alpena, Grand Rapids, Battle Creek and Kalamazoo. The company wants a franchise over a number of streets from the north line, passing through the principal section of Grand Rapids, for its main line and from the business section west for a branch to Grand Haven.

The New York, New Haven and Hartford Railroad has announced that in Providence, R. I., merchants and manufacturers whose establishments are not located on the line of the steam roads will be given the opportunity to have freight delivered directly at their doors in the cars in which it has been hauled to the city by the steam lines. The company has now acquired the electric street-railway system of the city of Providence and its suburbs.

It is announced that the Kalamazoo, Lake Shore and Chicago electric railway, known as the Fruit Belt Line, may pass into the control of the Benton Harbor and St. Joseph (Mich.) Railway and Light Company and will be constructed to Decatur, where connections will be made with the line now in course of construction from Benton Harbor. It is announced that it is the intention of the company, if possession of the Fruit Belt Line is secured, to build from Paw Paw to Decatur, and run through cars from Kalamazoo to St. Joseph.

H. F. Tate of Chicago and J. A. Cadle of Cleveland, representing the Cleveland Bonding Company, gave an interesting demonstration of the company's method or system of bonding electric railway rails in Indianapolis on February 20th. The demonstrators travel by trolley in a car rigged with all the equipment for bonding the rails and put on any style or type of bond required. The car weighs a ton but is easily handled and removed from the track with an automatic jack. The average time of putting on a bond is 1½ minutes. The process created much interest among Indiana interurban men.

A contract involving $2,500,000 is said to have been signed in Canton, Ohio, for the financing and immediate construction of the Canton-Youngstown interurban railway.

A new system for the rapid conveyance of parcels and letters from one part of Berlin, Germany, to the other is now said to be under consideration. Channels of sufficient size to allow a man to creep through them are to be hollowed out just beneath the road level, and through these it is intended to convey parcels and letter bags to the general post-office. Small electric locomotives would be used, and a train of trailers to the number of four or six would be attached to them. It is proposed to place two tracks in the up and down directions, one above the other in the same tunnel, and to construct the line for a trial of the system.

The Kensington and Eastern Railway, a subordinate concern of the Illinois Central Railroad, is planning, it is said, to connect Chicago with the Chicago, Lake Shore and South Bend electric railway within the next six months. Kensington is a southern suburb of Chicago. The new line is an interurban third-rail passenger railway running from South Bend, Ind., through Michigan City, East Chicago and Whiting. It is to be extended to Gary and Hammond, where it is proposed to connect the line with the Kensington and Eastern Railway. The latter is to be a double-track road, one track being used by electric passenger trains and the other by steam freight trains.

POWER TRANSMISSION.

The citizens of Port Angeles, Wash., have voted in favor of issuing bonds for a municipal power plant.

The Northern Colorado Power Company will build a new electric plant at Cheyenne, Wyo., which will cost $1,000,000.

It is rumored that the Philadelphia Electric Company has purchased a block of land on Washington Avenue, Philadelphia, on which a power plant to cost $1,000,000 will be erected.

The Auglaize River Power Company will erect a hydro-electric power plant near Defiance, Ohio. H. Von Schon, Wayne County Bank Building, Detroit, Mich., is the consulting engineer.

The Holmes Power and Light Company has been incorporated at Lansing, Mich., with $350,000 capital, for developing the waterpower at Grand Rapids on the Menominee River for transmission to Marinette and Menominee.

As soon as the Southern Railway puts in operation its new line along the Little Tennessee River, near Knoxville, Tenn., the construction of the Knoxville Power Company's dam, it is said, will be commenced. The dam will be 80 feet high and over 500 feet long. There will be a canal eight miles long, with a tunnel of 800 feet. It is stated that 40,000 horsepower may be generated.

The Commonwealth Power and Electric Company of Georgetown, Colo., will build a power plant on the Grand River in Summit County and has commenced the construction of a dam. A tunnel 4,600 feet long will be driven between the divide of the Gore range and the Sheephorn. It is expected that the plant will generate a maximum of 20,000 horsepower, which will be utilized by operators of mines and mills in the vicinity.

A company headed by W. T. Clark, Marvin Chase and F. M. Scheble of Wenatchee, Wash., has been formed for the purpose of building a power plant on the Wenatchee River and generating power for electric lighting and manufacturing purposes. The capital stock is fixed at $100,000. It is intended to erect the plant a few miles above Cashmere, where the fall in the river and volume of water are sufficient to generate 4,000 horsepower.

A power plant will be erected by the Portland (Ore.) Railway, Light and Power Company on the Upper Clackamas, 2½ miles above the Cazadero power house. The new plant, which will have a capacity of 25,000 horsepower, equaling that of the Cazadero plant when working to its full capacity, will cost about $750,000 and will require about four years for completion. The Cazadero plant, now completed, has cost $1,000,000. It will generate 15,000 horsepower for the present and additional current up to 25,000 horsepower can be generated in the same station by the addition of a few machines which will be installed as they are required.

The electric power plant of the Lewiston-Clarkston Company of Lewiston, Idaho, was put in operation recently. It represents an expenditure of $100,000, with an indicated horsepower of 2,500. The current supplies power and electric light for Asotin, Pullman and Clarkston, Wash., and Lewiston, Genesee and Moscow, Idaho. Before the year is out the same power station will be supplying electricity to Union and Colton, towns near Lewiston. The company will soon turn its attention to the proposed waterpower plant at Grande Ronde, which when completed will represent an investment of $850,000. This plant, it is expected, will generate 6,000 horsepower.

PUBLICATIONS.

Bulletin No. 68 of the Bureau of Labor, issued by the Department of Commerce and Labor, Washington, D. C., contains "Laws of Foreign Countries Relating to Employes on Railroads," by Lindley D. Clark, A. M., LL. M.

The Minnesota Electric Company of Minneapolis, Minn., manufacturer of the Chapman lightning arrester for telephone and telegraph lines, has issued an attractive poster depicting an armored soldier on horseback carrying a staff emblematic of authority to arrest.

The Benjamin Electric Manufacturing Company of Chicago shows its progressiveness in the issuing of a new Spanish catalogue. In it the company lists its entire line of wireless clusters and lighting specialties. The catalogue is neatly printed and profusely illustrated and in general appearance, except for color of the cover, resembles the book for the home market.

The Jeffrey Manufacturing Company of Columbus, Ohio, has issued bulletin C, describing and illustrating the Jeffrey coal and ashes handling machinery for power plants. The company also manufactures automatic grab-bucket hoisting machinery, chain and wire rope conveying specialties and screening, drilling, pulverizing, elevating, conveying, mining and power-transmitting machinery.

Allis-Chalmers Company of Milwaukee has issued Bulletin No. 1420, entitled "Gold Milling in the Black Hills." It is a reprint of a paper prepared by Prof. H. O. Hofman of the Dakota School of Mines, and contains a great deal of matter which will be found of practical value to those interested in propositions involving ores similar to any that are mined in the Dakota district.

The Monarch Electric Manufacturing Company of Warren, Ohio, has just published an interesting little booklet entitled "The Tale of Two Jacks," which is intended to show that users of "Monarch Special" lamps are possessed of "bright" dispositions. The company will be pleased to send this booklet with other advertising matter on request to those interested in its products.

The Joseph Dixon Crucible Company has published a very instructive booklet of 30 pages, devoted to "The Horse." The range of information is so broad as to make the booklet well worth retaining for future reference. Most of the information is from recognized authorities, just the thing for the man who owns or handles horses. A page or two in the back tells how to ease the load of the horse by using Dixon's graphite axle grease on the vehicle. Tests have proved the Dixon product excellent as to service, cost and cleanliness and ease of application.

A convenient price book has been published by the India Rubber and Gutta-Percha Insulating Company of 253 Broadway, New York, covering Habirshaw wires and cables. The book is full of information, including additional tables for extra braids, cotton or paper wrapping, Pacific Coast prices, 30 per cent. Para compound, flexibles and lead coverings, synopsis of rules, comparisons of copper gauges, and bar prices from 17 cents to 28 cents inclusive. A desirable feature is the code prices given on the various copper bars. The company will be pleased to forward a copy upon application.

The "Exide Battery Instruction Book" has just been revised by the Electric Storage Battery Company. The 1907 book is most complete and describes the various parts comprising the Exide battery and gives in detail the method of operating and caring for the battery, as well as instructions for assembling and putting it in commission. The book is not for sale, but is distributed by vehicle manufacturers, the Exide battery depots and the Exide distributors, which are located in the principal cities throughout the country. Upon request it will be furnished by any of the branch sales offices of the Electric Storage Battery Company of Philadelphia.

Instruction Book No. 3024, issued by the Fort Wayne Electric Works, Fort Wayne, Ind., treats of "Fort Wayne Series Alternating-current Arc Systems." The system designed by the company for alternating-current series arc lighting comprises the following apparatus: Constant potential step-up transformer, constant current regulator, alternating-current series arc switchboard, constant current alternating-current arc lamps and multiple lightning arresters, all of which are individually treated and illustrated. Interesting data on transformers, regulators and switchboards are given in tabulated form. Bulletins Nos. 1087, 1089 and 1090 have recently been issued by the company. The first named deals with standard direct-current switch-

board panels, the working parts being shown in a number of diagrams. Bulletin 1089 is devoted to a description of standard alternating-current switchboard panels for single-phase circuits, styles SG3W and SG2C being given special attention. Series alternating-current arc-lighting system is dealt with in bulletin 1090. The "Wood" system of direct-current arc lighting is well known among central-station managers. The Fort Wayne Electric Works is also distributing an index to bulletins Nos. 1001 to 1089, which names the various subjects treated in these bulletins.

The American Steel and Wire Company has issued its 1907 catalogue on "Rail Bonds and Appliances." The four styles of bonds manufactured by the company are known as the "Crown," "United States," "Multi-terminal" and "Soldered" types. Besides making a specialty of rail bonds, the company manufactures a very complete line of tools for their installation. On page 58 of the catalogue is shown a double-twin drill operated by an electric motor. The motor is light and compact and will operate directly on a 500-volt trolley circuit. The internal windings are well protected and insulated, and the armature shaft is geared direct to the drill spindles. The catalogue throughout is a particularly handsome specimen of the art of printer and engraver, no expense evidently having been spared in its preparation. It is a book that will be carefully preserved.

SOCIETIES AND SCHOOLS.

Among American universities Cornell leads in the number of students in scientific departments, with Michigan second, Illinois third and Yale fourth. Of the 12 institutions with an enrollment of over 500 scientific students, eight are in the West.

Additional officers for the Illuminating Engineering Society have been nominated as follows: Vice-presidents—Chicago Section, Albert Scheible; Pittsburg Section, G. B. Griffin; Philadelphia Section, H. K. Mohr. Directors—J. F. Gilchrist, Chicago; G. R. Stetson, New Bedford, Mass., and S. E. Doane, Cleveland.

Members of the International Association of Municipal Electricians are requested to suggest some papers for the next convention to be held in Norfolk, Va. Suggestions should reach the secretary, Frank P. Foster, Corning, N. Y., not later than March 15th. It is desired to have such papers as will be of interest to the greatest number. The Question Box is a valuable feature of the conventions. Those who confront problems in their daily duty which they do not thoroughly understand, or who have solved problems which would benefit others, should send questions designed to bring out the information desired to Walter M. Petty, borough electrician, Rutherford, N. J. The secretary would like to get names of municipal electricians who are eligible to join the association.

TELEGRAPH.

It is reported that the Western Union and Postal Telegraph companies will make an increase in the tolls on messages, to the extent of five cents on a 10-word message, which will make the charge 30 cents. It has been argued that the advance in the prices of all material makes the increase necessary.

MISCELLANEOUS.

It has been announced that a charter for an elevated railway system for Toronto, Canada, has been applied for from the Ontario government. The project is said to be backed entirely by Toronto capital.

Mr. Taft, the secretary of war, has asked for a judicial determination as to the extent of his power in the matter of the adverse recommendation of General MacKenzie, chief of engineers, relating to the application of the Sanitary District of Chicago for permission to divert the waters of Lake Michigan into Calumet River in sufficient quantities to cause that stream to run backward into the Drainage Canal and so into the Mississippi. General MacKenzie took the ground that the result of such diversion would certainly be to lower the level of the Great Lakes, injuriously affecting navigation, and would therefore be in excess of any powers vested in the secretary of war by Congress.

In the January quarterly bulletin of the committee on special hazards and fire record of the National Fire Protection Association, reference is made to the use of an electric motor in the hand-opening room of a cotton mill, the room referred to being generally isolated from the factory buildings. In this connection it is required that "when a motor is used to furnish power in an outside opener room, the motor should be installed in accordance with the National Electrical Code. If deemed necessary by the inspection department having jurisdiction, it must be enclosed in an approved case. When it is necessary to locate a motor in the vicinity of combustibles or in wet or in very dusty or dirty places, it is generally advisable to surround it with a suitable enclosure. The sides of such enclosures should preferably be made largely of glass, so that the motor may be always plainly visible. This lessens the chances of its being neglected and allows any derangement to be at once noticed."

TRADE NEWS.

The Franklin Electric Manufacturing Company of Hartford, Conn., has leased a large building in Middletown, where it will operate a branch of its business.

The American Conduit Company, manufacturer of bituminized fiber conduit, has moved its New York city offices to 140 Nassau street. The increasing business necessitated larger offices.

The Montague Manufacturing Company of Richmond, Va., is reported to be in the market for machinery to be used in the development of water-power and for transmission of electricity to individual motors for its sash and door factory.

James J. Wood, general manager of the Fort Wayne (Ind.) Electric Works, has announced that $1,500,000 has been appropriated for the purpose of making large additions to the company's plant which, it is said, will be increased to double its capacity.

The Pacific Platinum Company, which has been organized in San Francisco, with a capitalization of $1,000,000, for the purpose of mining platinum placer ground in Northern California, is said to be purchasing machinery. The officers of the company are: T. Heintz, president; A. S. Macdonald, vice-president, and F. Lang, secretary.

All the electric-car-building companies controlled by the Brill interests of Philadelphia, it is announced, have been consolidated in a new holding company called the J. G. Brill Company, capitalized at $10,000,000. The new company is said to be taking over the entire capital stock of the American Car Company of St. Louis, the G. C. Kuhlman Car Company of Cleveland, and the John Stephenson Company of Elizabeth, N. J.

The Electric Storage Battery Company announces that it has opened a sales office at Atlanta, Ga. This office is located in rooms 1126-27 Candler Building, and is placed under the charge of Mr. Harold H. Seaman. Mr. Seaman was formerly engineer of the Cleveland sales office of this company, and his experience gained there will enable him to handle promptly all matters pertaining to the territory of Tennessee, North and South Carolina, Georgia, Florida, Alabama and Mississippi.

The Heany Fireproof Wire Company of York, Pa., successor to the wire business of the Teter-Heany Developing Company, has won a victory over Louis W. Downes, in the matter of the alleged infringement of two patents issuesd to Mr. Downes. One patent, granted February 26, 1895, related to an improvement in methods of and apparatus for insulating electrical conductors, and the other, dated September 16, 1902, is for an improvement in the process of manufacturing electrical conductors. Both relate to asbestos-covered wires, and Mr. Downes brought suit for alleged infringement. The United States Circuit Court for the Middle District of Pennsylvania held, however, that no infringement was shown. An appeal was taken to the United States Circuit Court of Appeals for the Third Circuit, and that court has now affirmed the judgment of the court below, dismissing the complaint. The Appellate Court found that the Heany company's processes are essentially different from those of the complainant.

The Bollettino delle Finanze states that the Italian minister of posts and telegraphs has presented to the Chamber of Deputies a bill providing for the expenditure of $5,000,000 on measures for improving the postal, telegraphic and telephonic services of the country. The following are among the proposed items of expenditure: Forty thousand dollars on letter boxes, $200,000 on experimental pneumatic postal services in Rome, Naples, and Milan; $2,400,000 on telegraph materials, and $1,640,000 on the extension of the telephone service.

Net earnings of the National Carbon Company in the fiscal year ended January 31, as reported at the annual meeting of the stockholders in Jersey City, on February 25th, were the largest in the history of the organization. After charging off a liberal amount—$375,000—for depreciation and the payment of 7 per cent. on the preferred stock, the company had left a balance of $259,112, or 4.7 per cent on the common capital. The past year was the first in which the common stock drew 4 per cent. in dividends. The year's surplus of $39,112 brought the company's total surplus up to $434,695. The net income for the year was $951,078.

BUSINESS.

S. A. Bippus & Co. have purchased the electrical business of Bippus & Van Dusen at Las Cruces, N. M.

J. A. Hayes of Springfield, Mo., has sold his electrical supply business to the Electrical Supply Company.

The Warner Electric Company of Cleveland, Ohio, has been incorporated with a capital stock of $15,000 by E. L. Warsaw and others.

W. S. Barstow & Co. of New York and Portland, Ore., have recently issued an announcement of the opening of a Montreal office in the Bank of Ottawa Building, which will be in charge of Mr. Robert S. Stangland. This extension is necessitated through increase of business in Canada.

The Brooklyn Navy Yard has just purchased a quantity of Voltax, the high-potential insulating compound, for use in electric installation work at that place. It is said that this new compound possesses all the desirable qualities of rubber insulating compounds and is not so susceptible to climatic conditions and can resist a greater voltage. The Electric Cable Company of New York has recently received large duplicate orders for Voltax.

An English writer says that it is a good idea to have a grease in which there is graphite. If the grease melts, and it must melt in order to lubricate, the graphite prevents excessive friction and wear. When a bearing has become hot and cannot be lubricated with either grease or oil, graphite will prevent the fatal seize. The Joseph Dixon Crucible Company, with an experience of nearly 100 years in acquiring data on the subject, is specially qualified to advise on the use and value of the different graphites.

W. C Church has been in the lumber and coal business in Des Moines, Iowa, for more than five years. The business was carried on under the name of Church-Deal Company until January 1, 1906, at which time the co-partnership was dissolved and the W. C. Church Lumber and Coal Company was organized and incorporated January 1, 1907. The officers are as follows: President and manager, W. C. Church; vice-president, F. L. Townsend; secretary, W. K. Jones; treasurer, J. D. Whisenand. The principal place of business is Des Moines. The company controls 10,000 acres of cedar lands, manufactures its own products and handles direct to the trade. The company's co-operative stock offer is attracting the attention of users of cedar products.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 19, 1907.

844,314. Apparatus for Regenerating Electrolytes. Leo H. Baekeland, Yonkers, N. Y., assignor to the Development and Funding Company, New York, N. Y. Application filed February 16, 1906.

The apparatus described comprises a regenerating tank, means for supporting a body of salt therein, and means for circulating the electrolyte transversely through the tank beneath the body.

844,321. Lock for Incandescent Lamps. Jerome F. Boyer, Pittsburg, Pa. Application filed May 16, 1906.

In the lock are combined, with the socket and bulb, a split cap mounted on the socket, a wire passed around the bulb lengthwise thereof and having its ends fastened to the cap, and a retaining ring carried by the wire and surrounding the upper end of the bulb.

844,345. Electric Time Switch. Malon I. Flowers, Lincoln, Ark. Application filed November 22, 1905.

In an electric clock are switch lever and means, including a coil spring having operation in the direction of its axis and having operative connection with the strike mechanism, for shifting the lever.

844,352. Controller for Electric Motors. Harry U. Hart, Le Havre, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 12, 1905.

Combined with an electrical supply circuit, on which are two or more electric motors, the armature and field-magnet windings of each of which are normally series connected, and an electrically operated braking device, are means for connecting the motors with and disconnecting them from the supply circuit and for connecting them in a closed circuit having an equalizing connection for normal braking.

844,353. Circuit-breaker. Frank O. Hartman, Mansfield, Ohio. Application filed February 25, 1904.

In the circuit-breaker there are a stationary terminal, a supporting bar secured thereto and projecting laterally therefrom, a connecting plate, and an electro-responsive device secured between the bar and plate.

844,354. Pulling Box for Conduits. Andrew Hawkinson, St. Paul, Minn. Application filed December 11, 1905.

The device comprises in combination with the adjacent ends of an open conduit, a bushing on one of the ends and a cover between the ends, provided with reducers adapted to connect with the bushing and the opposite end of the conduit.

844,361. Electric Arc Lamp. Franz Janecek, Karlin, near Prague, Austria-Hungary. Application filed November 22, 1905.

In the lamp described are two carbons arranged side by side, a series of pins projecting laterally from one of the carbons, the lower pin being rendered inoperative by the heat of the arc, and means for supporting the lowermost pin while it remains operative.

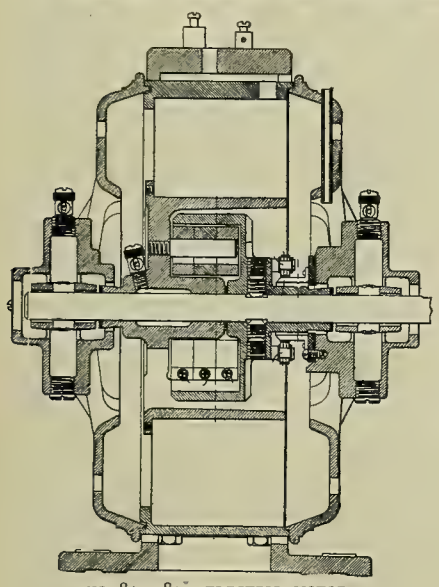
844,378. Device for the Justification of the Lengths of Lines of Typewriting or Similar Machines. Eduard M. V. Marchthal, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed September 18, 1906.

In the device patented are electrically operated means for releasing a detent used for normally maintaining a spring-pressed revoluble lever, at the times when it is desired to vary the amount of spacing effected during one step.

844,379. Electric Controller. Edwin Marshall, Warrensburg, Mo. Application filed May 29, 1906.

In the controller are two pairs of binding posts, one post of each pair being a combination binding post and switch contact, in combination with a pivoted switch-plate adapted to contact with one or both of the combination binding posts and switch contacts.

844,383. Electric Motor. Charles R. Meston and Herbert I. Finch, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed April 11, 1906.



NO. 844,383.—ELECTRIC MOTOR.

In the motor described are combined with an armature shaft an armature loosely mounted thereon, centrifugally operated friction-clutch devices rotatably carried by the armature, a companion-clutch member fixedly mounted on the armature shaft, and centrifugally operated contact-making plates, which, when the armature shaft is stationary, complete the circuit through the starting coils of the motor, and, when the armature shaft is rotated, the plates are moved to an inoperative position, so as to cut out the starting coils. (See cut.)

844,384. Electric Motor. Charles R. Meston and Herbert I. Finch, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed April 11, 1906.

This motor comprises contact-making plates mounted on the armature and occupying an operative position when the armature is attaining speed, the plates being rendered inoperative when the armature attains speed.

844,406. Electric Trimming Apparatus. Felix J. Rush, New York, N. Y. Application filed September 16, 1905.

Combined in the apparatus are a holder, a trimming wire, a guard composed of a number of wires, and means for translating an electric current to and through the trimming and guard wires. The trimming wire is composed of a metal of higher resistance than the guard wires, whereby the latter remain comparatively cool.

844,436. Metering and Controlling System for Electric Circuits. James J. Wood, Fort Wayne, Ind. Application filed September 12, 1905.

In an alternating-current system there are an electric meter, comprising series and shunt coils, a counting-down mechanism controlled by the meter, and a cut-off operated by the counting-down mechanism, a customer's circuit, a percentage transformer therein with its secondary in circuit with the series coil, a relay switch controlling the customer's circuit, the switch comprising a magnet, a shunt including the magnet of the switch and the cut-off of the meter, and another shunt including the shunt coil of the meter and arranged to be controlled by the cut-off.

844,439. Arc Lamp. John H. Bennett and Adrian I. Miner, San Francisco, Cal. Application filed June 3, 1905.

The arc lamp is provided with a seat for the bottom carbon, composed of a conductive tube open at both ends and secured to the bottom of the lamp frame, a small set-screw in the side of the tube, and a bottom screw cap for the tube extending over the set-screw.

844,506. Telephone Trunking System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 6, 1902.

A supervisory signal at the outgoing end of the trunk is placed in condition to operate by current over one side, when the connection is established at the end. There is a relay at the incoming end actuated by current over one side of the end when connection is established with the called line, to control the path for current over the one side of the outgoing end of the trunk. A second relay at the incoming end is responsive to current in the metallic line when the called subscriber answers to short-circuit the first-named relay, to cause it to complete the metallic circuit of the outgoing end of the trunk over which current flows to render the supervisory signal inoperative, the relay serving at the same time to close a locking circuit for itself. Means are provided to unlock the relay by the actuation of the ringing key after the relay has been operated.

844,533. Electric-light Switch. James McGavock, Denver, Colo., assignor to the New England Electric Company, Denver, Colo. Application filed April 6, 1906.

In the switch described are an oscillating lever pivotally connected to a support in a supporting casing, a spring which presses at one end against the oscillating lever, and contact brushes connected to the oscillating lever.

844,578. Spark Coil. John F. Cavanagh, Providence, R. I. Application filed September 28, 1905.

Waterproof insulating heads surround the ends of the core of the coil to hold the coil-winding in place.

844,593. Station Indicator. Clarence J. Harter, Herkimer, N. Y., assignor of one-fourth to Montraville E. Platts, Ilion, N. Y., and one-fourth to Ernest I. Harter, Ilion, N. Y. Application filed February 8, 1906.

The apparatus comprises an electromagnet connected with the operating devices at each end of the rollers, which are journaled in the supporting frame and casing, contact posts connected with each of the magnets, and a conducting contact bar adapted to be engaged with one or the other of the contact posts.

844,605. Electric-lighting Device for Lamps and Oil Stoves. Svend M. Meyer, New York, N. Y., assignor to George C. Batcheller, New York, N. Y. Application filed March 20, 1905.

In the device described there are means connecting the respective ends of an incandescing ignition coil with the opposite poles of a suitable source of electricity.

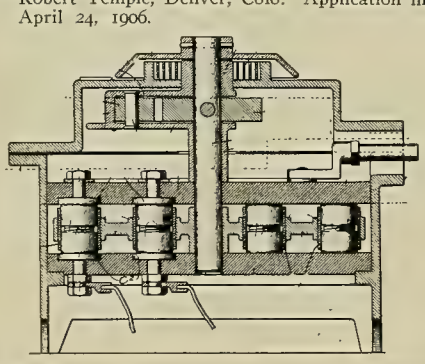
844,610. Electric Cigar-lighting Apparatus. Svend M. Meyer, New York, N. Y., assignor to George Clinton Batcheller, New York, N. Y. Application filed December 21, 1905.

A pair of conducting rods are mounted in a handle, insulated one from the other. A detachable incandescing coil is adapted to be applied to the rods to form an electric connection between them. The end of the torch is immersed in inflammable liquid, which is conducted by a wick of capillary material to the coil to be ignited thereby.

844,611. Electric-lighting Apparatus for Incandescent and Other Gas Lamps. Svend M. Meyer, New York, N. Y., assignor to Geogre Clinton Batcheller, New York, N. Y. Application filed March 10, 1906.

Combined are a suitable gas burner, electrically operated means for turning the gas on and off, including a pair of electromagnets and coupled armatures connected with the gas-cock, an incandescing coil for igniting the gas and means for simultaneously cutting out the magnet coils and passing the incandescing current through the igniting coil after the gas is turned on.

844,630. Speed Controller for Electric Motors. Robert Temple, Denver, Colo. Application filed April 24, 1906.



NO. 844,630.—SPEED CONTROLLER FOR ELECTRIC MOTORS.

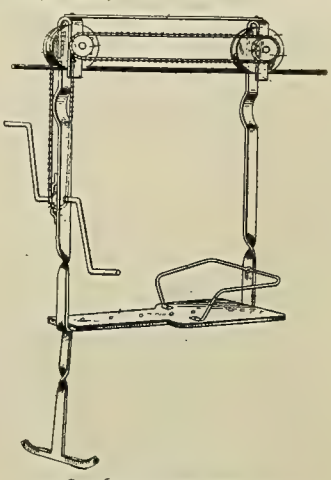
The controller comprises separated insulating contact plates provided with contact devices, a rotatable arm mounted between the plates, the arm carrying separated contact buttons, and a coil-spring conductor mounted between the buttons acting to force the buttons against the contact plates and the contact devices carried thereby. (See cut.)

844,635. Carbon-ball Transmitter. Kelley M. Turner, New York, and Norton W. Johnston, Chappaqua, N. Y., assignors to the General Acoustic Company, a corporation of New York. Original application filed September 8, 1905. Divided and this application filed September 8, 1905.

In a telephonic transmitter there is a block having a series of hemispherical cavities polished on their interior faces, each cavity being substantially two-thirds filled with carbon balls loosely resting against the diaphragm, whereby the balls may take a periodicity of vibration, which accords with that of the diaphragm.

844,641. Lineman's Chair. George P. Yeakel and Whorton C. L. Ireland, Norristown, Pa., assignors of one-third to Charles Keller, Norristown, Pa. Application filed September 14, 1906.

The device consists of a chair fixed to rigid suspenders or hangers rigidly held together and equipped with wheels or pulleys at their upper ends, the pulleys having their journals or shafts provided with pinions conjointly propelled. An additional pinion is supported upon one of the hangers, having means for manually propelling it. Means are provided for transmitting motion from the additional pinion to one of the other pinions. (See cut.)



NO. 844,641.—LINEMAN'S CHAIR.

844,650. Alternating-current Retaining Device for Electric Motor Controllers. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed November 2, 1903.

Combined with a circuit-controller are a stationary frame, an electromagnetic winding mounted upon the frame, a pivoted frame, a winding carried by the pivoted frame and arranged in proximity to the winding carried by the stationary frame, and a latch operated by the pivoted frame when the windings are energized to retain the circuit-controller in a predetermined position.

844,651. Drum Controller for Electric Motors. Thomas E. Barnum, Milwaukee, Wis. Application filed November 9, 1903.

Combined in a motor controller are a shaft having shells mounted upon it and insulated from each other, contacts carried by the shells, terminals adapted to engage the contacts, other terminals arranged in a plane substantially perpendicular to the axis of the shaft, and brushes or contacts carried by the drum and adapted to engage the latter terminals.

844,652. Three-wire Reversible-drum Controller. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed October 3, 1904.

A rotatable member in the motor controller, carrying contacts, is arranged to be rotated in either direction from the initial position for controlling the direction of operation of the motor. Another rotatable member, carrying contacts, is arranged to control the resistance of the motor and connect the motor with a source of low-voltage and a source of high-voltage electrical energy.

844,661. Clutch-controlled Elevator. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed December 31, 1903.

Combined with an elevator mechanism are an electric motor for operating the same capable of running independently thereof, a magnetic clutch or accelerator for connecting the motor with the mechanism, and a limit switch for controlling the circuit through the clutch.

844,662. Electrically Controlled Skip Hoist. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed July 20, 1904.

Combined with an electric motor provided with a resistance are a number of electromagnets adapted to be successively energized to remove the resistance from circuit step by step, a movable element for successively including the electromagnets in circuit, an electromagnet for operating the movable element, and a magnetically operated switch for closing the circuit through the last-mentioned electromagnet.

844,663. Self-starter for Electric Motors. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed May 12, 1905.

In combination with a motor are a number of controlling magnets therefor, a magnet for controlling the time of operation of the magnets, and means for causing the magnet to operate at predetermined intervals.

844,701. Electric Motor. Julius B. Wantz, Chicago, Ill., assignor to the Victor Electric Company, Chicago, Ill. Application filed February 23, 1906.

The starting and stopping switch device for an electric motor comprises in combination a rotary shaft, a line-wire terminal, a normally open contact spring movable into and out of engagement with the terminal and from which extends a direct armature circuit, and a motor field shunt circuit, a ratchet on the shaft, and a dog co-operating therewith both included in the shunt circuit.

844,722. Receiver Support. John Heisch, Jr., Allegheny, Pa. Application filed December 11, 1906.

A receiver support for telephones consists of a reversible pivoted frame, a transmitter supported thereby, a movable receiver supported from the frame, and means to establish electrical connections between the transmitter and the receiver.

844,731. Self-lighting Attachment for Lamps. Svend M. Meyer, New York, N. Y., assignor to George C. Batcheller, New York, N. Y. Application filed November 18, 1904. Renewed September 11, 1905.

A battery is removably supported in the base of the lamp, and a manually operated retaining device is adapted to disconnect the battery from the electric circuit and release it at the same operation, so as to permit its removal from the lamp.

844,748. Speed-changing Device. John Riddell, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 9, 1904.

Combined with a main shaft are the armature of an induction motor secured thereto, and a sleeve concentric with the shaft carrying the rotatable field magnet of the induction motor.

844,755. Vent Valve for Batteries. Frank J. Schalow, New York, N. Y. Application filed September 28, 1906.

A battery is provided with a vent-valve device, comprising a thimble-shaped cap, screw-threaded internally and provided in its opposite sides with openings.

844,777. Control System for Connecting Motors as Braking Generators. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 6, 1906.

In a system of control there are a number of motors, a motor controller, a reversing switch, service operating means for the reversing switch, contacts for completing separate circuits for each of the motors, and emergency operating means for the reversing switch and the contacts.

844,778. Luminant in Electric Incandescent Lamps. Francis M. F. Cazin, Hoboken, N. J. Application filed July 27, 1899.

The luminant consists of a permanent metal alloy core, covered with a film of other metal of less affinity for oxygen than the metal of the core.

844,787. Electric Switch. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 23, 1903.

Combined with a switch are secondary contacts, one of which consists of a homogeneous mixture of carbon and an abradant.

844,790. Support for Railway Motor Cables. Frank W. Garrett, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, a corporation of Ohio. Application filed March 6, 1905.

A motor is placed on a car truck, the cable leads being between the motor and the car body. A cleat, movable with the truck, supports the cable leads intermediate their ends.

844,791. Combined Fuse and Switch. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 14, 1904.

Combined with a movable switch member are a spring carried thereby and adapted to actuate the same, and a fuse connected in circuit with the switch member and holding the spring under tension.

844,796. Insulating Wire Holder. Andrew Hatchett, Louisville, Ky., assignor of one-third to S. I. I. Battiste and one-third to E. S. Porter, Louisville, Ky. Application filed November 13, 1905.

The device comprises an insulator having a flat base and having a transverse slot adjacent to its base portion, a spike, and an arm carried by the spike adapted to pass through the transverse slot.

844,797. Block Signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 31, 1905.

In the block signal described are means controlled by the signal for rendering the armature of the track relay polarized in one or more positions of the signal and non-polarized in another position.

844,800. System for Controlling Electric Switches. Edward M. Hewlett and Charles E. Eveleth, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed May 12, 1903.

In a relay controlling a trip circuit are an actuating magnet, a movable element actuated thereby to close the trip circuit, a circuit for energizing the magnet, a normally open lock for the movable element, a locking magnet for closing the lock to restrain the movement of the movable element, and an independent circuit for controlling the locking magnet.

844,810. Method of Increasing the Efficiency of Alternating Currents. Isidor Kitsee, Philadelphia, Pa. Application filed July 11, 1903.

The method consists in causing each cycle of an alternating current to induce two impulses in each of the secondaries of two converters, one impulse in each of the secondaries being generated by the flow of the current in the primary of the secondaries, and the other impulse being generated by the ceasing of the flow in the primaries.

844,811. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed October 14, 1905.

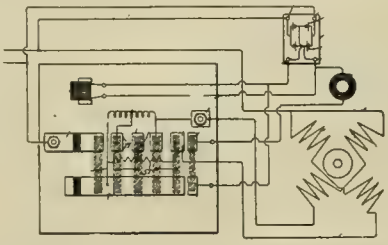
A telephonic line has a series of sub-stations connected thereto in multiple arc, an electromagnetic resistance in series with the circuit of each of the stations, means to short-circuit the resistance by the removal of the receiver from its hook, an armature for each of the electro-magnetic resistances, and a signal in operative relation to the armature.

844,815. Storage Battery. Simon Lake, Bridgeport, Conn. Application filed May 26, 1904.

A battery cell comprises an inner tank and an outer corrugated sheet-metal tank enclosing the same, an intermediate spacing member formed of non-conducting material, and a filling of non-conducting cement in which the intermediate spacing member is embedded.

844,829. Incandescent-lamp Socket. Johann G. Peterson, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed July 5, 1906.

An incandescent-lamp socket has a cap and a shell, and means for fastening the same together, consisting of an angled projection on the inner face of the cap rim with a corresponding hole in the shell.



NO. 844,997.—PHASE-SPLITTER AND CLUTCH.

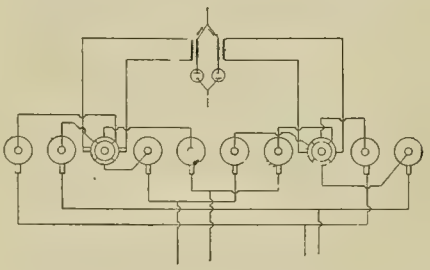
844,838. Device for Registering Vibrations of Musical Sounds. Lewis R. Wheeler, Tacoma, Wash. Application filed December 6, 1906.

A device of the type described comprises an inductorium, a variable-resistance sound-receiver in circuit with the primary coil thereof, a shunt circuit connected with the secondary coil or the inductorium and having an anti-inductive resistance therein, a second shunt circuit similarly connected and having an inductive resistance therein, electromagnets in each of the secondary circuits, pivoted armatures rigidly secured together and arranged adjacent to the magnets and adapted for movement with relation thereto corresponding to the frequency of the current passing through the magnets, an indicating hand controlled by the movement of the armatures and a calibrated scale associated with the hand.

844,839. Telephone Attachment. William R. Whitehorne, Bethlehem, Pa., assignor to Howard C. Bailey, Philadelphia, Pa. Application filed September 19, 1906.

In a telephone system are combined an electromagnetic device at a central station, the energization of which is controlled by the hook switch of any subscriber's instrument, and means controlled by the device for producing an alternating current on the telephone line, whereby one subscriber is enabled to cause an abnormal sound in the receiver of any other subscriber when this latter is off its hook.

844,878. Means to Increase the Efficiency of Alternating Currents. Isidor Kitsee, Philadelphia, Pa. Application filed June 13, 1905.



NO. 844,878.—MEANS TO INCREASE EFFICIENCY OF ALTERNATING CURRENTS.

The means described comprises a circuit connected to a source of alternating current and divided to provide a series of branches, means in each of the branches to permit the flow of the current in one direction and to prevent the flow of the current in the opposite direction, a primary for each of the branches, a secondary in inductive relation to each of the primaries, a consuming circuit, and means to adjust the flow of the induced impulses so that each induced impulse shall be of substantially the same value as the impulse following. (See cut.)

844,918. Car Magnet Support. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company, a corporation of Pennsylvania. Application filed January 25, 1906.

A magnet-supporting frame having extension beyond its pivotal points, has magnets mounted on the extensions and also on the frame between the pivots, in combination with the trucks of a double-truck car.

844,923. Automatic Shut-off for Fluids. Edmund L. Cridge, Passaic, N. J. Application filed February 16, 1906.

An electromagnet is provided for operating the valves.

844,961. Circuit-breaker for Electrical Conductors. William C. Shaw, White Plains, Md., assignor to John M. Boarman, Faulkner, Md. Application filed August 2, 1906.

The circuit making and breaking sections have heads movable laterally into and out of contact and are provided with thimbles fitting on their respective stub-shafts.

844,979. Electric Heater. Edwin R. Waterman, San Francisco, Cal. Application filed February 15, 1904.

The heater consists of an outer shell having an inner central receptacle provided with an inlet and an outlet in combination with a vent secured to the inner chamber. The electric heating feature presents no novelty.

844,991. Portable Dynamo. George A. Allen, Western Springs, Ill., assignor to the Aetna Powder Company, Chicago, Ill. Application filed December 3, 1906.

Details of an outfit intended to furnish a spark for the electrical ignition of explosives at a distance are described.

844,997. Phase-splitter and Clutch. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed August 7, 1905.

In combination with a motor are a phase splitter, a non-inductive and inductive resistance arranged in parallel paths, a magnetic clutch, a number of independently operated switches for controlling the resistances and clutch, and means for preventing the closure of the switches except in a definite order. (See cut.)

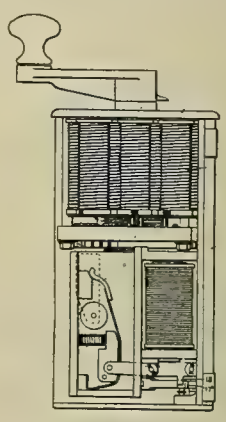
845,010. Electrical Protective Apparatus. Charles A. Rolfe, Rochester, N. Y., assignor to the Rolfe Electric Company, Rochester, N. Y. Original application filed April 21, 1902. Divided and this application filed February 4, 1905.

In the device described are a row of heat-coil devices mounted at each side of a support, line terminals connected with the heat-coil devices and all mounted at one side of the support, and switchboard terminals also suitably connected with the heat-coil devices and all mounted at the other side of the support.

845,023. System of Control. Harold E. White and Harold C. Pease, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed June 26, 1905.

Combined are a controller, electromagnetic actuating means therefor, a relay for controlling the actuating means, a master controlling device arranged to energize the relay, and means associated with the relay for rendering the master device inoperative upon the operation of the relay.

845,024. Controller. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 6, 1906.



NO. 845,024.—CONTROLLER.

In the controller there are a casing having a head, a movable controller member supported in the casing and journaled at one end in the head, stationary contacts co-operating with the member, a nest of resistance coils supported by the head, a member provided with a series of contacts in electrical connection with the resistance coils also supported on the head, and a contact finger carried by the movable controller member and arranged to engage the contacts of the series. (See cut.)

845,034. Safety Device for Overhead Electric Conductors. Emile Giraud, Paris, France. Original application filed April 10, 1905. Divided and this application filed March 6, 1906.

The device comprises a lever pivoted to the insulator of the conductor, and a hanger carried by an axis fixed to one end of the lever and closely engaging the conductor.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 25, 1907:

421,887. Electrically Propelled Vehicle. J. Adair, New York.
421,911. Regulating Apparatus for Electric Motors. P. Diehl, Elizabeth, N. J.
421,916. Secondary-battery Plate. J. B. Entz and W. A. Phillips, Schenectady, N. Y.
421,967. Dynamo-electric Machine. M. Pfatischer, Philadelphia, Pa.
421,968. Electric Conductor. E. F. Phillips, Providence, R. I.
422,058. Electric Connector. C. McIntire, Newark, N. J.
422,072, 422,073 and 422,074. Telegraphy. T. A. Edison, Menlo Park, N. J.
422,147. Electric Switch. W. E. Parker and H. E. Temple, Buffalo, N. Y.
422,148. Dynamo-electric Machine or Electric Motor. E. R. Parkhurst, Woburn, Mass.
422,149. Electric Motor. E. R. Parkhurst, Woburn, Mass.
422,164. Support for Overhead Electric Conductors. C. K. Sterns, Newton, and G. K. Wheeler, Boston, Mass.
422,190. Method of Electrically Heating Bars, Etc., for Welding and Working Purposes. M. W. Dewey, Syracuse, N. Y.
422,196. Electric-lighting Device. E. E. Flora and P. R. Hoy, Chicago, Ill.
422,201. Electrical Apparatus for Driving Artesian Wells. G. G. Fryer, Philadelphia, Pa.
422,216. Secondary Battery. W. R. Hollingshead, Bronxville, N. Y.
422,266. Electric-railway Motor Car. C. J. Van Depoele, Lynn, Mass.
422,295. Pyromagnetic Generator and Motor. W. B. Cooper, Philadelphia, Pa.
422,300 and 422,301. Electrode for Secondary Batteries. C. J. Hartmann, Summit, N. J.
422,302. Carbon for Electric Lamps. H. H. Head, Dublin, and L. Saunderson, Kingstown, County of Dublin, Ireland.
422,308. Electrode for Secondary Batteries. F. M. Lyte, London, County of Middlesex, England.
422,339. Electric-motor Car. I. H. Farnham, Malden, Mass.

WESTERN ELECTRICIAN

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Recent Steam-turbine Installations, Upright and Horizontal.

By Frank C. Perkins.

Among the American central stations which have recently installed generating apparatus driven by steam turbines of the vertical type may be mentioned the United States Electric Light Company and the Potomac Electric Power Company of Washington, D. C., and the Richmond Light and Railroad Company of New Brighton, N. Y. At the Washington central station the units are of 2,000 kilowatts capacity. One of them is shown in the illustration (Fig. 2) on the next page, while those of the New Brighton plant are of 500 kilowatts each. A general view of the latter equipment is shown in Fig. 1. The two-stage Curtis turbo-alternators at the New Brighton plant operate at a speed of 1,800 revolutions a minute and are directly coupled to vertical alternators of the four-pole General Electric type, supplying current at 2,500 volts, the frequency being 60 cycles per second.

The Richmond Light and Railroad Company has a capitalization and bond issue of $5,000,000, the president being H. H. Rogers of New York and the vice-president and general manager S. F. Hazelrigg of New Brighton, N. Y. The borough of Richmond has a population of about 70,000, and the company has a city contract for 570 arcs at $100 a year each and for 3,600 incandescent lamps at $25 a year. It lights all Staten Island and operates 185 commercial arcs and about 50,000 incandescent lamps, the base rate charged for this service being 10 cents a kilowatt-hour. In addition to the new steam-turbine units at the New Brighton station, the older equipment includes four Onondaga-Ridgeway direct-current dynamos of small size for continuous-current lighting service at 110 volts and three power generators of the Walker type of 1,650 kilowatts, supplying direct current at 500 volts pressure.

The alternating-current installation includes six two-phase machines of 60 cycles, having a capacity of 2,600 kilowatts, these machines being of the Stanley, Westinghouse and General Electric types, the pressure being 2,600 volts. The engine equipment of the New Brighton plant includes reciprocating engines of the Ball, Allis, Ridgeway and McIntosh & Seymour types, together with the Curtis steam turbines, the latter having a capacity of 1,350 horsepower.

The Washington unit shown in Fig. 2 consists of a three-phase alternator mounted on the top of the steam turbine and operating at a speed of 750 revolutions per minute. This alternator supplies current at 6,600 volts pressure, the frequency being 25 cycles.

The Washington Railway and Electric Company owns and controls the Potomac Electric Power Company and the United States Electric Lighting Company, and it has a capitalization and authorized bond issue of $25,000,000. The president is the Hon. Allen L. McDermott of Washington, and H. W. Fuller is the general manager. This company has a city contract for 1,000 arc lights of 4,000 hours at $80 a year and for 1,000 incandescent lamps of 25 candlepower each at $25 a year. Its station equipment includes, in addition to steam turbo-alternators of 6,000-horsepower capacity, McIntosh & Seymour engines of 7,150-horsepower output, driving four alternators of the General Electric make, of 4,600 kilowatts of the two-phase and three-phase types, the frequency being 25 cycles and 60 cycles, and the voltage 6,600 and 2,300 volts. There are also 11 direct-current Brush and Wood arc machines, capable of supplying 1,325 lights; also five direct-current dynamos of the General Electric type of 3,550 kilowatts. The incandescent connected load includes about a quarter of a million lamps of 16 candlepower, and the arc load includes about 2,000 lamps of 5.5 amperes each.

In Germany the horizontal turbine is employed more etxensively than the vertical type of steam turbine, the Zoelly, Parsons and Rateau machines being installed on the Continent quite generally in the up-to-date central stations, either newly constructed or requiring additional equipment. The steam turbine works so advantageously in connection with steam-engine equipment of the reciprocating type, taking the peak of the load advantageously and allowing the vertical and horizontal slow-speed engines to work continuously at constant full load, that it is largely used at the present time for supplementing old direct-connected alternating-current sets in existing stations. The accompanying illustration (Fig. 3) shows a Zoelly steam turbine of 500 horsepower coupled to an alternator turning at 3,000 revolutions per minute. This turbine operates at a steam pressure of 135 pounds.

A 700-horsepower turbine driving a direct-current dynamo of the Siemens-Schuckert type of 220 volts pressure is another type quite largely used abroad, the direct-current dynamo being employed with turbines to a greater extent in Europe than in America.

There is a low-pressure turbine now being installed of the Zoelly type at Rombach, in Germany, this unit being of 890-horsepower capacity and operating at a speed of 1,500 revolutions per minute, the direct-current dynamo supplying a 230-volt current.

At Kiel the city municipal electric station has at present under construction a 1,750-horsepower unit for driving a direct-current machine of 440 to 500 volts, this turbine having a speed of 1,300 revolutions per minute.

The central stations of Lille and Vichy are in-

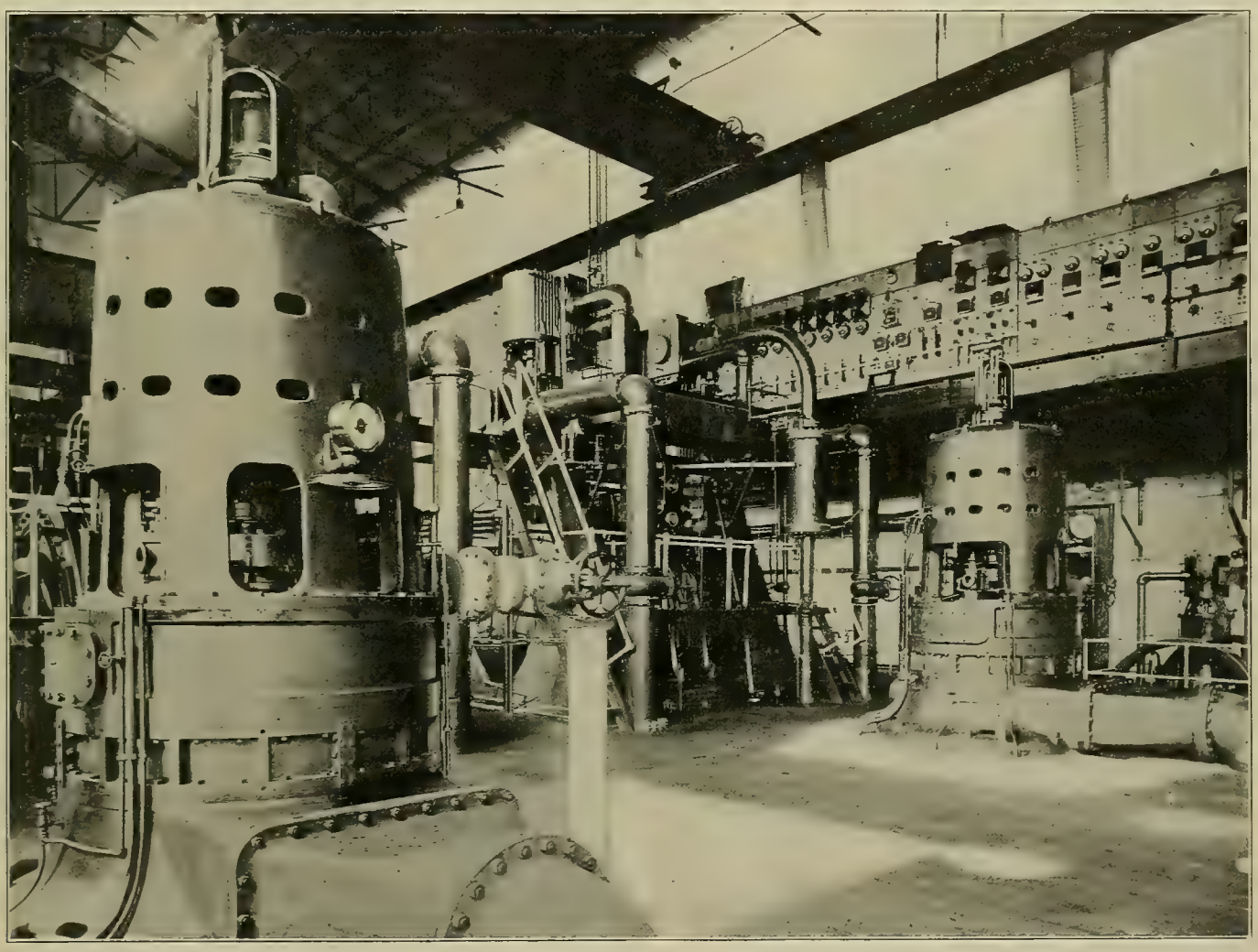


FIG. 1 VERTICAL 500-KILOWATT TURBO ALTERNATORS AT NEW BRIGHTON (N. Y.) CENTRAL STATION

stalling three-phase turbo-alternators. The Zoelly turbine at the former station has a capacity of 2,500 horsepower, with a speed of 1,500 revolutions per minute, while the latter plant is installing a 1,000-horsepower unit which operates at 3,000 revolutions per minute. A similar turbo-alternator of the three-phase type has just been placed in operation at the central station at Valencia, this machine developing 1,600 horsepower at 1,500 revolutions per minute.

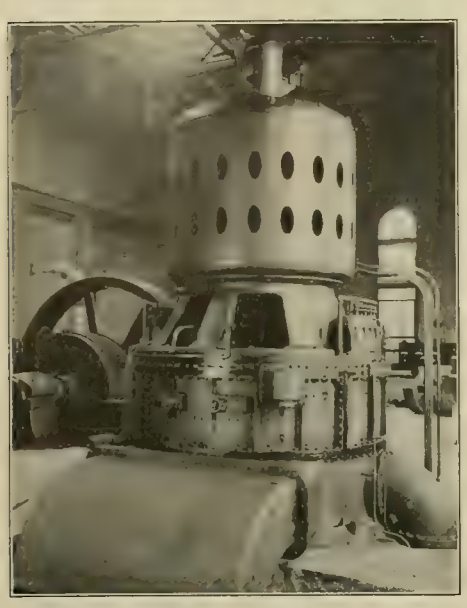


FIG. 2. 2 000-KILOWATT, 750-REVOLUTION UPRIGHT TURBO-ALTERNATOR IN STATION OF UNITED STATES ELECTRIC LIGHT COMPANY, WASHINGTON, D. C.

Energy Lost in Electric-railway Motors.

James Lyman, western manager at Chicago of the engineering department of the General Electric Company, who read a paper recently before the Western Railway Club on "The Anatomy of a Railway Motor and Control Equipment," reported in the Western Electrician of March 2d, gave in the course of his remarks some interesting data relative to the losses of energy in electric-railway motors.

In a well-designed electric-railway motor the losses at free running speed, as given by Mr. Lyman, are approximately as follows: Copper losses, 4 per cent.; iron losses, 6 per cent.; gear and bearing losses, 10 per cent., leaving a total efficiency of transformation from electrical to mechanical tractive effort of 80 per cent.

During acceleration the distribution of losses is as follows: Copper losses, 10 per cent.; iron losses, 2 per cent.; gear and bearing losses, 5 per cent., leaving a total efficiency of 83 per cent. These figures apply only to small railway motors, much greater efficiency being obtainable in large electric locomotives.

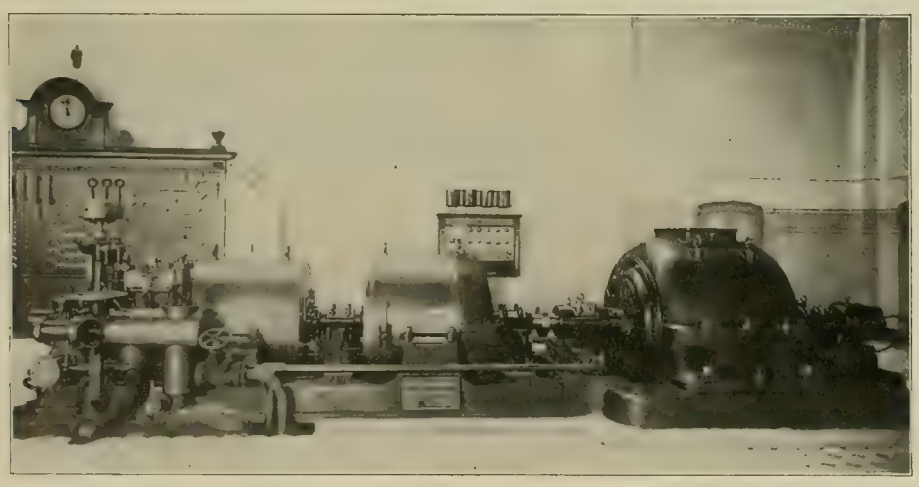


FIG. 3 500-HORSEPOWER HORIZONTAL ZOELLY TURBO-ALTERNATOR OPERATING AT 3,000 REVOLUTIONS.

A company in Bemidji, Minn., has let a contract for the machinery to develop the waterpower in the Mississippi River eight miles east of Bemidji, which will operate manufacturing plants in that town. It is said that 25,000 horsepower can be developed.

Mercury-vapor Lamps Operated by Induction.

Although applied for as far back as September 28, 1900, two patents issued to Peter Cooper Hewitt last month are interesting as showing a method of operating mercury-vapor lamps by induction. The object of the invention is to provide a lamp and method of lighting which shall yield a practical light without any conductor leading into the lamp, thus making it possible to dispense with any break or joint in the electric circuit.

If there be substituted for the secondary coil of a transformer a closed circuit of some vapor or gas of the proper character and under the proper conditions, it will act as a conductor, and the energy of such current will be induced in it if the rate of change is suitable. The energy of such current will manifest itself in the form of light and heat if sufficient lines of force are cut by the vapor to overcome its tendency to resist becoming a conductor.

The induced current in the lamp and its voltage depend upon the general laws of induction—namely, the relation of the turns in the primary to those in the secondary, and the rate of change of the pulsations or variations in the actuating or primary current, or, in other words, the rate at which the magnetic lines due to the primary current are cut by the secondary circuit. This rate is the measure of the electromotive force given to the secondary circuit.

In the present form of lamp it is practicable to employ for the secondary circuit a simple closed circuit of vapor having effectively one turn in connection with a multiple-turn primary giving a suitable ratio of step-down transformation.

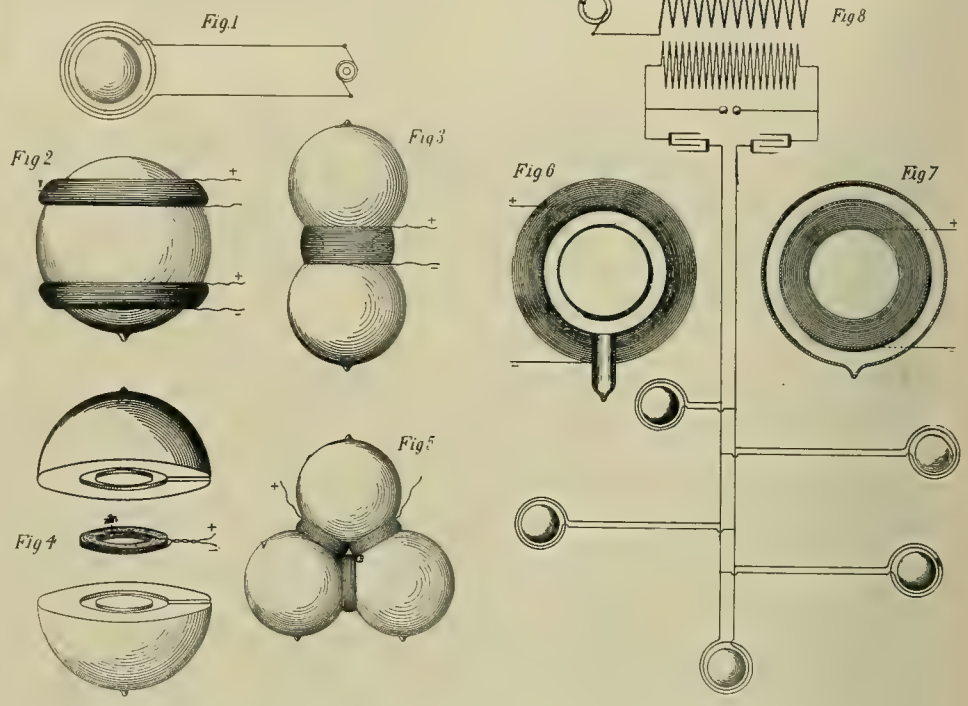
For the purpose of developing an electromotive force in the secondary sufficient to place it in a state where it will become readily conductive—that is, a true vapor conductor of low resistance—use is made of a current of such quantity and rate of variation in a primary of such multiplicity of turns and such interlinkage as will induce in one turn of a secondary an electromotive force which shall be sufficient to break down the tendency of the vapor to resist becoming a conductor, notwithstanding the decrease of electromotive force which must result from the use of such multiple-turn primary as will give the required interlinkage with the said vapor secondary.

The vapor found most convenient in use is that obtained from mercury, because of its low resistance; but other materials may be used, the use of any vapor being dependent only upon the requirement that there shall be induced in it a voltage sufficient to overcome its resistance. Certain impurities or vapors added to the vapors which are selected for forming the secondary or light-emitting circuit exercise such a reluctance to the passage of the electric current that it is almost impossible with the most rapid variation of current to induce a secondary current in the lamp when they are present. Such vapors as will be obtained from water and some oxygen compounds seem to have this state of non-conductivity in a marked degree. Also the vapors usually present in a globe until it has been exhausted, heated, and the current induced in it, which current liberates more non-conducting vapors, would seem to render the desired state of conductivity almost impossible to attain; but by properly preparing the lamp and supplying the globe with the conducting vapor freed from the objectionable ones a condition is reached where a practical and enduring lamp is obtained. The conducting vapor when in its conducting state, being a conductor requiring a rate of change in the primary that will induce in a secondary of one turn an electromotive force of, say, from three to 50 volts per inch in case the secondary is, say, three inches in diameter, the inducing current need not be over a few hundred volts when the current is passing in the vapor, the voltage depending upon the material of the vapor, its density, and other conditions.

The amount of light emitted by the gas readily shows at what time during the process of manufacture the lamp is completed.

"I am aware," says the inventor, "that others have proposed certain lamps claimed to be induction lamps having a luminous band induced therein; but in none has any considerable amount of light been produced. My lamp yields a large quantity of light and possesses other characteristics which clearly distinguish it from the faint luminosity of the electrostatic effect produced in the lamps above alluded to. The difference is also at once apparent in the source of current."

Of the accompanying drawings Fig. 1 is a diagrammatic view of one form of the lamp connected with a generator. Fig. 2 is an elevation of one form of the lamp, using two primary coils. Figs.



MERCURY-VAPOR LAMPS OPERATED BY INDUCTION.

3, 4, 5, 6 and 7 are views showing other forms of lamp. Fig. 8 is a diagrammatic view of several lamps and a form of generator in circuit therewith.

These drawings explain themselves. On the passage of a current of the proper character through the coil a current is induced in the vapor. Immediately the vessel becomes brightly luminous. A change in position of the primary coil causes a corresponding change in the position of the luminosity. By increasing the amount of energy imparted from the primary source practically all of the vapor in the lamp may be made to act as a secondary and to give the lamp a very intense brightness. The addition of a second coil on the globe of the vessel causes an increase of luminosity.

The operation of the lamp depends upon the possibility of obtaining a current of suitable rate of variation. Excellent results have been obtained by the use of the discharge currents obtained from condensers; but a properly constructed mechanical generator would produce the necessary current.

In Fig. 8 is represented diagrammatically one form of apparatus giving a rapidly varying current suitable for use to operate the lamp. The generator is to produce an alternating current of, say, 125 to 300 periods per second, and of a voltage of, say, from 50 to 100 volts. The generator supplies the primary coil of a transformer, the secondary coil delivering an induced current of, say, 6,000 volts. This induced current is delivered to condensers of suitable capacity, which may be arranged to be discharged through the line. It is preferable, however, to use two condensers as shown, using the current induced between them through the main circuit. The discharge gaps limit the charge of the condensers and serve to discharge them. Each time the condensers are charged and discharged the current induced between them will flow back and forth through the line. One of the glass vessels being placed in the field of its coil will act as a secondary, tapping off the amount of current that the lamp is constructed to take. The coil thus becomes the primary and the vapor in the vessel the secondary of the vapor transformer or lamp. With a pressure of 6,000 volts and a bulb six inches in diameter a coil of 15 turns will serve to illuminate the bulb.

The completed apparatus acts like an ordinary transformer, the primary in this case being the coil and the secondary being the light-giving part within it, with its contained vapor, or, more strictly, the contained vapor itself. Unless current is drawn off by the secondary the primary, as in an ordinary transformer, chokes back the current in the line and prevents the passage of current through the primary coil.

Annual Convention of the Institute to be Held at Niagara Falls.

A regular meeting of the American Institute of Electrical Engineers was held in the auditorium in the Engineers' Building, New York city, on March 1st. Dr. Samuel Sheldon, the president, was in the chair. Secretary R. W. Pope announced that at the meeting of the board of directors held in the afternoon 125 associates were elected and nine associates were transferred to the grade of member.

Mr. Pope also stated that upon recommendation of the committee on papers and meetings it was decided to hold the annual convention at Niagara Falls during the week beginning Monday, June 24th. Niagara Falls was selected largely on account of its favorable geographical position, considering the center of membership. Conventions held there in the past have been well attended and eminently successful.

Three papers on electrolysis were then presented. They are: "Alternating-current Electrolysis," by J. L. R. Hayden, Schenectady; "Electrolytic Corrosion of Iron and Steel in Concrete," by A. A. Knudson, New York, and "Some Theoretical Notes on the Reduction of Earth Currents from Electric Railway System by Means of Negative Feeders," by George I. Rhodes, New York. Among those taking part in the discussion were L. B. Stillwell and F. N. Waterman of New York, Paul Winsor and John W. Corning of Boston, S. M. Kintner of Pittsburg, Calvert Townley of New Haven, Conn., Prof. George F. Sever of Columbia University, New York; Prof. A. F. Ganz of Stevens Institute, Hoboken, N. J., and Prof. C. P. Steinmetz of Schenectady. A condensed report of the discussion is given on another page.

The opinion of most of the members of the Rapid Transit Commission is that the only solution of the surface railroad track problem on the lower West Side of New York city is an elevated railroad constructed and owned by the city to which all the railroads with piers on the North River shall have access.

Electrical Show at the University of Illinois.

Illinoisans have a proverb to the effect that nothing small can come out of Illinois soil, and the substantial truth of the saying was again demonstrated and in a new way last week, when, at the State University located at Urbana, was held probably the largest exhibition of things electrical ever conducted by an educational institution. It may not be generally known that Illinois has one of the leading engineering schools in the country, having on its rolls over 300 electrical students; for, although University of Illinois graduates are in strong demand, and are known as men of ability and push, and the University of Illinois has always borne a high reputation as an educational institution, yet the modesty of the head of the department of electrical engineering, Prof. Morgan Brooks, has not heretofore brought it into the limelight of public gaze.

The Electrical Show just ended, however, showed conclusively that the University of Illinois is a powerful factor in the supplying of brains and energy as the lines of force in the field of electrical engineering. It was unique in several respects. Being the first exhibition of its kind ever held at the university, in fact the only one on so large a scale ever attempted by the students of any technical school, all ideas and methods of procedure were original and entirely new. It was throughout a students' enterprise, planned and executed by their Electrical Engineering Society, one of the strongest organizations in point of numbers, interest and general aggressiveness, in the university. It was due to the ability, activity and hearty co-operation of the members of this society, as well as advice and assistance of the corps of instructors in the electrical department, that the show was such a remarkable success.

Several reasons actuated the giving of the exhibition. One of the principal motives being to provide a subscription for the Robert Fulton memorial fund, now being raised by a national committee of engineers and college men to erect on Manhattan Island a monument to the genius of America's early engineer, the inventor and builder of the Cleremont, the first steamboat to plow the waters of the Hudson, 100 years ago. Other reasons for the holding of the show were that it might be a means of enlightening that large class of non-scientific people in the community who knew little or nothing about electricity; that it would afford recreation and entertainment to many, and that it would advertise, as nothing else could, the department of electrical engineering of the university.

The exhibition struck the public fancy and appealed to students and citizens alike, as was shown by the large attendance at the Electrical Building on March 1st and 2d. For some time previous a vigorous advertising campaign was carried on, and the results in the 1,800 paid admissions during the 11 hours total that the doors were open proved conclusively the value of advertising as a means of bringing the project before the public attention.

New methods were employed by the student advertising manager. A miniature newspaper, the Electrograph, was published, forecasting in a breezy way the principal things of interest to be seen at the show. This little publication was distributed in the circulation of the university's daily, and found its way into many homes of the twin cities, Champaign and Urbana. Among other novel means of advertisement were the running of a special "boom-train" to Danville and other towns within a radius of 30 miles over the interurban lines of the Illinois Traction System centering in Champaign, and the operation for several nights of a powerful searchlight from a 150-foot tower on the university campus.

The Electrical Building, one of the largest structures of the university, was turned over to the show management, and nearly every available foot of space was required for the needs of the various exhibitors. The installation of all exhibits was made under the personal supervision of the chief installing engineer, a senior in the electrical school, and while it was necessary to suspend classes in the laboratory for a few days previous to the show, everything was conducted smoothly and in a businesslike way.

MAIN EXHIBITION HALL OF ELECTRICAL SHOW AT UNIVERSITY OF ILLINOIS.—7½-KILOWATT INDUCTOR ALTERNATOR BUILT BY STUDENTS IN FOREGROUND.

To avoid confusion and to facilitate the handling of the visitors, a unique system of showing the exposition was introduced. Official guides, upper classmen as a rule, assumed the duties of "live conductors," indicated by satin badges, and they escorted parties of visitors from end to end of the show, explaining the interesting features, and pointing out the principal displays. All exhibits were operative, and were in charge of capable engineers, conversant with the details of their particular installations.

To describe the details of the show in an article of this length would be out of the question, although a few strong points may be mentioned. A charge of 25 cents was made as admission to the entire exhibition, and no sideshows or "fakes" were allowed. A shadowgraph gallery, producing silhouette photographs "while you wait," was entirely open to the public, although a small charge was made for the product.

On the first floor of the Electrical Building was located the free check room, the storage-battery room and the "Lightning Laboratory," in which was shown in full operation the 100,000-volt transformer, designed and constructed by students. This was one of the most popular as well as spectacular features of the show, those in charge of this exhibit explaining, at 10-minute intervals, the various insulator tests, demonstrating their breakdown un-

der the high pressure, and showing other high-tension phenomena.

On the way to the second floor the visitor was escorted through the university power plant, noting by the way the automatic telephone exchange, fire-alarm system and electrically operated pump room. From the plant the sight-seer was taken into the electrical department's test car upon a siding near the building. In addition to the regular equipment of indicating and recording test instruments, was found the "speaking arc" connected with a transmitter in the main laboratory. On exhibition here also was the oldest trolley car of the Illinois Traction System, a relic of early days of electric transportation.

Returning to the Electrical Building, the visitor was taken to the third floor. Here he was shown the general lighting section, where were mercury-vapor, Nernst, tantalum and metallized-filament lamps, as well as the various types of the carbon-filament lamp, with samples showing the process of manufacture. Here also were shown late ideas of artistic interior illumination, and methods of wiring.

Passing to the first lecture room, the spectator was entertained by a 10-minute demonstration of the Thordarson transformer, thence through the telephone-exhibit room, with its Poulsen telegraphone, selenium cell, microphones and other apparatus of a similar nature. Here also was a complete telephone exchange of 12 stations, located at different points, including one at the gymnasium, a block away. These instruments, installed by students, especially for the amusement of the show patrons, proved a very attractive feature.

The next exhibit was that of high-frequency phenomena, with lectures of a popular nature every 15 minutes. One of the most striking displays of the entire exhibition was that of static apparatus given in the physics section. Here was a very large Wehnelt interrupter operating an X-ray and numerous Geissler tubes giving effects of a spectacular nature. A Holtz machine, built by students, rotated a similar machine by static influence.

An exhibit of local interest was that of the National Self-Winding Clock Company, whose factory is situated near the university.

In the main exhibition hall, located on the second floor, was "Electron," the widely advertised juggler, swinging his electrically illuminated Indian clubs in the darkened hall, followed by a duel with electrified foils.

Another startling novelty was introduced as the lights were coming on by the "Man with the red hat" receiving a seemingly fatal shock, followed immediately by efforts at resuscitation by the regulation methods, which soon successfully accomplished the desired result. These "stunts" were repeated hourly.

The main exhibition hall was divided into sections, with numerous booths, each complete in itself. Here was found the magnetism display, with all forms of permanent and electromagnets; the integrating-wattmeter exhibit; a complete wireless-telegraph outfit of the Arco-Slaby system; precision instrument displays; also an electric welding forge in successful operation.

One of the local contracting firms had a well-stocked booth of artistic portable lamps and fixtures, cooking utensils, electric flatirons and heaters. Other points of interest were the battery exhibit, where the various types of primary and secondary batteries were shown; the arc lamp burning under water; the 7½-kilowatt inductor alternator, built entirely by students, furnishing power for the 100,000-volt transformer in operation below. Various amusement features were found in the "bucking bronco;" series-generator shunt-motor self-reversing combination; in the voltage tester; in the Magic Apple tub, where, at the risk of receiving a severe shock the visitor might gain an apple.

Besides the anticipated advantages successfully gained, the Electrical Show has also brought out the practical ability of the student engineer. The engineering world has been inclined to discount the immediate availability of the recent graduate, but such a large enterprise, so well executed in all its details by undergraduate students of the University of Illinois should go far to prove the fact that the college student of today is not exclusively a man of theory, but a man of action as well.

Between $200 and $300 was realized for the memorial fund, or over $2 for every member of the Electrical Society, which managed the affair throughout.

ELECTRICAL SHOW, UNIVERSITY OF ILLINOIS.—PHYSICS SECTION, THIRD FLOOR.

ELECTRICAL SHOW AT UNIVERSITY OF ILLINOIS.—A CORNER OF MAIN EXHIBITION HALL.

A charter has been granted to the Dakota Power Company for the purpose of using the water of Rapid Creek, S. D., for a light and power plant. The company will put up a plant that will furnish from 2,000 to 3,000 horsepower, and this will be added to according to growing need of the community.

Development of Electric Power at Shoshone Falls, Idaho.

The project of harnessing the great Shoshone Falls of Southern Idaho will be accomplished within a few weeks. A 420-foot tunnel through black, flinty basalt was completed several months ago. The concrete power house is finished and steel workers are now riveting the rings of thick sheet metal that will make up the 120-foot penstock. The forms are in place for the concrete reinforcement around the base of the penstock, and much has been done toward completing the big electric power installation.

Shoshone Falls are the greatest of the several cataracts on the Snake River, the river taking a plunge here of 210 feet. It may be a surprise to many to know that this cataract is 50 feet higher than Niagara Falls, and that across the crest of the falls the distance is 900 feet. Snake River, which is 1,000 miles long, has its source in Yellowstone Park.

The power installation at Shoshone Falls is accomplished by confining a portion of the water above the falls in a forebay, from which it enters the portal of a sloping tunnel. The tunnel leads to a perpendicular penstock, and the water is thus carried to the turbine wheels in the power house, which is built upon a shelf of rock at the level of the lower river. The hydraulic installation provides for 25,000 net horsepower. The first electric installation is for 1,000 kilowatts, with provision for additional equipment as fast as conditions warrant.

The development of power at Shoshone Falls is a costly undertaking, and is incident to or coordinate with the great project of reclaiming and peopling the vast stretch of surrounding desert.

Notwithstanding that the construction of the power plant was begun two years ago, when the whole desert south of the river was one field of sage brush, the market has for months been demanding the power that this enterprise has promised. In those two years an area of 240,000 acres has been invaded by men who have started the creation of 2,000 farms. Six or seven villages have been built and one town of more than 3,000 population has come into existence. A line of railroad 60 miles long was built to this new town, and travelers thither may find a hotel that cost $100,000, as completely equipped as some of the best metropolitan hotels.

The lighting of this town and of many villages in the vicinity will be among the first duties of the Shoshone Falls plant.

In building the irrigation canal for the Twin Falls North Side Land and Water Company, of which W. S. Kuhn of Pittsburg, Pa., is president, Shoshone Falls power will be used to drive the drills, operate the derricks, draw the cars, light the works and to do all that power can be made to do in constructing the great engineering works necessary in a project of this kind. One feature of this development is the construction of an electric railway, 55 miles long, from Milner to Gooding, on the Oregon Short Line Railroad. Sixty-pound rails will be used and the road will be in operation before there will be a single house along the entire line. But the absence of houses or business causes no worry. Having colonized an area of 400 square miles in two years, the projectors have no fear.

The great canal, 70 miles long and big enough

to float a small ship, will be completed in the spring of 1908. By that time the 250,000 acres in the tract will be cut up into 2,000 or more farms.

The dam in the Snake River which diverts its waters to the two great tracts is one of the huge engineering works of the Northwest. It is situated at the head of the famous canyon of the Snake and raises the stream 49 feet above its ordinary level. The dam is 1,900 feet long, with a width of 20 feet at the top and 460 feet through the base. Its height is 79 feet. Two rocky islands are incorporated in the dam, one of them serving as the foundation for a battery of 99 steel waste-gates, five by 10 feet in size, the other being used for a permanent cement waste weir, 500 feet long. This dam sets the water of the river back some 15 or 20 miles, creating a reservoir of no mean dimensions.

The north-side canal will have the same dimensions as that on the south side of the river, namely, 80 feet wide at the bottom, with banks sloping one in three, and carrying a depth of 10 feet of water. In the north-side system will be several reservoirs with vast storage capacity, where the waters will be impounded in the season of abundance, to be used in seasons of possible scarcity or to give greater volume to the flow in the growing season. The south side has one such reservoir covering two square miles.

It is an interesting fact that the building of the dam was done by the aid of electricity generated in a temporary installation in the river below the dam site. The site at the time of construction was 27 miles from a railroad station, where soft coal was $7 a ton, and 50 miles from a forest which offered the only other available fuel. But the river aided in its own diversion by operating drills, derricks and railroads and furnishing light and power for all needs.

Salt Lake City, about 150 miles away, has become interested in the power development to the extent of wishing earnestly for it, and future development will undoubtedly see its transmission to that city. A transmission line, once built, would be followed by the development of considerably greater power than provided for in the present installation at Shoshone Falls.

SHOSHONE FALLS, SNAKE RIVER. 210-FOOT FALL.

CREST OF SHOSHONE FALLS, SNAKE RIVER, 900 FEET WIDE.

Mr. H. L. Hollister of Chicago is largely interested in the undertaking, to which he has devoted much attention, spending not a little of his time in Idaho.

Sedalia's Inspection Ordinance.

At Sedalia, Mo., what is virtually a new electrical inspection ordinance has been adopted in the shape of amendments to the old one. It establishes the 1905 Code as the standard and is otherwise modeled along lines approved by the Underwriters' Electrical Bureau. The office of electrical inspector is established, and this official is given practically unlimited authority. Charges are made for electrical inspections, ranging from 2½ to 10 cents a lamp, according to the number involved. A new departure is made from the usual practice, in that a charge of 25 cents is made for the inspection of telephones and wires incident thereto.

Up-to-date Electrical Equipment in a Modern Apartment Building.

By George Gilbert.

One branch of electrical work rarely touched upon is that of the installation and maintenance of electrical wiring and equipment in apartment buildings. In truth, however, there are many apartment buildings having electrical equipments costing thousands of dollars and containing apparatus for lighting, heating and cooking that would not have been dreamed of a decade ago.

The tendency of recent years has been toward larger and more elaborate apartments, and in some instances, in the more aristocratic neighborhoods, no expense has been spared in providing improvements in the electrical equipment. These electrical innovations undoubtedly do much toward influencing prospective tenants.

As an instance of modern apartment-house wiring it will be of interest to consider the work in the 12-apartment building, an exterior view of which is given herewith. Here not only lighting but electric heating and cooking devices played a part in the wiring, as provision was made for an electric oven in the kitchens and also for curling-iron heaters in each of the two lavatories in each flat.

A NEW NORTH SIDE APARTMENT BUILDING IN CHICAGO WITH UNUSUALLY ELABORATE ELECTRICAL EQUIPMENT.

The total number of incandescent lamps installed in the 12 apartments and also in the halls is over 800. There are approximately 70 16-candlepower lamps in each apartment, not counting the public halls.

In each of the parlors and dining rooms provision was made for installing 16 16-candlepower lamps, there being eight for each chandelier, and the remaining eight on four two-light side-wall brackets, both of which are controlled by flush wall switches.

In the library 12 two-light brackets were installed and controlled so that one lamp on each of the 12 brackets could be lighted independently of the other. By turning the switch one-half turn both lights on all 12 brackets would burn. Three-point switches were used. In addition to this each library has two floor plugs with a capacity of 12 lights each.

In addition to the above there was installed in each of the eight clothes closets and pantries an automatic door switch, set flush with the butt of the door hinge, the action of the door controlling the light inside.

The public halls are controlled by two switches. One is an ordinary double-pole snap switch controlling the lights in both halls above the first floor. The other switch installed is a time switch and operates the lights in both vestibules and first-story stairways. There are two front entrances, and in connecting these two halls together it was necessary to make a run nearly 200 feet long, as they are separated by a wide courtyard. This made it necessary to install a conduit three inches in diameter and running under the courtyard, which also accommodates the various feeders and service wires run between the two parts of the building.

The cut-out cabinets are located in the basement, and from them to each apartment is run a 1¼-inch conduit which contains the six circuits for lighting each flat. These conduit feeders end in an iron junction box, six by eight by four inches, placed in one of the clothes closets. From each junction the circuits split and run through one-half-inch conduit to different sections of the apartment.

In the basement are located 12 butlers' rooms. Each of these rooms is set aside for a certain apartment and metered accordingly. It contains two two-light bracket fixtures and one single-pole indicating snap switch that controls one light on a 12-light cluster hung in the general lavatory, so that on turning any one switch only one light will burn, and this is metered through the particular room that is using it at that time.

The service used is the Edison three-wire 220-110-volt direct current, which is run in through the foundation walls in two different places and connected to the house mains through two 150-ampere fused three-pole switches. From this point two 2½-inch conduits are run to the different distribution centers, where they turn and come up. The feeders then run across the meter boards in the form of bus-bars, with the various meter loops taped off.

There are in each apartment two 10-point annunciators, one located in the kitchen and the other in the front hall leading from the reception room to the chambers. Three-point pushes are used at all places on the annunciator system, making it necessary to carry two indication wires to each push, the two annunciators being operated together.

A complete telephone system was installed, there being one telephone in each vestibule and 12 apartment telephones. These instruments are set flush with the plaster. The ringing and talking circuits for this system are entirely separate. One of the features of the wiring is that there is no current on any two adjacent wires except at the time the telephones are being used. This is accomplished by having the carbon side of the talking battery common to the apartment telephones, and the zinc side common to the vestibule telephone, which is provided with a movable switch-hook which opens the talking circuit when the receiver is restored. In addition to this system, each apartment has located in the kitchen a wall telephone connected with the janitor's quarters and also with the laundry, located in the basement.

The building contains about 20,000 feet of one-half-inch conduit and about 22,000 feet of No. 14 duplex wire.

Three-phase Railway Apparatus Discarded at London, Ont.

The Southwestern Traction Company of London, Ont., has discarded the three-phase alternating-current motors with which the line was at first equipped and has re-equipped its line with the standard American direct-current system. Mr. Mower, the general manager, has announced that, in addition to discarding the experimental alternating-current system, arrangements have been perfected for strengthening the financial condition of the company, and that the management will give the best possible service between St. Thomas, Port Stanley and London the year round. The plans also provide for the erection of car shops, substation and express depot in St. Thomas.

This is an announcement of some importance, because the Canadian company named was one of the very few electric-railway companies on this continent which have attempted to use the three-phase railway apparatus, which has attracted so much attention in Europe.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

THE ELECTRICAL STUDENTS of the University of Illinois and their instructors are to be congratulated on the success of the electrical show which they gave at Urbana last week. From the account given elsewhere it will be seen that the affair was well conceived, well executed and well patronized. There were demonstrations of practical value and also many popular and amusing exhibitions which the students and townspeople greatly enjoyed. Indeed, this popular feature is never to be disregarded in any electrical show designed to attract the public; the average American likes to have his pills of information sugar-coated. The show at Urbana was a "popular" one, but it was, nevertheless, an electrical exhibition and not a "fake." Indeed, some persons who attended both it and the big show in Chicago in January said that they got more out of the little show than the more pretentious one. This might very well be the case with the layman, for there was greater opportunity for attention to individuals and the students entered into the affair with the enthusiasm of high-spirited amateurs. Moreover, there was one excellent feature which might well be imitated elsewhere if possible. This was the practice of taking all visitors around the show in personally conducted groups at frequent intervals, the student in charge, or "live conductor," explaining the "points" of each exhibit or entertainment feature. This idea of electrical-show guides is a good one, although it is difficult to see how it could be carried out in the thronged aisles of the Coliseum.

Electrical shows like that at the University of Illinois are to be encouraged. They are good for all concerned, and there is no reason why they should not become a permanent feature of college life at technical schools. We are credibly informed that the electrical show at Urbana was the "biggest college event in years with the exception of some football games." If the electrical show can rank within measurable distance of the football game, then indeed is a new and important avenue opened for the irrepressible energy of the American college student.

SAD NEWS from London for municipal-ownership advocates is that giving the result of last Saturday's election of a new County Council. There are 118 members of the London County Council, and on March 2d the Reformers or Moderates elected 79, the Progressives or municipal-ownership men 36 and the Laborites three. How complete a revulsion of feeling is thus indicated is shown by the fact that the old Council stood: Progressives, 83; Moderates, 34; Independent, one. The Progressives have controlled London for 18 years, or since the creation of the County Council. From the outset they have engaged in a constantly broadening policy of municipal ownership, and it is this policy that formed the sole issue in the recent campaign. "London has now condemned and repudiated municipal ownership," says the London correspondent of the Chicago Tribune, "in a decision so emphatic that its revival is deemed impossible." After exhaustive trial the electors have now voted two to one against the wasteful, inefficient policy of municipal ownership. It is asserted—although with how much truth we know not—that the per capita debt of London has increased from $35 to $80 as a result of municipal-ownership experiments. At any rate the old Council, with its mania for a municipal finger in every pie, is entirely discredited, and the fact redounds to the good sense of London voters. Many of the Council's schemes were of an electrical nature, as railways or lighting supply, and in nearly every case the result was distinctly unsatisfactory.

The lesson of this reverse to municipal ownership in London is of course obvious to American cities, practically all of which are struggling with similar problems. If in conservative London, where the highest type of men accept municipal office and where the merit plan obtains in the public service, if not absolutely at least to a greater degree than in New York and Chicago—if in London, under the most favorable circumstances, municipal ownership fails to give the fondly expected results, what are we to expect in our own municipalities, with conditions widely different and much more unfavorable to efficient municipal service? The question answers itself. But because municipal ownership of industrial enterprises is unwise, it does not follow that the abuses brought about by private public-utility companies are not to be checked. On the contrary, operation of such public utilities should be strictly regulated and controlled by intelligent, judicious municipal authority in the honest (not pretended) interest of the public. Municipal control, not municipal ownership, is the thing. And a little unselfishness all around will help a good deal.

THREE PAPERS on the important subject of electrolysis were presented at last week's meeting of the American Institute of Electrical Engineers in New York. Mr. J. L. R. Hayden's paper on "Alternating-current Electrolysis" gave the result of tests in Dr. C. P. Steinmetz's laboratory at Schenectady, undertaken to determine whether, and to what extent, alternating currents passing between any metallic conductor and the ground will produce electrolytic corrosion. Some of the conclusions of this important investigation may be quoted from Mr. Hayden's paper:

Alternating-current electrolysis is not a phenomenon like direct-current electrolysis, on which definite quantitative general laws can be formulated; but is of the character of a secondary effect; that is, the action of the positive half wave is not quite reversed by the action of the negative half wave, leaving a small difference, rarely exceeding one-half per cent. of the electrolytic action of an equal direct current. Under the conditions of the investigation, which were chosen to represent as nearly as possible actual service conditions of lead cables, alternating-current electrolysis varies from practically nothing to somewhat less than one per cent. of direct-current electrolysis.

Alternating-current electrolysis, when expressed quantitatively, or in per cent. of the action of an equal direct current, varies very greatly with the chemical character of the electrolyte. The nitrates and similar compounds, as fertilizers, tend to increase electrolytic corrosion. Carbonates and, in general, alkaline reaction of the soil decrease the corrosion; that is, exert a protective action.

In general, lead is more attacked than iron, and the latter shows still more erratic behavior than lead, probably due to the existence of a passive state.

Alternating-current electrolysis under conditions representing as nearly as seems feasible the conditions of lead cables in the soil, does not appreciably depend upon the current density, but is practically independent thereof, except indirectly, in that very high current densities may by an increase of temperature give an increased corrosion.

In general, electrolytic corrosion by alternating currents increases with decrease of frequency. This increase with decreasing frequency does not follow a general law, but depends largely upon the chemical character of the electrolyte.

Chemical corrosion by the soil and electrolytic corrosion by alternating currents increase very greatly with increasing temperature of the soil.

Not much is known about alternating-current electrolysis, although with the introduction of the single-phase motor with grounded return the subject becomes of immediate importance. The thanks of the electrical fraternity are therefore due to Mr. Hayden and Dr. Steinmetz for laying the results of these researches before the Institute.

The remaining papers were more specialized in character. Mr. A. A. Knudson dwelt on "Electrolytic Corrosion of Iron and Steel in Concrete." He is of opinion, apparently, that "so long as the single trolley with its grounded return is in general use, just so long may we look for electrolytic action in some form upon various underground structures; and reinforced concrete is no exception to the rule." Mr. George I. Rhodes gave a theoretical, mathematical consideration to the reduction of earth currents from electric-railway systems by means of negative feeders.

An excellent discussion followed the reading of these papers, and a condensed report of it is given on a following page in this issue.

Electrical Exports for January.

Electrical exports from the United States for the month of January last amounted to a total value of $1,577,449, compared with $1,329,192 for January, 1906. Electrical exports are divided into two classes—electrical machinery and electrical appliances and both exhibit a large gain for January, as shown by the following figures: Electrical machinery—January, 1907, $903,082; January, 1906, $799,030. Electrical appliances—January, 1907, $674,367; January, 1906, $529,253.

A commendable improvement has been made by the Bureau of Statistics of the Department of Commerce and Labor in the January Advance Sheets from the summary showing exports. For a number of years the Bureau has shown the exports of electrical machinery by countries, but electrical appliances have been shown only in the total value of the exports. The January advance sheets show the destinations of electrical appliances as well as of machinery. The total value of each country's electrical imports from the United States can now be given instead of electrical machinery only, as heretofore.

The following figures, therefore, show the total value of electrical exports—machinery and appliances—to the principal purchasers from the United States in January: British North America, $242,491; United Kingdom, $235,580; Mexico, $232,695; Japan, $186,608; Brazil, $156,038; France, $152,074; British Australasia, $63,298; Philippine Islands, $35,648; Cuba, $35,198; Germany, $32,661; British East Indies, $31,642; Argentina, $24,708; Central American States and British Honduras, $21,571; Belgium, $12,282; British Africa, $11,636.

Lighting Situation in San Francisco.

The San Francisco Board of Supervisors has spent some days in its annual investigation of the cost of lighting for the purpose of fixing the maximum rates to be charged for gas and electric light by the local companies during the ensuing fiscal year. John A. Britton, president of the San Francisco Gas and Electric Company, a subsidiary of the Pacific Gas and Electric Company, testified at length through several sessions of the board. He said that the ordinary expenses of the maintenance of the gas plant during 1906 were $87,163.57, and of the electric plant $157,950.80. The extraordinary expenses caused by the destruction in part of the two plants were, respectively, $276,018.10 and $570,326.99.

Mr. Britton testified further: "I estimate that we will sell 2,500,000,000 feet of gas and 50,000,000 kilowatt-hours of electricity during the coming year. While the existing ordinance fixes a maximum rate of nine cents for electricity, we collected an average of only 4½ cents per kilowatt-hour.

"The loss to the plant by the fire and earthquake in April last was $4,273,000, of which $1,815,813 represented the loss of 36,663 meters, 955 lamp posts, 1,053 lanterns, two holders at Fifth and Howard streets, damage to the North Beach plant and the gas mains, and $2,457,187, the loss on the electric plant, including the seven stations, poles, overhead and underground wire systems destroyed."

Speed and Track Held Responsible for New York Central Wreck.

The coroner's jury which inquired into the wreck of the new electric train on the New York Central in which 23 persons lost their lives on February 16th has returned a verdict. The verdict charges that the train was run at unsafe speed and that the tracks were not properly reinforced for the sort of traffic which the heavy electric trains imposed. The jurors held the operating and construction departments of the railroad to be culpable.

Coroner Schwanneke, after inquiring of the jurors if they would name the officials whom they regarded as responsible for the accident, and receiving a negative reply, announced that he would hold the president and directors.

The jury holds that the train pushed the east rail out of position and that the running of the train at unsafe speed caused the rail to shear off the spikes.

To prove their confidence in the new electric locomotives and the stability of the track, operating officials of the company made an experimental trip on a train exactly similar to the one which was wrecked. The train went around the curve at a speed of 82 miles an hour—far above that required in the schedule—and the rails stood the strain perfectly.

Frank J. Sprague and Bion J. Arnold, advisory engineers, explicitly deny responsibility for the upkeep and operation of the electrical equipment.

Growing Scarcity of Lumber Demands Attention to Preservative Processes.

The growing scarcity of lumber, with the consequent high prices, is making it imperative that more attention be paid to preservative processes whereby the time of service of timber may be lengthened. Considering this subject the Forest Service of the United States Department of Agriculture presents some interesting points under the head of "Methods of Creosote Analysis."

Coal-tar creosote is generally regarded as the most efficient of the wood preservatives. This product is very variable in composition, owing to differences in the coals used and in the methods employed in their distillation. Creosotes of different compositions are believed to have different values as wood preservatives, and an analysis of the oil used is, therefore, important.

No very large amount of study has been directed to perfecting the methods of creosote analysis, and the Forest Service, believing the matter vitally important to the progress of wood preservation, is now carrying on an investigation of these methods.

The most important part of a creosote analysis is the fractional distillation, since by this operation an approximate determination is made of the relative proportions of the most important substances in tar oil. There has been considerable divergence of opinion as to the best way of carrying out the fractionation of tar oils, some recommending a retort as a distilling vessel and certain temperatures for taking fractions, others recommending a distilling flask and a different set of temperatures.

Laboratory experiments carried on by the service have shown that the difference in the weights of the fractions obtained when using different sorts of distilling vessels are not large, but that the composition of the fractions indicate a little better separation by the flask than by the retort. As regards the influence of the rate of distillation, variations of from one to three drops per second have but slight influence on the weights of the fractions, though the slower rate is more satisfactory.

It is commonly believed that the relative amounts of light oil, naphthalene and anthracene oil are the most important factors determining the value of a creosote for wood preservation. A number of creosotes were very carefully fractioned and determinations made of the amounts of naphthalene and solid anthracene oil distilling between various temperatures. The average of the results shows that at least 25 per cent. of naphthalene was present in the distillate between 205° and 250° C., and that over 25 per cent. of anthracene oil solids are present in the distillate above 300° C. Work on the specific gravity and the index of refraction of the distillates between different temperatures is now being carried on.

The desirability of getting the criticisms and suggestions of users of creosote has led to the publication of a detailed account of the methods employed in the experiments and the results which have been obtained. Those who desire the publication should ask for circular 80, Fractional Distillation of Coal Tar Creosote. Request should be made to the Forester, Forest Service, Washington, D. C.

Power-transmission Voltages.

The New York Electrical Society held its two-hundred-and-sixty-fifth meeting in the new Engineers' Building, New York city, on February 27th. Prof. Harold B. Smith of Worcester Polytechnic Institute, in his address on "Power Transmission Voltages of Today and Tomorrow" outlined briefly the history of electric power transmission at high potentials, beginning with the pioneer plants of 1890 to 1895, and tracing the progress of experimental and research work, together with actual installations, from that time to the present.

The speaker made some estimate of probabilities in the matter of developments within the next few years. It was shown that of the three factors entering into power transmission on a commercial basis—the line, the insulation and the transformer—less difficulty was to be expected in reaching higher voltages from the transformer than may be encountered with either the insulation or the line construction. In all three of these features there is much room for improvement, and there seems to be a reasonable prospect of the solution of many of the problems involved in the near future, permitting transmission at higher voltages than any yet attempted on a commercial scale and over much greater areas than are now considered feasible. The use of voltages of 120,000 to 150,000 is in fact a not distant possibility.

In a series of lantern slides the development of experimental transformers built at the Worcester Polytechnic Institute for voltages up to 50,000 was shown and numerous illustrations were given of notable recent installations.

The following-named were elected members: W. G. Heep, New York Telephone Company; E. Hugh Watlington, Hoboken, N. J.; F. H. Ballon, Hoboken, N. J.; F. M. Swaney, Frederick J. Good, Arthur Eichenberg, M. L. Pomares, Robert Velton, Archie Wainman, Frank Sutton, R. W. Marshall, L. G. Nilson, all of New York city; Charles H. Bedell, Bayonne, N. J.; Francis X. Scott, New York city; Walter A. Seymour, Pelham, N. Y.; Raymond Cilley, Brooklyn; William Simpson, Harold P. Daniels, Sheldon Leavitt, Jr., all of New York city.

Street-railway Politics in Chicago.

Edward F. Dunne has been renominated for mayor of Chicago by the Democrats. The Republicans have nominated Fred A. Busse, the present postmaster of Chicago. At the convention which nominated Mr. Dunne the party pledged itself to municipal ownership of all public utilities, against franchises for utility corporations, and to oppose at the polls the traction ordinances passed by the City Council and which will be voted on at the April election.

The Republican platform commends the traction ordinances as the best means of securing adequate transportation for the city, and pledges itself to enforce all their terms if adopted by the people. The ordinances are 20-year grants, but contain clauses whereby the city may purchase the properties when it finds itself in a position to do so. For all franchise grants the party says that the city should receive adequate compensation if sane business principles suggest the granting of franchises.

Chicago's first four-year mayoralty term begins with the next election, and in view of the important questions bearing on the city's future opportunities much interest is manifest in the mayoralty campaign. The two parties have taken directly opposite stands on the traction-ordinance question. Other important matters to be settled by the incoming administration are the telephone question, the consideration of plans to utilize the Sanitary District waterpower for municipal purposes, local improvement, public school management, etc.

Electric-railway Statistics of Canada.

According to the annual report of the Department of Railways and Canals of Canada, there were in operation at the close of the fiscal year ended June 30, 1906, 814 miles of electric railway, 195 miles being double-tracked. The paid-up capital amounted to $63,857,970. The gross earnings aggregated $10,966,872, an increase of $1,609,747, and the working expenses $6,675,038, an increase of $756,844, leaving the net earnings $4,291,834, an increase of $852,903. The number of passengers carried was 237,655,074, an increase of 34,187,757, and the freight carried amounted to 506,024 tons, a decrease of 4,326 tons. The car mileage was 50,618,836, an increase of 4,659,735 miles. The accident returns show a total of 47 persons killed during the year and 1,653 persons injured. Power was supplied in 15 cases by water, and in 41 cases by steam. Ontario has 441 miles, Quebec 198, New Brunswick 16, Nova Scotia 54, Manitoba 32, and British Columbia 72 miles. Returns were received from 47 companies.

Electrochemical Factory at Niagara Falls Burned.

The works of the Acker Process Company at Niagara Falls, N. Y., were destroyed by fire on the afternoon of February 25th. The origin of the fire is somewhat of a mystery. Henry S. Fairchild, an electrician, was on a ladder leaning against a wall, when the wall collapsed. He was buried under the debris and killed, his being the only life lost. The loss is estimated at about $800,000, partly insured. The Acker plant was located on the lands of the Niagara Falls Hydraulic Power and Manufacturing Company, along Third Street. The products were caustic soda, bleaching powder, tin oxide, carbon tetrachloride and sulphur chloride. The plant was built in 1900, but C. E. Acker, who started it, has not been connected with the company for fully a year and a half. The company used about 3,500 electric horsepower at a voltage of 300, supplied by the Niagara Falls Hydraulic Power and Manufacturing Company.

Clash of Inspectors in Cleveland.

City Electrician John Dunn and the Building Department at Cleveland, Ohio, have begun work on a new electrical code. The city officials, it is said, will seek to make their inspections the only official ones and the insurance men will have to abide by their decision. The latter have appealed to the law department for a decision on the contention, as the city inspection bureau has raised an objection to the underwriters taking so much authority upon themselves. Much information from other large cities has been obtained, and Mr. Dunn has already drawn a rough draft of the code. The insurance men say that they cannot abide by the decision of the city officers unless the latter adopt the National Electrical Code in its entirety.

Electrolysis: Its Results and Remedies.

At a meeting of the American Institute of Electrical Engineers, held in the auditorium of the Engineers' Building, New York city, on the evening of March 1st, a very interesting discussion took place on the following-named papers read before the Institute: "Alternating-current Electrolysis," by J. L. R. Hayden, Schenectady, N. Y.; "Electrolytic Corrosion of Iron and Steel in Concrete," by A. A. Knudson, New York city; "Some Theoretical Notes on the Reduction of Earth Currents from Electric-railway Systems by Means of Negative Feeders," by George I. Rhodes, Interborough Rapid Transit Company, New York city.

Mr. L. B. Stillwell of New York city, in opening the discussion, took occasion to congratulate the Institute upon the presentation of the three excellent papers dealing with the very important subject, "Electrolysis." While the results of Mr. Hayden's tests show, said Mr. Stillwell, that electrolytic damage to subterranean metallic structures, which alternating currents are liable to cause, is practically negligible under ordinary circumstances, they illustrate also the fact that special conditions may exist which call for the adoption of preventive measures.

Continuing his discussion Mr. Stillwell said: The papers read by Mr. Knudson and Mr. Rhodes deal with the subject of electrolysis by continuous current. Engineers representing the owners of water pipes or gas pipes have seriously recommended that street-railway companies should be compelled to provide complete metallic circuits for their current, absolutely insulated from rails and ground. On the other hand, street-railway companies, in many instances, have installed their plants apparently in absolute disregard of the effect of stray current upon the property of their neighbors, even going so far as deliberately to connect their track return to lead service pipes wherever opportunity offered. There can be no question that in many of our cities and towns, damage, due to electrolysis, is in progress which might be prevented by reasonable application of known principles and methods. The plans of the Hudson companies contemplate the use of boosters to prevent possible electrolytic damage to the metallic shells of the tube tunnels, destined to connect the Borough of Manhattan and the New Jersey shore, and the Interborough Rapid Transit Company is also proposing to use them for a similar purpose in connection with its tunnels under the East River. Mr. Knudson's paper would seem decidedly to require revision of methods employed before satisfactory conclusions can be drawn. Mr. Knudson's method of increasing the potential to keep current constant notwithstanding the apparent tendency of the reinforced concrete to protect itself, seemingly makes the conclusions reached of little value. No proof is presented that the splitting of the concrete blocks was due to electrolytic action, as no effort has been made to exclude other possible causes, as, expansion due to chemical changes in the concrete itself. It is important to ascertain the facts as regards electrolytic corrosion of iron or steel in concrete.

Mr. F. N. Waterman, New York: With reference to the subject dealt with by Mr. Knudson, it should be stated that iron encased in concrete is like a battery electrode in a porous cup, so far as insulation is concerned. Cement as a protector of iron acts both mechanically and chemically. If we deliberately introduce current into the midst of it, no protection is to be expected by chemical action with the initial products of the decomposition; a protective or highly resistant coating is formed which will restrict the flow of current. So far from indicating that iron encased in concrete will be injured in practice, the curves shown by Mr. Knudson seem to suggest that had the samples exhibited by him been subjected to anything like natural conditions, they would promptly have protected themselves against damage. Mr. Knudson appears to have established just one scientific fact, namely, that electrolytic action can be made to take place through a porous cup immersed in an electrolyte, and we have been using such cups in batteries long enough to be quite sure of that fact. In concluding his paper, Mr. Knudson says: "If but a small fraction of an ampere of electricity passes from an interior metallic column or structure into concrete or masonry as usually made, there will be corrosion of the metal and disintegration of the concrete or masonry." What the author calls a small fraction of an ampere amounted in fact to nearly one-fourth ampere to the square foot, or, for the sake of comparison, to 5,000 amperes per mile of 30-inch water main, or, in other words, current which is large as compared to those likely to exist in practical conditions, unless under very exceptional circumstances. There does not seem to be any ground for the assumption that the current had anything to do with the cracking of the concrete, much less that it would under practical conditions have such an effect. The papers of Mr. Hayden and Mr. Rhodes both indicate that the single trolley is entirely consistent with substantial protection to water pipes.

Mr. Rhodes shows in his paper that earth currents can be substantially eliminated by proper care of the return system. There is one thing in his paper, however, which appears to be a very picturesque way of stating what all of us have encountered, who have undertaken to calculate the size of copper, paralleling railroad track to reduce the drop. The unit which he takes is weight of copper, conductivity, equal to the total conductivity of the rails, and it is an impressive thing when one has occasion to figure what that means. The natural result, in the cases where remedies are necessary, is the negative booster. Unfortunately, we do not deal with the negative booster on the simple lines of the paper. We are not given roads which run straight from the power house and uncomplicated by branches of network. Some systems can be reduced to a plurality of such lines, but the majority will involve more or less complicated network. This distribution of current is determined by constantly changing bond resistances, particularly where special work is not kept up. The negative booster offers an extremely interesting possibility in that connection. It gives the means, with reasonable watchfulness, of determining the distribution of current in that network. The paper dealing as it does only with the single trolley line, naturally does not bring that out.

Mr. Paul Winsor, Boston: We think we have a pretty good railroad in Boston, well bonded, a good deal of return copper, and we follow it pretty closely. However, in certain places we have bad conditions; and what trouble we have had has taken place near the Harvard power station, where we have a marsh of salt water, and beyond which, about a mile away, is our first car track. We have in the vicinity a large number of water mains, but a careful study of the situation has reduced the trouble most materially. The telephone company has taken great pains to survey its cables, and when it finds a place where it thinks there is danger of electrolysis, it takes the matter up with our engineers, and we put in a negative feeder or connection in our rail, as may be best, and we get over the trouble. On our own cables we have cut them in many places, and made special connections and got rid of the trouble.

Mr. John W. Corning, Boston: We have made experiments in Boston along the line of a study of the power situation, which incidentally brought up the question of the effect of these experiments upon the electrolytic conditions in our system. Our system, which is supplied with power from 10 power stations, is divided into upward of 60 or 70 feet of sections. Some of the sections were supplied from one of the power stations by current from a machine placed in three-wire relation with the rest of the power station, that is, the power was supplied to the trolley wire from the negative pole of the machine and the positive pole grounded. No change was made in the feeder sections; they were simply, as it were, turned over in polarity without any change except the installation of an additional set of insulating joints in the trolley wire at the points of intersection of positive and negative sections. In order to study the effect in reducing the return current to ground in this system and comparing it with the ordinary two-wire operation, test wires were run from the power station out in three directions, and simultaneous readings taken at various points along the line.

Mr. H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, read a contribution to the discussion by Mr. S. M. Kintner, part of which follows:

The results obtained by Mr. Hayden in connection with alternating-current electrolysis, were in fairly consistent agreement with certain tests that he (Mr. Kintner) made some two or three years ago.

The laboratory tests made showed the following points: (1) The loss was not directly proportional to the ampere-hours, as repeated weighings of the same plates after equal ampere-hours of current action failed to show equal losses. (2) The shape of the plates had a very decided effect upon the results obtained, the edges being by far the most active part of the terminals. The best results were obtained with terminals mounted so as to form two sides of the box containing the electrolyte, the rest of the box being of impregnated wood. The terminal plates were approximately six inches square. (3) It was necessary to have a duplicate cell for everyone subjected to the alternating-current electrolysis, the duplicate being used to determine the chemical action alone. Attempts to reduce the corrosion loss to so much per unit surface, and thus correct for losses in various-sized cells, gave very inconsistent results. (4) The loss on the so-called gain plate of a cell in which a sodium-chloride solution and iron terminals were used when subjected to the action of a direct current, was greater than the losses on similar plates subjected to alternating currents. (5) The residue in cells, such as the last described, showed a very marked difference when analyzed chemically. The analysis of residue for the cells subjected to chemical corrosion only and those subjected to the alternating-current action were very similar, while that of the direct-current cell was very different.

A long-time test was undertaken in which pipes of from four to six feet in length were buried for a period of one year. During all this time an alternating current of 25 cycles and 25 volts was applied between each pair of pipes. In this test pairs of pipes of wrought-iron, cast-iron and lead were used. Each pipe was carefully weighed and marked before it was buried and was weighed again after one year's action. The loss in weights of the several pipes was not materially different, it being on the average the same for the pipes subjected to the alternating current as for those which were subjected to corrosion only. Careful inspection of the pipes as they were removed from the ground failed to show any difference between those subjected to the alternating currents and those which were not. It was the author's opinion that the alternating current, in so far as practical service conditions are concerned, will not cause electrolysis damage to pipes that will be of consequence.

Mr. Calvert Townley: The electrolytical problems show themselves to be no more difficult of solution than the ordinary questions of every day. The telephone companies, Mr. Townley understood, in the protection of lead sheathing cables from continuous-current electrolysis, have adopted a plan which they believe is entirely satisfactory and sufficient, in so far as it prevents any burning electrolytical action. They connect the lead sheath of the cable where the cable is positive to the return circuit, with a metallic conductor or bond, so that the differences of potential between these two conductors is practically eliminated. They do not pay any attention to the sheath where it bears a negative relation to the return current, that is, where the tendency of the return current is to flow from the rail of the trolley road to the sheath. But where the tendency of the current is to flow from the sheath to the rail, and electrolytic damage occurs in consequence, they bond at that point. The tendency to flow naturally is not concentrated to one particular point. There will be a positive area, through all of which area there will be a tendency of the current to flow from the sheath to the rail, and it is not necessary to bond the two conductors together at every point in the area. Some central point is selected and the bond inserted there. Consequently, it obviously must follow that, while the tendency to flow is not entirely theoretically removed altogether, it is removed to a sufficient degree so that electrolytic action is practically nullified.

Prof. George F. Sever: The engineer, whether he represents the water interests or the gas supply, reports the electrolytic difficulty to someone in authority, and possibly a suit against the railroad company results, with absolutely no possibility of any definite conclusion that the pipes are not incurring any further damage. The only way to handle the situation is for all parties in interest, with their engineers, to agree upon a policy, and to study the situation carefully and together, and endeavor to reduce the difficulty wherever it appears. In one city that Professor Sever knew of the water system is supposed to be going through continuous damage, whereas the gas system owned by the city has not indicated that any damage is occurring to its system, this being simply two different engineers, with two different ideas. The results of certain tests and investigations made at Columbia University, in 1904, on alternating currents as producing electrolytic action, were: First, that alternating currents can have a slight electrolytic action; second, that the rate of this action is very much slower than the direct currents of the same value; third, when insoluble or semi-soluble salts are formed, the rate of action with a given current strength decreases with the passage of time; fourth, that the resistance of the cell decreases with increasing current strength for both alternating current, as well as direct current; fifth, that the resistance is not only in the liquid itself, but particularly in the contact layer, where the electrode and electrolyte meet. Variations in the density of the current, or of the electrolyte, unless excessive, have no marked effect.

Prof. A. F. Ganz of Stevens Institute: The experiments described by Mr. Hayden show that with an alternating current electrolytic corrosion is generally a very small fraction of that which would be produced by a direct current of the same strength, and under the same conditions. The action is explained by the statement that the corrosive effect of the positive half wave of current is not entirely reversed by the reconstructive action of the succeeding negative half wave. The reason for this lies probably in the fact that a portion of the products of the electrolysis, produced by the current during the positive half cycle, diffuses away so that the negative half wave of current does not quite reverse the action of the positive half wave. Since these rates of diffusion vary greatly with different materials, the percentage of direct-current electrolysis produced by an alternating current varies greatly with different electrolytes. On this theory the effect of increasing the frequency would be to diminish the electrolysis, and in general this has been found to be the case.

The suggested protective measure of superimposing a small direct current upon the alternating current, so as to add to the effect of the negative half wave sufficiently to completely neutralize the corrosive action of the positive half wave, does not seem to be a desirable thing to do in practice, because it would mean to deliberately send a stray

direct current through the ground and to have this enter the metal to be protected and return by way of this metal. This stray direct current, while small in percentage of the alternating current to be counteracted, in its passage through the ground may in itself be a source of electrolytic danger to other underground metal. Mr. Rhodes' paper brings out the very important fact that the disposition of return-feeder copper is quite as important as the weight of return-feeder copper used in order to minimize stray currents. The calculations given show clearly that the way to secure a minimum of stray current from the grounded rails of a single-trolley electric road is to insulate the negative bus-bar, and to employ two or more insulated return feeders, either so proportioned in resistance or provided with negative boosters as to produce equal potentials at their connecting points to the rails. This method results in minimizing the potential differences in the rails, and for this reason also minimizes stray currents from the rails.

The laying out of a proper system of insulated return feeders has been frequently neglected in this country, and even where insulated return feeders have been installed, they have only in rare cases been properly proportioned for equal drop in potential. The usual method is to connect the rails with the negative bus-bar at the station with large copper cables, and in large installations to run out additional return feeders from these bus-bars to points on the rails distant from the station. The drop in potential in each of these long return feeders establishes points of higher potentials in the rails at these connecting points than exist in the rails at the station. The tendency is therefore for currents to leave the rails in these distant points of higher potentials, pass through the ground and buried metals, and return to the rails in the vicinity of the station.

Great improvements in the ground return circuits could generally be secured in most of our trolley roads by insulating the bus-bars, removing all bonds to pipes, and installing a properly proportioned system of return feeders. The use of adjustable resistances in the return feeders is not a practical arrangement for the large currents generally used on American roads. The use of negative boosters, as suggested by Mr. Rhodes, is, however, entirely practical, and when applied with a judicious number of insulated return feeders will greatly tend to minimize stray currents. In a large system the stray currents obtained with two return feeders may still be a dangerous stray current, making a larger number of return feeders imperative.

Prof. C. P. Steinmetz: We are liable to overlook some features of electrolysis and mainly consider only that side which is of popular interest, that is, the destruction of gas and water pipes or bridge piers, and such things in the soil. Fortunately, iron is a material which is least attacked by electrolytic action; even wrought-iron is not attacked very badly, steel very much less, and those iron carbides and silicides called cast-iron are hardly attacked at all. The problem of protection against electrolysis is not the problem of protecting the rails or gas or water pipes. They can very well look out for themselves, and with the reasonable use of negative feeders, etc., there is no danger with them. It is in the case of the lead cables of the telephone system that there is the greatest danger of electrolytic action. Electrolysis, due to stray current, is most destructive on lead. The underground metal structures which are suffering most are the underground lead cables, and there again it means the telephone cables. The high-power cables are relatively little affected, because they are better protected in subways, conduits, manholes, etc., and, furthermore, it is not economical to let a power cable lie idle, and as long as it carries current it is at a temperature above ground, and condensation is not likely to occur at or near a power cable, but it does occur at or near a telephone cable. The telephone companies have worked out protection by maintaining the cable negative against ground, by connecting to the negative terminal. This protection is not to see that no current passes between the lead cable and the rail. That cannot be done. The current may pass, and should pass, but the protection is perfect and absolute by making the cable throughout its whole extension more negative than the surrounding ground. As long as the lead-cable armor is maintained at a potential, however slight, negative against the ground, current may pass, but there will be no electrolytic corrosion. In this manner cables have been protected.

It has been stated in the discussion that alternating-current electrolysis does not need to be feared, because it is only one-half of one per cent., or even less, of direct-current electrolytic action. I understand that in many cases of telephone cables an electrolytic corrosion, amounting to one-half per cent. of the direct current would be disruptive in a very short time of the lead cable, and entirely permissible. I believe that was the great fear which was expressed by those responsible for the maintenance of lead structures, that, even with the greatly reduced electrolytic corrosion, due to the alternating current, the corrosion would still be destructive and harmful to the telephone cables, because against direct current the lead cables can be protected, but against the alternating current it did not seem possible. It is only in isolated places where moisture condenses, and the cable comes in contact with moisture, and in those spots, where the current is high, rapid destruction would take place, and may be expected if no protective action is resorted to. It is true that direct current would strain also, and somewhere eat up the metal. That it does anyhow, and when we say we can protect lead cables against direct-current electrolysis by making them negative, that means that, although we may prevent the electrolysis at one point, somewhere else it may take place. The rail may act as a return, but that can stand it, because, even with the direct-current electrolysis, the total amount of corrosion when distributed over the whole extent of rails in the railroad return, with its inch or more thickness, does not amount to anything. We may well neglect it altogether. It is only in lead cables and thin cable sheaths and exposed places where damage may result, so the stray superimposed direct current would not need to be feared in its electrolytical effect on the positive side of the rail return. The problem of guarding against electrolysis of iron rails and gas and water pipes is not a very difficult proposition. It is mostly the problem of guarding against electrolytic destruction of lead cables, and from the alternating current, slow as its action may be, it is still altogether too high to be permissible in very many cases.

If we can protect against the alternating current or direct current, we may then lay out a system of negative feeders for an underground cable system, so as to insure that the total stray alternating current will be within the limits for the total direct current superimposed upon it. Investigation along the same lines as Mr. Rhodes' paper proposes may well be carried out, and it will result in an intelligent protection of the lead-cable system against alternating-current electrolysis.

Mr. Knudson's paper could not be considered as a conclusive decision on electrolytic corrosion of iron in concrete, but merely as some preliminary experiments, which show that a further investigation is very desirable and should be made. All that the paper really shows is that a piece of iron in a concrete block will actually give results different if a direct current is made to flow, than if no current is made to flow. The whole phenomena resulting from the stray currents on concrete structure may well be further investigated in view of the importance of concrete as structural material in the ground.

In regard to the protection by negative feeders and permissible potential drop against ground, if you keep the potential difference between rail and ground in the return circuit below one volt, you will not be troubled with electrolysis. Lead is a structure which requires special protection, and can be protected by maintaining the negative against ground. If all the water and gas pipes are connected to the negative terminal of the dynamo, and maintained negative, that is a complete protection for them. Everything can be maintained by making it negative, and the question of electrolysis of outside structures need not be considered.

Mr. Knudson then explained further the views shown in his paper, which were thrown upon the screen, and in the course of his remarks stated that the water meters referred to in his paper were made of bronze and not of iron.

Induction Motors In Havana, Cuba.

Manufacturing interests in Cuba have not been slow to realize the advantages of electricity for power purposes, as is indicated by the increasing exports of electrical apparatus to that country.

FIG. 1. INDUCTION MOTOR IN CIGAR-BOX FACTORY IN HAVANA.

This is especially true of induction motors, two recent applications of which in Havana—one from a viewpoint of economy alone, the other from consideration of novelty as well as economy—may prove of interest.

Fig. 1 shows a 15-horsepower 1,200-220-volt form L induction motor installed in the cigar-box factory of Diaz & Vega. This motor operates, through a line shaft, a large number of small circular and jig saws on the first and second floors of the establishment. The interesting part of this installation consists in the fact that a steam engine and boiler costing to install some $3,500, and still new, were replaced by the motor at a fraction of the cost of the steam plant.

FIG. 2. ELECTRIC DRIVE USED IN FINISHING MARBLE TILES IN HAVANA.

The new Centro Dependiente clubhouse now building on the Prado, Havana, will be, when finished, both the largest and most costly building on the island of Cuba. Large quantities of marble tiling are being used in the construction of the floors and staircases, for the rapid installation and finishing of which the "rubbing bed and tiling machine" shown in Figs. 2 and 3 was devised. This machine is operated by a 15-horsepower induction motor. It is interesting to note that four

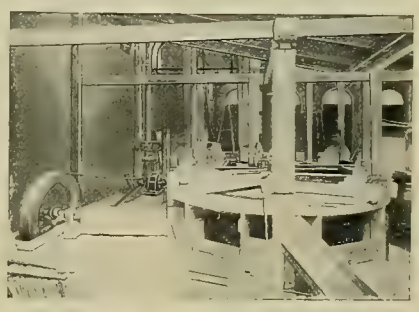


FIG. 3. RUBBING-BED AND TILING MACHINE, ELECTRICALLY DRIVEN, IN HAVANA.

men working at the electrically driven "rubbing bed" can accomplish in one day what formerly would have required a week with the same number of operatives, using older methods.

Both of the motors mentioned were sold through Sussdorf Zaldo & Co., agents for the General Electric Company in the island of Cuba.

Readiness to Serve.

In the February number of Edison Light, published by the Edison Electric Illuminating Company of Boston, the company gives a popular explanation of its method of charging. The following may be quoted:

"Just as the warships at Santiago had been made ready and held in readiness through no matter how many days or weeks or months for the supreme moment of need, so must the equipment of the company be ready to meet instantly the demand of the public and its customers. The company must be prepared to supply this demand at the moment it is made and to continue to supply it as long as the demand exists. Getting ready, and remaining ready, are vital factors in the production and satisfactory supply of electricity, and readiness represents more than 75 per cent. of the total cost upon which must be based the charge for electricity. The rate of the company is a differential rate—that is, it is a rate larger for the first hours of use in any installation than in subsequent use. It is a rate related to cost. After any consideration of the conditions under which electricity is produced it will be perceived that a differential rate is justly based upon those conditions."

Railway or Railroad?

By decisions rendered recently in the Hennepin County Court the Minneapolis and St. Paul Suburban Railway is declared to be an electric street railway and not a railroad in the legal sense of the term. These decisions deny the Minneapolis and St. Paul Suburban Railway the right of exercising the power of eminent domain in condemnation of land in Excelsior and Tonka Bay village for the purpose of a right-of-way for the proposed Birch Bluff extension of the Minnetonka line, and also the right to operate a line in Deephaven village without first having procured a franchise from the Village Council. The railway officials contended that their line is a railroad because it is employed as a common carrier of both passengers and freight to the lake points, therefore removing it from the street-railway class.

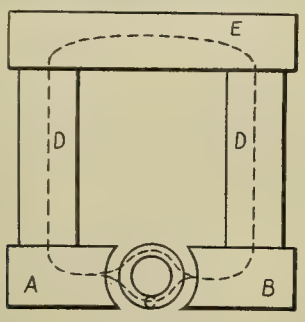
ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

VI.—Dynamo-electric Machinery.

The Armature.

The armature is that part of a generator which supplies the main working current for the outside circuit, and it is similar in function to the elementary loop of wire in which a current is generated when moved past the poles of a magnet in such a way as to cut a varying number of lines of force. The winding of an armature contains



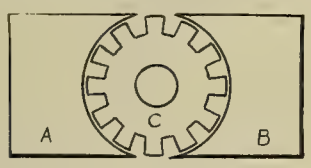
MAGNETIC CIRCUIT OF TWO-POLE GENERATOR WITH SMOOTH ARMATURE CORE.

a series of just such loops of wire assembled upon an iron core, the object of the latter being to offer an easy path for the magnetic lines of force generated in the field magnets.

In some very old machines the armature windings were built up without an iron core, but such a construction is very inefficient. Not only is a core used in all modern armatures, but almost all cores are now provided with teeth around their circumferences, between which the windings are laid, the object being to make as small an air-gap between the armature and pole faces as is consistent with safe mechanical construction. This toothed construction not only reduces the magnetizing current by a large amount, but it also serves the very useful purpose of keeping the armature conductors firmly in place.

The value of a small air-gap may be gathered by means of the accompanying illustrations. In the first figure is shown the magnetic circuit of a typical two-pole machine, including the pole pieces (A) (B), the armature core (C), the poles (D) (D), and the neutral portion (E).

In calculating the number of turns required to



TOOTHED ARMATURE CORE, SHOWING REDUCTION IN AIR-GAP.

energize this magnetic frame the process is to calculate the ampere-turns necessary for each of the different portions of the circuit and take the total of these figures for the total ampere-turns required for the machine. It will be found that where a large space exists between the armature core and the pole-faces, as is shown between (A) and (C) and (C) and (B), far more ampere-turns are required to force the magnetism through these air-gaps than are necessary for all the rest of the magnetic circuit.

The effect of using the toothed armature core is shown in the following illustration. Here the windings, instead of lying upon the outside of a smooth core, are sunk between projecting teeth, which extend very close to the pole-faces. This gives a much smaller air-gap in the magnetic circuit, and consequently fewer ampere-turns are required to energize the machine. These toothed armature cores were invented by an Italian in the very early days of electric machinery, and, strangely enough, the value of the discovery was not appreciated, nor was it put to any practical use until recent years. Now, however, practically all armature cores are provided with teeth.

The armature core revolving within a magnetic field offers the same opportunity for an induced current within it as do the conductors. These stray currents induced in the core are known as Foucault or eddy currents and are extremely wasteful of power, as their energy is expended in heating up the metal in which they circulate.

In order to provide against eddy current the cores are made of laminations of sheet metal, each lamination being insulated from the next one, so that there is no path available for the eddy currents, which tend to circulate lengthwise through the armature core, and at the same time the magnetic circuit which traverses the core transversely is not broken by the laminations. In practice these laminations are made of very thin wrought iron of the finest quality and are frequently annealed. They are then varnished all over and assembled either directly upon the armature shaft or between two spiders mounted upon the shaft.

It is frequently necessary to pass bolts through the core in order to fasten it to the spider, and when this is done the bolts are thoroughly insulated from the laminations through which they pass, in order to avoid the heating effects of eddy currents which might be set up within them.

The heating of all kinds of electrical machinery is one of the most important points the designing engineer has to contend with. It is the heating effect which really determines the ultimate capacity of a generator or a motor. A generator will in-

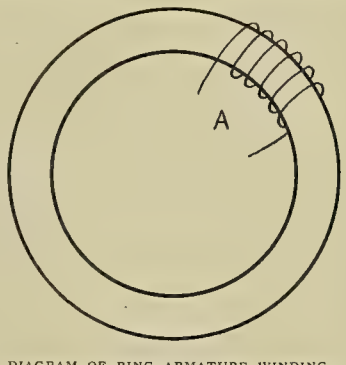


DIAGRAM OF RING ARMATURE WINDING.

crease its output automatically, provided it has sufficient driving power behind it, as long as additional loads are thrown upon it. The greater the output of its current the greater is the heating effect on both the conductors and the magnetic circuit, and ultimately a point is reached where the insulation is endangered or the conductors are liable to be melted owing to the rise in temperature of the machine. It is apparent that the temperature of the various parts of the generator is the limiting measure of its capacity, and it is therefore essential to adopt every available means to prevent the dissipation of current as heat.

Armature Windings.

There is a wide variety of armature windings for both direct-current and alternating-current

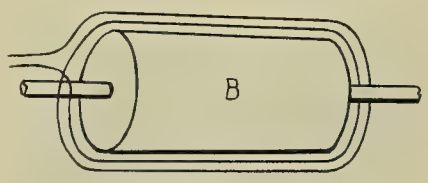


DIAGRAM OF DRUM ARMATURE WINDING.

machines, the differences in the winding depending upon the special use for which the machine is built. In general, direct-current machines are wound quite differently from alternating-current machines, although any direct-current winding could be used for alternating-current winding. The converse of this, however—namely, that any alternating-current winding would do for a direct-current machine—does not hold good.

Taking up, first, direct-current machines, we have two general types of armatures, one known as the ring type and the other as the drum type. The difference in these two types of winding is shown in the accompanying sketches. In the ring type the armature core is made up of laminations in the form of a ring, and the winding is wound about this ring as illustrated at (A). In the drum type of armature the core usually extends nearly to the shaft, and the winding is wound around the outside of the entire drum, as shown at (B).

The difference, therefore, between the ring winding and the drum winding is that all of the wire in the drum winding is distributed about the outside surface of the core except that part which runs across the ends of the core, while in the ring winding a very much smaller proportion of the winding lies on the outside of the core, and that part which lies inside and at each side of the core merely serves as a connection for the part which is situated on the exterior of the core.

In the ring winding each loop of wire is in series with the next, the connection being made by that portion of the wire which lies inside the ring. On a drum armature what might be called the return portion of the loop lies on the outside of the core, and, in order that the electromotive force of one side of the loop shall not oppose that of the opposite side, each side of the loop must lie under poles of opposite polarity. In a two-pole machine, therefore, the two sides of the drum winding would be diametrically opposite each other.

There are still two further general divisions to be considered in direct-current armature windings. These are the closed-coil windings and the open-coil windings. In the closed-coil windings the wire, whether on the ring type or drum type of armature, forms in effect one continuous and unbroken coil which constitutes the whole body of the winding. In practice each section of the winding, corresponding to one division of the commutator, is usually put on as a separate coil, but in the closed-coil winding the effect of the connections of the different coils to the commutator is to make the entire winding one continuous coil, having taps connecting it to the commutator segments at regular intervals.

Closed-coil windings are far more generally used than open-coil windings. Closed-coil winding gives a constant pressure or voltage, and the amount of current varies with the load upon the generator. All generators for operating incandescent lighting, driving motors and for running certain kinds of arc lights are of the closed-coil type.

The open-coil type of winding has the effect of producing a constant current, whose pressure varies with the load, and the principal use to which these machines are put is the operation of series arc lamps. The arrangement of the open-coil winding is that each coil acts as an independent unit, and one end of the coil is connected to one commutator bar and the other end to another bar directly opposite it. This arrangement leaves the ends of the coil open except when they are closed through the brushes in series with the outside circuit, and therefore the current is broken each time a commutator segment passes under a brush. This abrupt breaking of the current each time a commutator bar passes under the brushes generally results in considerable sparking at the commutators.

Commutators.

It was explained in a previous chapter that a current actually generated in any armature coil is an alternating current, as the coil first cuts the lines of force passing from the north to the south pole in one part of a revolution, and the next portion of the revolution is cutting lines of force passing from the south to the north pole.

The commutator consists of a number of copper segments each thoroughly insulated from the rest, the whole being turned in the shape of a cylinder, which is located upon the shaft at one end of the armature. The number of commutator segments is usually the same as the number of coils upon the armature, and this number is generally chosen with relation to the voltage of the machine, so that the average electrical pressure between two adjacent commutator bars shall not be so high as to permit the current to flash over from one bar to the next.

The brushes which rest upon the commutator are either small blocks of carbon or strips of soft copper, and their function is to lead the current from each coil successively as it attains its maximum value. If the brushes are adjusted to the right position, the commutator bars connecting under the brushes will always have the same pressure. In this way a continuous current is drawn from the machine. By a continuous current is meant a current flowing always in the same direction.

The strength of the current taken off is not

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

absolutely uniform, but is what might be called pulsating. These pulsations in strength vary with the number of commutator bars used. If less than 30 coils are used in a machine for incandescent lighting, the pulsations become perceptible, but by increasing the number of coils they can be reduced to any desired amount. The commutator, therefore, carries all the current generated in the machine, which has a tendency to heat it considerably, and in addition to this the friction of the brushes also adds to the heat effect. It is, therefore, one of the most vulnerable points of a direct-current machine, and in order to avoid trouble each segment must be very thoroughly insulated from the others and from the shaft on which it is mounted. The best quality of mica only should be used in building up the machines, and the mica should be perfectly clear, free from cracks and uniform in thickness.

[To be continued.]

Some Aspects of Modern Switchboard Engineering.

By C. W. Stone.

Part II.

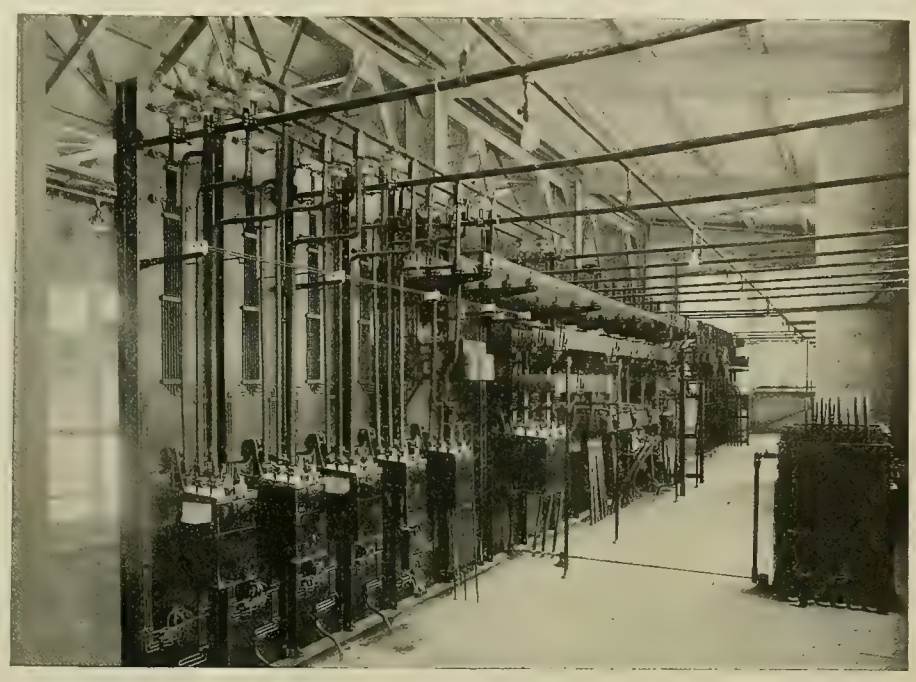
Materials of Panels.

A number of different materials have been used for panels carrying the instruments and switches; the principal ones are slate and marble. Slate has been finished in a number of different ways. In some cases it is black enameled; in other cases it has been marbleized; in other cases it has been finished with a dull black paint; but the best finish seems to be to take a fine quality of black slate and finish it with a smooth dull finish, and then oil it. This makes practically an indestructible finish, and in case of scratches simply rubbing over the finish with a little oily waste will remove it.

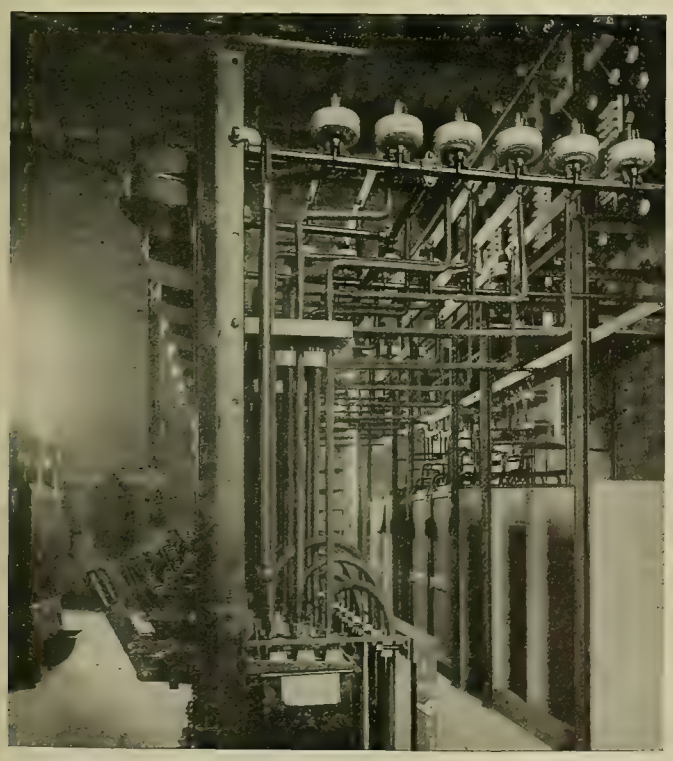
Different kinds of marble have been used, such as pink Tennessee, white Italian marble, white Vermont marble and blue Vermont marble. Pink Tennessee marble is difficult to get in large quantities, and varies so in color that it is very difficult to match the different panels. White marble, either of the Italian or Vermont quality, is very easily discolored, particularly by oil. Blue Vermont marble, however, being of a slightly darker color, does not show stains as quickly as white marble, and can be obtained in large quantities. This marble, while it varies greatly in its general markings and in its general color, can be very readily matched, so that when a complete switchboard is ordered it is possible to look over the stock and pick out panels which will match sufficiently close to give a good general appearance.

Marble is not as necessary for high-tension switchboards as formerly, as with the oil switches no dependence is placed on the marble for insulation.

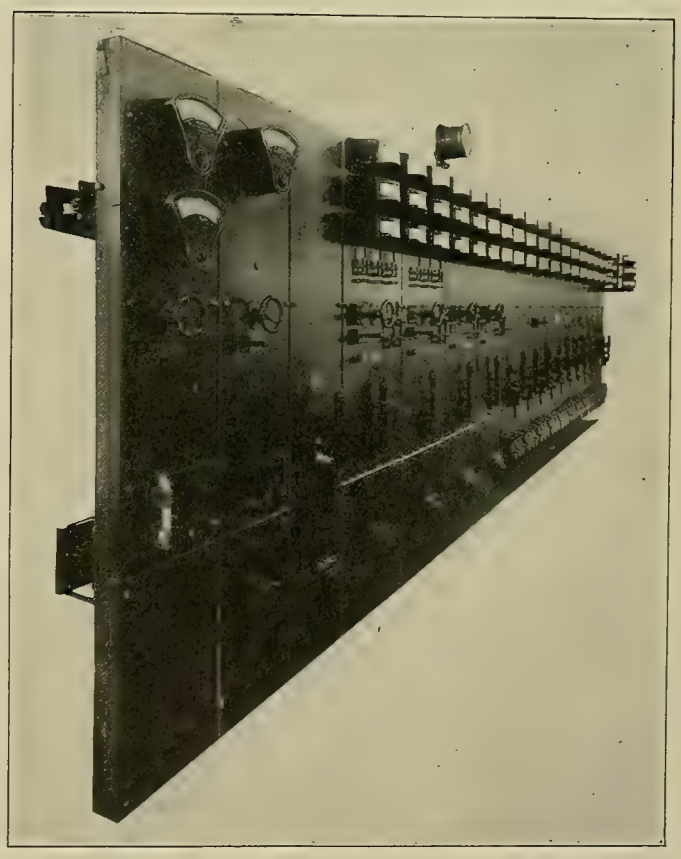
The question is often raised as to how to remove oil stains from marble. There is no good way that I have ever heard of for removing oil stains which are of long standing. However, it is possible, if the stains are comparatively new, to remove them by several different methods. One method is to use a blow torch, but this is a very careful operation, as, unless carefully used, the marble is very liable to crack. Another method is to cover over the portion of the marble which is stained with a preparation of plaster of paris, allowing this plaster of paris to harden. It will then absorb, during this process, most of the oil. This process can be repeated several times if necessary. Another method is to saturate the panels with oil in the first place; thus they will not show any stains. This method, however, is thought objectionable by some people, on account of the rather dirty gray appearance of the marble.



REAR VIEW OF SWITCHBOARD AT CALUMET AND HECLA MINE, CALUMET, MICH.



SIDE VIEW OF SWITCHBOARD AT CALUMET AND HECLA MINE, CALUMET, MICH.



ALTERNATING AND DIRECT-CURRENT SWITCHBOARD OF 18 PANELS.

Relays, etc.

In direct-current practice the only relays which are used to any great extent are straight overload relays, which are usually made a part of the direct-current circuit-breaker. For special work, such as storage-battery work, an underload relay is often required. This relay simply opens the circuit when the current has dropped below a certain value.

Reverse-current relays for direct-current work are considered necessary when storage batteries are used in connection with motor-generator sets and rotary converter sets, in order that in case of trouble on the high-tension side of the system the storage batteries will not feed back through the rotary converters or motor-generator sets. These relays are very simple in construction, consisting simply of a horseshoe frame of iron, which is placed around the stud of the circuit-breakers. The ends of this horseshoe frame are equipped with pole-pieces, between which is placed a shuttle armature with a single winding. This winding is connected across the bus-bars. Thus with any current flowing through the stud of the circuit-breaker, the armature tends to rotate in a certain direction. A stop, however, is provided to prevent movement beyond a certain point. If the current reverses

naturally the armature of this relay would tend to revolve in the opposite direction. Contacts are provided so that in case movement in this direction takes place, contacts will be closed and will close a circuit through a shunt trip coil provided on the circuit-breaker, or in some cases will short-circuit a no-voltage coil which is placed on the circuit-breaker.

For alternating-current work a number of different types of relays are in use. The overload relay which has been generally used consists of a simple solenoid and a set of contacts so arranged that the movement of the plunger in the solenoid will either close or open the contacts. Where it is possible to obtain direct current for the tripping of the different circuit-breakers, the type of relay usually used is the one which has the contacts normally opened. In sub-station practice it is frequently impossible to obtain any constant source of power to do the actual work of tripping the devices. In cases of this kind contacts on the relay are usually reversed and current from the current transformers is used for tripping the circuit-breakers. Under normal operation the trip coil will be short-circuited by contacts, but in case of overload the contacts would open, thus sending the alternating current through the trip coil of the circuit-breaker.

These relays are made both for instantaneous operation and with time-limit arrangements. The best type of time-limit arrangement to use in most cases is one which has been developed in the last few years, which consists of a simple bellows placed above the contacts and fastened to the plunger. This bellows is provided with a small valve at the top, the opening of which can be adjusted so that the relay can be set for any desired time. With a relay of this type it will be seen that the time element is dependent upon the amount of current flowing through the solenoid and is practically directly proportionate to this current. Thus, if set for a certain time with a certain current, if the current is double, the relay will open in practically half the time, and in cases of short-circuit it becomes practically instantaneous.

Another type of time limit relay is the definite type, which is made in two ways. One is the bellows type, which is very similar to the inverse time element type, the only difference being that the plunger is not rigidly connected to the bellows, and has a spring interposed in such a manner as to make the pressure on the bellows constant whenever the relay operates. The other form is a clockwork mechanism, which consists simply of an ordinary clock mechanism which revolves a fan, the blades of which can be adjusted so as to obtain a predetermined time of operation. This clock mechanism is released by a simple electromagnet connected to the series transformers in the circuit.

There have been no reverse-current relays developed for use on alternating currents which can be depended upon at all times. Many different types have been brought out, which, under certain circumstances, operate very satisfactorily, and before any are recommended the operating conditions should be very carefully studied and the type to use determined after this investigation.

General Arrangement of Apparatus.

The general arrangement of switchboards and switchboard apparatus is of necessity more or less determined by the local conditions.

The general dimensions of panels have been more or less standard for a number of years. The height is 90 inches, and the panel is divided into two sections. The lower section of the General Electric panels is 28 inches and of the Westinghouse panels 25 inches.

All switchboards are laid out with the idea of using standard height panels, and by making many different arrangements of instruments and switches it made it possible to determine on the best locations of the different devices on the panel. By so doing any standard panel for any machine or feeder can be added to the switchboard and one can be sure that all the devices will line up. All instruments should be so placed as to be easily reached by the attendant, and also high enough on the panel so that they will not be readily injured.

All operating devices should be mounted beneath the instruments, except the direct-current circuit-breakers, which, as stated above, should be at the top of the panel and should be so constructed that they can be readily operated when in this position.

The location of the bus-bars and connections cannot always be the same, but on direct-current switchboards it is much better to place them in back and at the top of the panels. Sometimes this will mean some extra copper, but on the other hand the back of the board is very much more accessible and the chances of short-circuits on the buses are much less. Great attention should be paid to making the back of the panels as simple and as open as possible.

High-tension alternating-current switchboards for medium voltages and for medium-capacity stations should have the buses mounted at the top and in back of the board, or in some cases beneath the floor, and the oil switches mounted directly on the panel or preferably on a pipe framework at a considerable distance back of the panels. As the potential increases and the capacity of stations increases, extraordinary precautions must be taken to prevent any trouble and to confine any trouble. Switches should be mounted in brick compartments, and at 10,000 volts or above the switches should be made up of single-pole elements and each pole kept in a separate compartment. The bus-bars should also be placed in brick or concrete compartments, keeping each phase separate from the others.

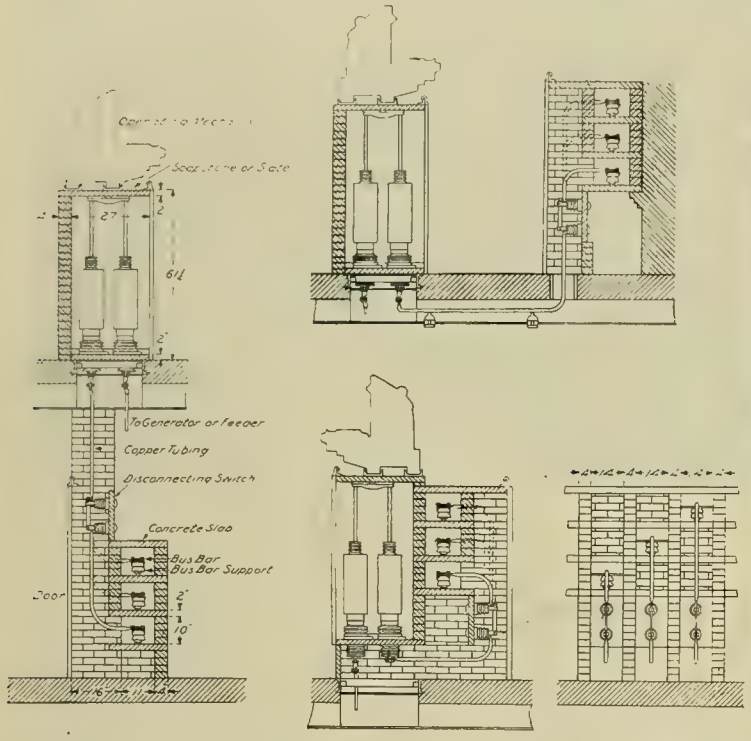
Some engineers seem to prefer the end of the station for the switchboard, but this is about the worst place that can be chosen. One can never tell to what size the station may grow, and consequently may find that later it will be necessary to move the entire switchboard to some other place, which is not only expensive but it is also difficult when the board must be alive at all times.

I think that in the majority of cases it will be found that, all things considered, it will be best to locate the board along the wall opposite the boiler room, avoiding galleries as much as possible. Many galleries always mean long and expensive runs of cable and controlling circuits, and in consequence increases the chances of trouble. If the feeders go out below, the switches can be placed on the main floor and the bus-bars and compartments placed in the basement. If it is not possible to get the buses in the basement, it is possible to build one gallery for the switches, and place the buses on the main floor.

A number of stations have been built recently with all the switching devices in a separate house. This has numerous advantages. The switchboard men are not disturbed by any unusual sounds, and in case of trouble in the engine room, such as a broken steam main, would not cause them to become confused and make wrong moves. All the necessary orders can be transmitted, either by signal devices or by telephone. A separate switch house, of course, is not desirable, except in very large stations.

No matter what arrangement is decided upon, one should always keep in mind that simplicity means that troubles become less. Do not provide some automatic protection if it is possible by changing the arrangement to dispense with it. Flexibility is a good thing to have, but the more flexible the switchboard the more complex it becomes, and then automatic devices become necessary. And after they are put in it is found that, to assure their accurate operation, others must be put in also.

[*The end.*]



TYPICAL ARRANGEMENT OF 13,200-VOLT BUS-BARS, OIL SWITCHES, ETC., IN THREE-PHASE STATION.

50-CYCLE ALTERNATING AND DIRECT-CURRENT CONTROLLING AND INSTRUMENT BOARD FOR NECAXA, MEXICO.

Continued High Price of Copper.

Under date of February 20th the "Copper Gossip" circular of the National Conduit and Cable Company of New York says:

"The situation as regards the copper market shows a tendency to continued firmness, and there is no semblance at this writing of an immediate change in the character of the market. There has been very little fluctuation in local quotations for a considerable time, and new business for several weeks did not figure up to the heavy transactions we were accustomed to hear of a few months ago. A fresh buying movement was started recently, however, which resulted in producers disposing of large quantities of copper for future deliveries. Latest sales include deliveries up to May and June. The market for distant futures now quotes 25¼ to 25½ for electrolytic wire bars, with Lake as high as 26 cents for the best brands.

"If we are able rightly to gauge conditions, we believe consumers of copper, to an extent more or less annoying, are compelled to operate their plants under disadvantages because of the inability to procure copper up to the level of their requirements during the next two or three months. There is no question that some of the leading consuming interests deem it inconsistent with conservative methods and strictly sound business principles to run short-handed for the next 90 days, and at the same time jump into the market and load themselves up with copper at present prices, for which they cannot obtain delivery before the months of May, June and July. What the level-headed manufacturer specially wants is copper now wherewith he can fill his orders in February, March and April, and when April comes round he will be fully

prepared to negotiate for his May, June and July copper on the market basis then current.

"Consumers of copper are in the position where they want to be reassured to a tolerably definite extent that everything possible will be done to prevent a scantiness in the supplies of raw material. This is necessary for the promotion of good and satisfactory business conditions. The present remarkable success of the entire copper-mining industry is owing to the enormous demand for the product of the companies furnishing the metal, and every consumer is contributing his quota to the marvelous prosperity of the copper companies. We disclaim most positively any disposition whatsoever to make any rash or unmerited criticism on the methods of producing interests or to dictate what their policy should be, but we do believe the importance and magnitude of the establishments melting down copper in this country are such that they may rightly claim every reasonable consideration from those who have it in their power to adjust matters to prevailing conditions, so that the least possible hardship or injury will be done to the great and influential body of manufacturers dependent upon copper for from 75 to 90 per cent. of their raw material."

QUESTIONS AND ANSWERS.

Dynamo Output.

J. R., Peoria: If the voltage that a dynamo will generate is proportional to cutting of lines of force, what will the output in amperes be proportional to?

ANSWER.

The ampere output of a direct-current machine is directly proportional to the voltage of the terminals and inversely proportional to the resistance of the external circuit.

Primary Battery Troubles.

W. T. H., Hammond, Ind.: I am caring for gravity batteries and would like to know the cause of that dark deposit that forms on the zincs. What will prevent it? What causes the crystallizing of vitriol? Can it be prevented?

ANSWERS.

The dark deposit that forms on the zinc is black cuprous oxide (CuO), that is, oxidized copper from the blue vitriol (copper sulphate, $CuSO_4$). If blue vitriol and water alone are used for the electrolyte, and especially if the cell is allowed to remain with its circuit open, the copper sulphate diffuses upward, and when it reaches the zinc the black deposit is formed and sometimes crystals of copper become suspended from the zinc. The battery should therefore be kept on a closed circuit of comparatively high resistance when not in use. It is well to draw off the white vitriol (zinc sulphate, $ZnSO_4$) from time to time and replace with water. Crystals of copper sulphate must also be added occasionally.

Crystallization of the zinc sulphate is due to the evaporation of the water. The sulphate creeps up over the edge of the jar and flows over the sides. By dipping the top of the jar in hot paraffine this creeping can be prevented.

Commutator Sparking.

W. H. D., Chicago: Why does a commutator spark when brushes are not in right place?

ANSWER.

When there is no current flowing in the armature the lines of force between the poles, which are due to the field excitation, are not disturbed and are very nearly symmetrically distributed along the pole faces. The points at which the armature coils then cut the least lines of force are midway between the poles or in a plane at right angles to a line passing through the center of pole-pieces. This is the commutating plane for no load. When current flows in the armature the magnetic field due to this current produces a distortion in the lines of force set up by the regular excitation. This distortion causes the plane of the points at which the least lines of force are cut by the armature conductor to be moved at an angle from the perpendicular plane. In a generator this movement is in the direction of rotation and in a motor in the opposite direction. If the brushes are not moved to correspond, and if the armature has fairly high reaction, sparking will result. This is because at any other than the correct position the brushes, when spanning two commutator segments, will short-circuit an armature coil through which more or less current is flowing, and also because current will be reversed in some coils before it has dropped to zero.

Armature Reaction.

W. H. D., Chicago: Please explain armature reaction.

ANSWER.

The magnetic effect of the current flowing in the armature to distort, weaken or strengthen the fields is usually termed armature reaction and is one of the causes of the drop at the terminals of the generator as the output is increased.

In direct-current machines the magnetic field produced by the ampere-turns of the armature is at right angles, or very nearly so, to the lines of force between the pole-pieces, and it is this field that has a tendency to distort the fields toward the trailing pole-tips in dynamos, with the reverse tendency in motors. The distorting of the fields is minimized and reduced to an inappreciable amount in the design of the pole-pieces. The effect of the armature ampere-turns, usually called cross-turns, is compensated for in the calculation of the ampere-turns for the fields.

In alternating-current machines the armature current has very little effect on the fields when the current is in phase with the pressure, but when the current is lagging or leading it has a powerful effect. A current lagging 90° will have a maximum effect when the coils are midway between the poles and will consequently weaken the fields. This is true in the case of a generator, but for a motor it has a strengthening effect. Distributed windings minimize the effect of the current when out of phase. When the load has a power factor of zero the demagnetizing effect is practically 100 per cent., and when the load has a power factor of 100 per cent. the demagnetizing effect is practically zero.

Self-induction should also be included in armature reaction, but in modern machines this effect on the drop at the terminals of the machine is of little consequence.

Installation and Construction of Rheostats.

Differences of opinion exist concerning the relative merits of ventilated and enclosed types of rheostats. Just at this time when some changes in the National Electrical Code bearing on this question are suggested by a sub-committee for consideration by the Electrical Committee of the Underwriters' National Electrical Association at its meeting on March 27th and 28th, discussion on the subject is especially welcome. It is worth while, therefore, to quote from a comparison of ventilated and enclosed resistances by an experienced maker of both types, the Cutler-Hammer Manufacturing Company of Milwaukee. This company is issuing a 12-page booklet on this subject, entitled "A Tale of Two Types." Advance sheets have been kindly furnished to the Western Electrician, and from them the following extracts are taken:

Careful study of the two types, exhaustive tests and experiments, and long-continued observation of the rival types under service conditions have demonstrated that for nearly all purposes the ventilated type is best; and practical expression of this conviction is found in the fact that in 90 out of every 100 installations the ventilated type is given the preference. This, too, in spite of the fact that an enclosed or sandbox type of rheostat has been and is being offered at a lower price.

Under certain conditions, as, for instance, in flour mills, or other places where inflammable dust or vapors are present in large quantities, wisdom will dictate the installation of an enclosed type of rheostat, not because it is better than the ventilated type, but because the exceptional conditions existing in flour mills and similar places render inadvisable the use of the best type of rheostat.

Concerning a paragraph in the Underwriters' rules stating that "starting rheostats and auto-starters should be treated about the same as knife switches, and in all wet, dusty or linty places should be enclosed in dust-tight fireproof cabinets," the booklet says: There can be no objection to insisting on extra precautions when exceptional conditions demand it, and had the sub-committee appointed in December, 1905, to revise the rules and requirements of the National Board in so far as they relate to starting rheostats clearly differentiated between exceptional and ordinary conditions its work would have met with general approval. Unfortunately, its recommendations, which will be submitted for approval to the electrical committee at its next meeting, do not so differentiate, but in effect make it necessary to employ an enclosed type of rheostat under all conditions, whether the installation is designed for a flour mill, a furniture factory or a foundry.

A change in the rules governing the construction of rheostats suggested by a sub-committee of the Underwriters' Association reads: "For motor-starting rheostats of small or medium size the material of the resistance should be such that it will not change its value with rise of temperature." This, says the booklet, is equivalent to prohibiting the use of ventilated resistances of "small or medium size," because all standard starting rheostats of this type, of whatever make, use iron as the resistance material, and the resistance offered to the passage of the electric current by iron does change with rise of temperature.

Starting rheostats using alloys possessing low-temperature coefficients as the resistance material are a commercial possibility only when enclosed, and then only because of the small amount of resistance material incorporated in them. If the use of these alloys is made obligatory in rheostats of the ventilated type the cost of the large amount of higher-priced resistance material called for in constructions of this type will render the further manufacture of ventilated resistances a commercial impossibility.

The enclosed type of rheostat sweats inside under certain atmospheric conditions, making absolutely necessary the use of non-corrosive resistance material in its construction. It so happens that the commercially available non-corrosive alloys possess the quality of low-temperature coefficient, and as these alloys must be used in enclosed types of construction, manufacturers of enclosed resistances have made a virtue of necessity by employing low-temperature coefficient resistance material, not because it is desirable in itself but because constructional conditions demand it. The cost of these non-corrosive alloys being much higher than the iron resistances used in ventilated constructions, it follows that in order to compete in price with rheostats using iron as the resistance material the manufacturer of enclosed resistances must economize on the amount of resistance material used, and this has led to the employment of sand in enclosed starting boxes, the function of the sand being to absorb the heat generated in the resistance material when in service.

The ventilated type of rheostat gives a larger margin of safety for overloads than the enclosed type, and will recover more quickly from the effects of such overloads, due to the fact that the heat resulting from the passage of current is more quickly radiated. Under these conditions a ventilated type of rheostat will successfully withstand the repeated starting of the motor under load, while the enclosed type, as at present constructed, will open circuit.

It is safe to assume that motor manufacturers know what is best in their own business. They have tried both the enclosed and ventilated type of starting box and have almost without exception decided in favor of the latter. Every motor manufacturer knows that the enclosed type of rheostat as exemplified by a cast-iron box containing a resistance ribbon embedded in sand has not met with general acceptance by the trade. This has not been on account of price, as repeated attempts have been made to sell enclosed apparatus at lower prices than are asked for ventilated rheostats. It seems fair, therefore, to infer that if the motor men have been and are today purchasing the higher-priced apparatus in preference to the other, it must be because the ventilated type of rheostat possesses inherent advantages which are lacking in the enclosed type.

The reason for the quiet burning out of the enclosed rheostat is due solely to the fact that its capacity is such that it can carry the current only for an extremely limited time. In other words, the enclosed-type starting rheostat will not stay in circuit long enough to develop external evidences of heat. This may be desirable from the point of view of the underwriter, but it is safe to say that such a performance would not be considered a good "talking point" by motor manufacturers.

The Inland Empire System.

Several articles have appeared in the Western Electrician (October 14, 1905; August 25, 1906; February 2, 1907, and in other issues) describing and illustrating the extensive system of the Spokane (Wash.) and Inland Empire electric-railway system. The additional details which follow will be of interest:

Progress is being made at the company's generating plant at Nine-mile Bridge, where the waters of the Spokane River are being harnessed to furnish 10,000 horsepower for operating railway lines and furnishing light and power. William F. Zimmerman, representing the company, is consulting engineer, the designing and constructing engineers being Sanderson & Porter, and the work is being carried forward under the supervision of F. M. Sylvester, local manager. The development of power is being accomplished by diverting the river, with a flow of 12,000 cubic feet a second, from its natural channel. The dam will be 75 feet at its base and 225 feet in length, exclusive of the power house, 110 by 87 feet, 87 feet above the low-water mark, forming part of the dam, which will create a head of water of 60 feet, also backing the water a distance of five miles, thus furnishing storage to carry large fluctuation of load. The plant is designed to accommodate four 5,000-horsepower units, two of which are being installed. The electric generators will be 3,750 kilowatts, three-phase, 2,200-volt, 60-cycle alternators. The plant will be in operation within a year.

A storage-battery plant of large size has been in-

stalled on the Coeur d'Alene and the Spokane and Inland lines, and in connection with these is a frequency changing station. The company buys its power from the Washington Water Power Company on a basis of $20 a horsepower a year for 24 hours service. The surplus energy occasioned by light loads on the lines is utilized in the battery system. The battery contains 275 cells.

President Jay P. Graves' application for a franchise to build a subway on Main and Front Avenue, Spokane, to connect the freight terminal with the main passenger station, a distance of nearly a mile, has been granted by the City Council of Spokane, and it is given out that work will begin in a short time. The subway will be double-tracked, 30 feet deep, built of concrete and stone. The franchise provides that it must be completed in five years, but Mr. Graves says it will be ready in half that time. The purpose is to afford rapid transit within the city limits. As the franchise permits the use of steam and electricity, it is not unlikely that the Chicago, Milwaukee and St. Paul, the North Coast and the Kettle Valley Railway lines will use it to gain entrance to the heart of the city.

Street Lighting Discussed by Illuminating Engineers.

A brief report of the meeting of the Chicago branch of the Illuminating Engineering Society in the Coliseum on January 17th was given in the Western Electrician at the time. The meeting devoted itself to a discussion of the problems of street lighting, and the general subject was divided into three questions, viz.: Large vs. small units in street lighting; globes and reflectors for street lamps, and new street lights. There were a number of well-informed speakers, and the following abstract from the stenographer's report will be of interest:

Albert Scheible: The question of large versus small units is interwoven with that of the permissible spacing and locating of the lamps, and the latter in turn will vary with the purposes to be accomplished by street lighting. If street lighting had always been only a single aim, the problem would be simpler, but conceptions of it differ, and practice must vary accordingly. Path-finding is one of the great aims of all street lighting. The other aim, to which too little attention has been paid, is crime-preventing. The prevention of crime by street lights makes three demands, the first being the absence of strong contrasts. These we find whenever lamps are placed so far apart that their rays do not appreciably overlap, so that consequently we have a strong shadow contrasting with the light on the street nearer the lamp. Second, the police function, or prevention of crime by street lighting cannot be complete unless the alley entrances are lit also. How we are to do that without small units at those entrances is more than I can see.

Then, this crime-preventing by street lighting also means that our street illumination should not be judged merely on the level of the ground. If you see a man approaching after dark, you do not care what his feet are like; it is his face that you want to see, and what he has in his hand; and that means a level considerably above the ground. The curves given for present street lighting and the heights of lamps, all seem to have been based on getting the illumination on the level of the street, although the lighting that would enable you to see at a height of three or four feet above the ground would usually be ample at the feet for path-finding. This point certainly does not seem to have been considered by those who reduced the height of their alternating arc lamps to 15 or 16 feet above the ground. Of course, an effective illumination on a higher plane than the ground means a further effort toward horizontalizing the rays of light, and unfortunately we cannot resort to prismatic reflectors, because of their expense as compared with the cheapness of brickbats and overgrown boys.

Still, we can perhaps see the ideal more clearly by noting the curve of light distribution for an ideal street lamp, as figured out by Dr. Hugo Kruess of Hamburg. It looks almost like a horizontal view of the blades of a vertical fan motor, and contrasts strikingly with the acorn-shaped distribution curve of a flaming arc lamp, leaving the curves of other lamps to come between the two. The nearer we can get to the bat's-wing type of curve, the more efficient will be the distribution of our light from any given unit.

W. D'A. Ryan, Lynn, Mass.: The question of large versus small units resolves itself into a question of local conditions and application. There are certain streets, suburban streets, and alleys where incandescent lighting does very well. There are other streets where a high-power arc is desirable. The latest lamp for street lighting in this country is known as the magnetite type. It is a lamp of the flaming-arc class; more properly, a luminous arc rather than a flaming arc. The flaming arc has a downward characteristic and is not desirable for street lighting. What we want is something on the bat's-wing order, as just shown by Mr. Scheible. The lamp takes 325 watts, has a maximum lighting distance in the illuminometer of 309 feet. Five feet above the street the direct-current light has a lighting distance of 256 feet at the same level, consuming 480 watts. There are different ways of making this comparison. We may speak of linear feet per watt, which is very useful when you are lighting straight up and down the street; or, if you are lighting in the center of a square, you are interested in comparing the square feet per watt. Comparing these two lamps in linear feet, we have in one case one-half foot per watt and in the other 0.95 foot, practically double. If we square it, on the illumination of the area, we have 254 square feet for one, as against 588 for the other. The lamp is, of course, somewhat more efficient than a direct-current arc, but its principal value is in the fact that it has this fine distribution at the maximum of 10 degrees below the horizontal.

As for incandescent street lighting, up to the present time we have not attained what might be called the best results. I am of the opinion that an incandescent lamp of 50 candlepower should be the minimum for all suburban street lighting, particularly in a town or city of any size. These 24's and 32's are too small. Further than this, we should use a reflector which will give us some value as a distributor of light rather than a water shed. At the present time we get practically nothing out of these reflectors we have been using for years, and it is not at all difficult to increase the effective illumination 35 to 40 per cent.

Frank McMaster: From my experience in street lighting, the tendency in nearly all the better-lighted cities is to the smaller units. It is perhaps one of the hardest things that the engineer has to do to measure the real light of an arc lamp on the street. The apparatus to get at any sort of reliable results is cumbersome; and when the whole thing is simmered down, it is not a matter of candlefeet or candlepower, but it is the effect. To do this with large units means that we get an effect on the eye which contracts the pupil, and as the effective light on the eye to see objects is practically entirely from reflection, where we have high-candlepower units the pupil is so closed up that we do not take in enough of this reflected light to see distinctly, and the street appears badly lighted for that reason, while the candlepower-feet delivered to the street, or four or five feet above the street, may be very high; whereas if we used a larger number of small units, we would get a more uniform distribution of the light, the pupil is not so contracted and we are able to see better, and we get a better effect. Take the cases of a number of the larger cities that are making an effort to better light the business sections. A few of these are doing it with arc lamps, but a large majority are doing it with smaller units. The incandescent lamp, particularly in the smaller units, is not a lamp for outdoors, first, on account of its color, which is yellow-red, which gives a very poor reflection from green or brown or gray, the ruling colors outdoors, and for the other reason that the incandescent lamp in the smaller units is simply "too small for the dark."

R. W. Bingham (Mr. Bingham discussed gas street lighting): The basic principle of our system is the small unit, that is, a unit of a standard 60 candlepower. When you speak of small units you must, of course, have a unit large enough to light the territory required by such unit. The great trouble, we find, with the arc electric light today is that on account of its great cost they are obliged to place them so far apart, and, in order to cover the territory required, so high that much of the intervening space is, practically, dark. This is particularly true on densely shaded streets or park districts. We find that this 60-candlepower gas light will light very satisfactorily 200 to 250 feet; therefore, when the blocks are only 300 feet long, it really only has to light 150 feet, and we find that the rays cross each other at the center of the block. In the larger cities, like New York, Philadelphia, St. Louis, etc., of course, they place these lamps closer together, having as many as six to the block in some places.

Another feature in favor of gas-mantle street lighting over incandescent electric street lighting is that a mantle street light does its best work in a horizontal direction, which, of course, is the proper direction for any street light; whereas, an incandescent electric light, especially the Nernst, throws its best light downward or toward the street immediately under the lamp. As our street lights are only about 10 feet high, and as all trees should be trimmed at least 12 feet high, the foliage does not interfere with the distribution from our lights. We use no deflectors or reflectors of any kind, for the reason that a mantle light seems to scatter in all directions, with the horizontal rays the strongest—the ideal method for street lighting.

We have put two and three lamps on one post. This not only gives much better lighting, but is very ornamental, which is one of the good features we claim for our street lighting. We do away with the unsightly poles and wires, which are particularly objectionable in the residence district, and give them the same amount of light in an ornamental shape. Of course, there are a great many people today who think that gas lighting is a step backward. They do not give us any credit for the improvements we have made along the lines of introducing mantles, special burners and handsome boulevard lamps. In a great many instances the gentlemen who seem to be prejudiced against gas lighting have never seen an up-to-date gas-lighted street. We cater particularly to the residence districts, because they are more or less shaded, which is particularly true in the smaller towns. We are not attempting to entirely eliminate electric lights from the streets. We believe that there are certain territories to which the gas light is better adapted and other territories to which the electric light is better adapted, and there is certainly plenty of room for both systems.

Edward M. Tompkins: You seem to be agreed that the large unit is the thing one place and the small another; but you speak from the standpoint of the manufacturer or salesman of lights, not from the standpoint of the man who has to pay money for them and maintain them. It comes down to dollars and cents and what will satisfy the people. The people, that is, the laymen, are not interested in "candlefeet" or "candlepower," but rather in the appearance which a street presents, while those responsible for the lighting of the streets are interested both in the appearance and cost of maintenance. In so far as my present knowledge goes, I am not familiar with any small units whose operating and maintenance costs compare favorably with the large units as at present installed, illuminating effects being the same in each case. As has been said before this evening, the small unit has its field of usefulness. But until operating charges can be reduced to a price to equalize first costs this field seems to be limited to isolated places or points where temporary lights are desired.

Frank McMaster: I happen to have a copy made from the 1906 report of the Department of Electricity of Chicago, giving the cost of operation for arc lamps, seven amperes, 4,000 hours; the mantle lamps, 3½-foot burners, 3,786 hours, rated at 60 candlepower; an open-flame lamp, rated at 20 candlepower, for 3,786 hours; and a gasoline-mantle lamp at 60 candlepower, which are let by contract. These figures are as follows:

Arc lamps, 505 watts at the bus-bars, price per year, $52.63; mantle lamps, including all labor and material, gas at $1 a thousand, 3½ feet per hour, rated 60 candlepower, $20.36; open-flame, including all labor and material, gas at $1 a thousand, 3½ feet of gas per hour, rated 20 candlepower, 3,786 hours, $16.11; gasoline mantle lamps, 60 candlepower, by contract, $25.80.

W. E. Daniels: Nearly everyone seems to be in favor of the smaller unit. Very likely it is good practice in many cases. There are places, though, where I think the large units are more advantageous. In the underground system, for street lighting, while the lamps cost, say, $20, the posts necessary to hang those lamps will cost $75 or $100, which makes the cost per lamp greater, the cost of the post, etc., being the larger part of the investment. It therefore follows that the larger the unit that can be satisfactorily used per post, the less the cost per unit of light. The appearance of the street in the daytime should also be considered. A lamp post is an ugly thing at best, and the fewer that can be used the better.

F. W. Willcox, Harrison, N. J.: My opinion is necessarily biased, because I represent the end of the business which is the small unit, that is, the incandescent lamp. The proposition, however, from a purely engineering standpoint, aside from my affiliations, has always seemed to me something like this: The arc lamp, where conditions permit of its being used at frequent enough intervals, undoubtedly gives a greater volume of light and a better service than you can obtain, perhaps, all things considered (investment, operating cost, etc.), from a smaller unit. Those conditions, however, do not obtain in a very large percentage of our installations. They are confined to relatively small portions of our large cities, and therefore affect relatively only a small percentage of the total lighting which we have to deal with. It has always seemed to me also that if it were possible to produce an efficient, satisfactory form of arc lamp of 200 candlepower, instead of 400 candlepower, or 100 candlepower, that there would be a strong tendency to distribute the lamps at more frequent intervals and not space them as we do today at 1,000 feet, and even greater distances, because of the restrictions of cost and other details. Coming back to first principles, we all know the well-known rule that uniform illumination is always the more satisfactory illumination, because it permits of very low values with satisfactory results, where non-uniform requires very high values to give anywhere near satisfactory light. It is quite readily possible, therefore, for us in a competition between the large and the small unit, to readily surpass the large unit with the small unit with even less degree of candlepower, by reason of the fact that by more frequent spacing of those units we can more evenly light the area and therefore more satisfactorily light it. A uniform lighting of one foot-candle is far more desirable than even two or three foot-candles with uneven lighting.

We all know, from testimony at previous meetings in

New York on this subject, that even today there are instances in suburban districts where requirements could not be met by arc lamps, because of collisions between vehicles, especially automobiles, because the arc lights were placed so far apart that the distances between were so poorly lighted the vehicles were constantly colliding with each other. They were replaced by incandescent lamps of much smaller candlepower, with the result that the illumination was even, and people could see their way. With the improvements of today, which are coming very rapidly, those relative advantages are going to be accenuated decidedly in favor of the incandescent lamp, it seems to me. I do not mean to say that the arc lamp is to be relegated or abandoned. It has its place, as in the city of Chicago, in the business districts. There is nothing to match it where the city appropriations permit it to be placed close enough to give reasonably uniform illumination. We have the incandescent lamp at the present time of three, 3½ to four watts per candle, which has shown better efficiency by uniform illumination than the arc.

There is another feature in connection with the matter, and that is the artistic effect, ornamental appearance. It seems to me that demand can be better met by a smaller unit, which lends itself more readily to artistic effect than is possible for the large. Those are the elements that, it seems to me, from an outside point of view, are going to give their influence very largely in favor of a smaller unit in street lighting.

Harold Almert: I do not think there is any question but that the smaller unit would be the most desirable if the maintenance would permit it and if the construction features would permit. I cannot just at this time conceive of the type of construction that would permit of a sightly installation and at the same time a cost that would not be prohibitive. The last occasion that I had to install a street-lighting system, one of the underground kind, was in Chicago about eight years ago, when, as some of you remember, Diversey Avenue was illuminated for the Lincoln Park Commission. The board that was in at that time looked more toward good illumination than first cost. At that time the distribution curves that were available showed that the series enclosed direct arc lamp gave the best curve and the best efficiency for street lighting. The small units were considered only to see what the relative cost would be, and, as I recollect, the ratio was about two as to five in favor of the large units. In order to get a uniform distribution, and in order to cut down the objectionable feature of the large units, namely, riding in under the lamp and having the light affect the retina of the eye, and then riding into the space between two lamps and having that space seem doubly as dark as it was, the lamps were placed on each side of the street, 250 feet apart, giving one lamp for every 125 feet, which, of course, is more than is permissible in average street lighting. This happened to be a boulevard, and the cost was not so essential. The series direct enclosed lamp was adopted, and using an opal inner globe with a clear outer, a very beautiful effect was obtained. I don't know any street or any boulevard that I have had occasion to pass anywhere in the United States, where the effect was so good. The dark spots in between lamps were almost entirely eliminated. I regret to say since then the operating man felt that he could get more light (and more light was all that he wanted —he either knew or cared little about quality), and he removed the opal inner globes and put on clear globes. The different effect is surprising. With the clear inner globes the traveling of the arc throws intense shadows. When you go out into small communities, into country towns, the problem becomes more serious. It is not a question of light only. You have to take in the question of the construction. And while the small unit may work out as a desirable feature, when you come to the construction, I think it is very questionable whether it will work out or not.

J. S. Allen: I had occasion to close a contract within the last five or six weeks with our city. We installed an alternating-current multiple distribution system, just as we have for private lighting. We distribute at 2,400 volts to transformers and use incandescent lights almost entirely. We only have a few arc lights right in the center of the town. We distribute about a mile and a half or two miles in either direction from the station and our cost has been very moderate. The city constructed its pole line, owns its lamps, etc., and buys its current from us. It owns the switchboard in the station. I know very little about the candle-foot results. All I know about it is that it is satisfactory. I know that we are getting a pretty fair sort of contract, a little bit better than anything else I ever saw, and the people are satisfied. We use just ordinary 32-candlepower lamps and have hoods over them. They are placed one to a block, about 400 feet apart. In the downtown district we have a few arc lamps. The number of transformers is not large. By using No. 6 copper the small amount of secondary current necessary to transmit can be carried long distances. I had no idea this could be done until I got into it and figured it out myself and laid the whole thing out. I found the number of transformers to be small, and the cost of the installation is small. We had an old-fashioned series direct-current system before and the people were dissatisfied, but they are paying a larger bill now and paying it readily. They are satisfied. I think there are very few places where they are as well satisfied.

A. J. Marshall, New York: I want to avoid the subject of globes and reflectors. I do not think this is the time to talk on a commercial basis at all. I think the subject of street lighting is one that should be given careful consideration. The first thing that I notice in street lights is something which I think will soon be almost a criminal offense; that is, having lamps bare, especially gas. In the use of incandescent electric lamps it is necessary to cut down the intrinsic brilliancy of the light by some form of artistic glassware. There is an installation in town I would like to call your attention to, that along the boulevard near the Auditorium Annex, where incandescent lamps are used, placed in opal or ground-glass globes placed in an upright position. They are doing there what a great many other people are doing, confining the light sources so that a great deal of the light never gets away from the units. For instance, you take an ordinary gas-mantle lamp having four burners. As in the case of gas lamps using two, three or four burners, it has been demonstrated conclusively that where four mantles were used the efficiency is 30 per cent. less than where four individual lights were used. I want to place myself on record as saying that I am absolutely opposed to the use of several small units within a globe. If you want to use 50 or 100 candlepower, use one light, not several. I think our attention should be given to the style of glassware, not using the old familiar ground glass, which, to my mind, is more or less of a mockery, which will slightly diffuse or cut down the intrinsic brilliancy of a light source, but is extremely inartistic in that at all times a ball of fire is visible through your glass. I prefer, personally, the use of—I will not say opal, because that word is rather ambiguous, but more of a milk or porcelain shade, which completely hides the light source. My work is given up principally to indoor effects, but I do prefer the small units, that is, 40, 50 or 75-candlepower lamps, placed on artistic posts (not the bunching of a half a dozen small lamps on one post), and placing them in a graceful manner, endeavoring to get away from the shadow effects as much as possible.

J. R. Cravath: It seems to me this question of large versus small units simmers down principally to a question of the total amount of light we are going to expend on a given length of street. If we are going to put in a lot of light on a given length of street, we can do it with large units without producing disastrous blinding effect. If, however, we are going to spend but a small amount of energy on that length of street, the large units so far apart will produce a very serious blinding effect. That, of course, is independent of all considerations of shade trees and that kind of thing. I think you probably have all noticed that in the business streets, where we have a great amount of light coming from all sources, the ordinary arc lamp is not a thing that we notice as blinding; but take it out in a residence street, where we have one to every two blocks, as we do in some of our country towns, and you can't see against it at all.

As to the relative distribution of light from gas and ordinary incandescent lamps, the ordinary electric incandescent lamp and the Welsbach burner give a very similar distribution; that is, the maximum candlepower is nearly horizontal, the principal difference being that the distribution from the Welsbach-mantle burner is about what we get from an inverted incandescent lamp, that is, the lamp base shuts off light immediately underneath, and the lamp burner shuts off light immediately underneath the gas. This brings up naturally the question of reflectors for street lamps, which has not been touched on very extensively. The ordinary cheap reflectors used in incandescent lighting in residence streets at the present time, most of us know, are very inefficient things for getting light up and down the streets. They are simply water sheds and protectors. There is a large amount of light that goes above the horizontal that is not caught by the reflector.

Mr. Willcox: If you have seen the tungsten multiple lamps exhibited here at the Electrical Show, you have some idea of the brilliancy and efficiency of the lamp. You have no doubt been told it has an efficiency of 1.25 watts per candle, the average lamp running about 1½ watts per candle under the average outdoor conditions. This lamp would seem to lend itself particularly well to a street series system, because those systems use generally low-voltage lamps running from 10 to 50 volts per lamp, according to the amperage of the circuit, and therefore permit a metal-filament lamp like the tungsten to be used to good advantage. A filament can be made particularly for candlepowers above 50, sufficiently strong and heavy to make it very durable. With filaments which give remarkably good light at an efficiency of 1¼ watts per candle, it seems to me that this lamp must effect quite a profound revolution in street series lighting, because it is a lamp there which surpasses any illuminant you have today except the flaming arc. That type of lamp in street series lighting seems to me to have a great future, and it was just exactly what I referred to in my previous remarks when I said the tendency toward these high-efficiency lamps would more and more accentuate, it seemed to me, the advantage of smaller units of higher efficiency type more evenly distributed upon our highways.

Economical Operation of the Electric Car.

By T. H. Reardon.

Notwithstanding that the electric car is in many ways the most elegant and luxurious vehicle moving on wheels, yet in connection with its operation there is a waste of energy so apparent as to engage even the attention and interest of the novice, and yet failing to receive the attention that its importance deserves from the electrical designer and the power-station proprietor, whose profit or loss is intimately connected with this wasteful operation.

What is said in this article has particular reference to rheostats and other forms of resistance that absorb and give out nothing that has useful effect.

At the same time that the interior of the car is approximating "cold storage" we are apprised of the fact that the trolley potential is too much for the arc, and the ever-handy resistance is used to cut down this surplus of volts, wasting upward of 80 per cent. of the watts taken from the trolley in securing this result. There are times when the headlight is required, when interior heating of the car is not desired, and there are times that the traveling public is sadly in need of those kilowatts that are liberated exterior to the car, and serve no purpose, except, perhaps, exercising a modifying effect on the weather.

The writer is reliably informed that the arc resistance, in the majority of cases, is located exterior to the car, and the heat is not available for any useful purpose. Now, why could not circuits be so arranged that when conditions make it desirable, part of this wattage could be absorbed in the heating system, and even used for driving the motor that actuates the air compressor?

It is understood that the work of the air compressor is very intermittent in character, but it may be said that it could be made much less intermittent if this apparatus had either hand or automatic regulation, and was run more uniformly, instead of by fits and spurts.

When the arc and incandescent lights are required, and heat is not wanted, some arrangement should be made to have the incandescent lamps form the resistance for cutting down the arc voltage to the proper value, as suggested by Mr. R. C. Taylor, in his very able remarks on the subject in the Western Electrician of February 16, 1907. The illumination of cars is so sadly at fault in numerous cases that anything in the way of improvement would be greatly appreciated.

It might be so arranged that with lamps five in series with the trolley potential, when the drop is great enough to burn four in series an automatic regulator would operate and reduce the number of lamps by dropping the fifth lamp. When the voltage dropped to the point at which three lamps in series would burn properly, the fourth lamp should be dropped. This controller or regulator should operate a rheostat. The only point to be gained by its use would be the substitution of lamps for a dead resistance at each 100-volt step in the fluctuation. This automatic controller should remove or cut out resistance as the voltage dropped, until 100 volts were compensated for, when lamps should be substituted, either cut in or cut out, to adapt the lamp circuit to existing conditions.

The problem no doubt presents many difficulties, but the great waste that is going on should serve as a stimulus to inventors and electrical designers to strive for a practical solution, and the man that does this will share liberally in the saving that his knowledge and ability has brought about.

If the electrical engineers that are concerned with the solution of this problem will apply themselves with the zeal and energy that characterized the labors of the men that struggled with the quadruplex telegraph, the wasteful features connected with the operation of the trolley car, if they are not wholly eliminated, will be minimized to a great extent.

Nothing has been said so far about the wasteful

rheostat used in starting and regulating the speed of the car to more or less extent when the brake cannot be used for this purpose. A proper disposition of reisstance, including subdivisions of the heating system, should be so arranged as to absorb at least part of the heat that is going to waste from this source, when conditions will permit of it being so applied.

Another feature that deserves attention is the large amount of window glass in street cars. The heating problem is one of the most difficult that comes up in practice, and the energy for heating is supplied in a form that makes it very expensive, even under more favorable conditions. A secondary evil, not too slight to be deserving of attention, is the fact that in cold weather the windows are frost coated to such an extent that a view of the outside is next to impossible. This is a matter that causes much inconvenience, as passengers must exercise more or less care in ascertaining the point at which they desire to leave the car; the idea that a conductor can carry all this in his memory is entirely too far fetched.

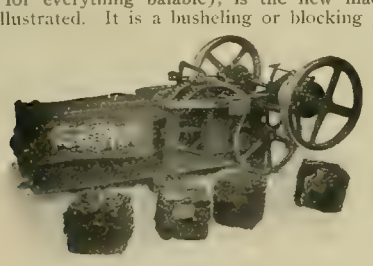
There is a practical remedy for the waste of heat and the lack of transparency caused by frost coating. The trouble can be obviated to a great extent by using double glass in the windows, with one-fourth or one-half-inch space between the panes. The imprisoned air between the two panes of glass acts as an excellent medium to prevent the passage of heat, and with glass properly set in sash, dust-tight, the inner surfaces of the glass would not become soiled, and washing of the exterior surface could be effected as usual.

With this arrangement in extremely cold weather frost coating scarcely occurs at all, as the inner pane is not at a freezing temperature, and the slight condensation that does occur can be readily rubbed off.

It is a fact that a great many trolley cars are not as comfortable in the matter of temperature as steam-heated cars, and this can be accounted for easily, when we consider that the doors of the electric car are opened to admit or discharge passengers at very frequent intervals, while, with steam trains, this happens far less frequently. Then there is the difference between heating with electrical energy and heating with steam in point of cost, and in time of intense cold and drifted tracks the demand for current for traction and for heating purposes both is enough to exhaust the resources of the power station.

Busheling Press for Sheet-metal Scrap.

One of the extensive assortment of baling presses manufactured by the Famous Manufacturing Company of East Chicago, Ind. (including, it is said, a press for everything balable), is the new machine here illustrated. It is a busheling or blocking press



SHEET-METAL-SCRAP BUSHELING PRESS.

for use in compressing and baling scrap sheet metal of various kinds, as iron, tin-plate or copper. The device requires little power to run it and the attention of but one man. Sheet-metal scrap accumulating in electrical manufacturing plants or elsewhere can be baled with this machine and made a source of revenue where otherwise it might be thrown away on account of the difficulty in handling. The bales shown in the picture are, respectively, of stovepipe shearings, old tin cans and scrap sheet metal of two grades.

New York Attorney-general Prevents Big Telephone Combination.

Concerning the reported acquisition of the United States Independent Telephone Company, including the Stromberg-Carlson Telephone Manufacturing Company, by the Bell interests, the latest information is that Attorney-General Jackson of New York state has secured an injunction restraining the proposed merger by the American Telephone and Telegraph Company. A hearing on the case was set for March 7th. Information that the merger would create a monopoly in the telephone business in New York was lodged with the attorney-general by James B. Hoge of Cleveland, president of the International Independent Telephone Association of America, and other representatives of Independent telephone companies. The United States company is the holding corporation of a large number of Independent telephone companies. Affiliated with it directly are the Independent companies at Utica, Herkimer, Syracuse, Rochester, Jamestown and other intermediate places.

Indiana Telephone Items.

The Central Union Telephone Company and the Indianapolis Telephone Company are each building large exchange buildings to be equipped with modern devices and accessories in Indianapolis. The Richmond Home Telephone Company, the Lafayette Telephone Company and the Wabash Home Telephone Company are each completing new and extensive exchange buildings to be installed with the latest type of switchboards and equipments.

The New Long-distance Telephone Company is putting the finishing touch on over 600 miles of copper metallic toll lines, including new circuits to all the prominent cities and county seats in the state; the Rushville Co-operative Telephone Company is expending $30,000 on a new switchboard and telephones; the South Bend Home Telephone Company is constructing an additional 30-foot seven-inch-top pole line supporting two No. 10 copper circuits; the Citizens' company of Columbus is completing the installation of 10,000 feet of 150-pair cable, and the North Vernon Telephone Company has begun the construction of new cables throughout its system, having already installed a complete central-energy switchboard.

A large force of men is at work in the vicinity of Plymouth, putting in poles for a new Independent trunk telephone line from South Bend to Logansport. This line is to be an outlet for the central and southern part of the state into Chicago, to which place a line will be continued. Local companies will hang their wires on the poles of this new line. The line will make connections with the 600 miles of toll lines just completed out of Indianapolis.

The Decatur County Independent Telephone Company is placing all wires underground where they cross the trolley of the Indianapolis and Cincinnati electric road. This is made absolutely necessary on account of the disturbing high-tension wire, and to protect persons against live wires in case the trolley and telephone wires should come in contact.

A number of suits have been filed against the Central Union Telephone Company at Shelbyville, seeking to annul the recent sale of the interests of the old Mutual Telephone Company to the Central Union, declaring the sale brings about a monopoly. A restraining order is asked to enjoin work which the Central Union is attempting to complete.

A bill is now pending before the Legislature requiring all telegraphers to be examined and licensed by a state board of expert telegraphers. The bill is meeting with favor, being regarded as the best precautionary measure for the safety of the traveling public so far devised. S.

Independent Telephone Association of Texas and Louisiana.

The third annual convention of the Independent Telephone Association of Texas and Louisiana was held at Fort Worth, Texas, on February 21st and 22d. More than 100 delegates, representing about 35,000 telephones and 4,000 miles of long-distance lines, were present. President J. C. Casler of Fort Worth, presided. C. A. Shock of Sherman is secretary. The welcoming address was delivered by Mayor Harris, Sidney Samuels of Fort Worth responding.

A good part of the convention was taken up with a discussion of legislative matters. The bill before the Legislature undertaking to force a connection between the Independent properties and those of the Bell Telephone Company was opposed on the ground that it would hinder further development.

The delegates went in a body to visit the packing plants of Fort Worth. J. B. Earle was selected as the delegate of the Texas and Louisiana Association to the meeting of the International Independent Telephone Association convention, which will be held in Chicago June 4th, 5th and 6th.

Following are the names of the officers elected: President, J. B. Earle of Waco; first vice-president, E. M. Chamberlain of Greenville; second vice-president, C. W. Roberts of Abilene; third vice-president, C. W. Emmer of Beaumont; secretary and treasurer, C. A. Shock of Sherman; executive committeemen—J. B. Earle, E. W. Johnson of Corsicana, J. C. Casler of Fort Worth, H. L. Moseley of Weatherford, and T. A. Gould of Ennis.

Representatives of the Northwestern Telephone Exchange Company and other companies have appeared before a legislative committee in Minnesota and protested against a bill pending which seeks to make telephone companies common carriers and requiring them to make connections with competing lines.

GENERAL TELEPHONE NEWS.

W. E. Hoyt and others have organized the South Madison Farmers' Telephone Company of Decorah, Iowa; capital, $1,750.

The Laporte City (Iowa) Farmers' Mutual Telephone Company has filed articles of incorporation with a capital of $24,000.

The Chesapeake and Potomac Telephone Company of Washington, D. C., will erect a new exchange to cost about $200,000.

The Montello (Wis.) Farmers' Telephone Company has been incorporated with a capital stock of $7,000 by John Foster and others.

The Belvidere (Ill.) Telephone Company is arranging to make extensive improvements in its plant and $50,000 will be expended, it is said.

Arrangements are being made at Wheeling, W. Va., to organize a syndicate for the purpose of establishing a new telephone company at that place.

The Independent Telephone Company of Milwaukee, Wis., has purchased a stite on Fourth Street for the purpose of erecting a new exchange building.

A franchise has been granted to the People's Telephone Company of Taylorsville, N. C., with a capital stock of $25,000. The company proposes to construct a line to Statesville.

At the annual meeting of the stockholders of the Chesapeake and Potomac Telephone Company, held at Baltimore, Md., an appropriation of $2,100,000 was voted for additions to the plant.

The Northwestern Telephone and Telegraph Company of Freeport, Ill., has been incorporated with a capital stock of $30,000. C. B. Cheadle, L. A. Herrick and others are the incorporators.

The Colorado Telephone Company is arranging to make extensive improvements in its plant at Denver. A new line between Denver and Kansas City is expected to be in operation by July.

Capital stock of the Nebraska Telephone Company is to be increased from $2,000,000 to $5,000,000. A toll line is to be built at once from North Platte to Julesburg, and later to be extended to Cheyenne, Wyo.

A bill has been presented to the Minnesota Legislature which makes it a misdemeanor to use slugs, blanks or other articles except lawful coin of the United States for securing telephone service. Similar bills have been introduced in each body of the Legislature.

A movement is being discussed at Colville, Wash., north of Spokane, to consolidate all the Independent telephone lines in Stevens County, establish exchanges at Chewelah, Colville, Marcus and at Northport, extend short lines to contiguous points along the route of main lines and give a continuous service, and a rental rate to all subscribers to exclude any toll through the exchange. In exchange for the franchise privileges on the public highways all county business will be handled free.

The eleventh annual convention of the Iowa Independent Telephone Association will be held in Sioux City on March 19th, 20th and 21st. Headquarters will be at the Garrettson Hotel. The programme is an especially good one as regards discussion of the varied operating problems and financing methods. There will be an exhibit of telephones and telephone equipment by manufacturers and dealers. A banquet and other entertainment features have been provided. P. C. Holdoegel of Rockwell City, Iowa, is president of the association.

The following-named telephone companies have recently been incorporated: The New State Telephone Company, Cooperton, Okla., capital stock $25,000; Bluegrove (Texas) Independent Telephone Company, $2,400; Farmers' Rural Telephone Company, Bentonville, Ark.; Johnson County Telephone Company, Smartville, Neb., $25,000; Mineola (Neb.) Telephone Company, $5,000; Farmers' Telephone Company, Aurora, Neb., $10,000; Laporte City (Ind.) Farmers' Mutual Telephone Company, $24,000; Rosendale (Wis.) Telephone Company, $5,000; Madison (Minn.) Telephone Company, $50,000; Current River Telephone Company, Winona, Mo., $10,000; Fairview (Okla.) Southwestern Telephone Company, $1,000.

The Chicago Telephone Company has issued a circular commending the excellent discipline and high loyalty of its employes displayed at the time of and subsequent to the recent fire in a building adjoining the company's main office and exchange. The telephone building was filled with smoke and the conditions tended toward demoralization. About 250 girl operators remained at their posts during the period which was so trying that 34 of the girls were overcome by the excitement and smoke and were taken to places of safety. A few days after, the company presented each of the employes at the main exchange with a gold piece, and usually the gift was accepted with the remark, "I thought I was only doing my duty in behalf of the company."

CORRESPONDENCE.

Continental Europe.

Paris, February 19.—A new hydraulic plant of considerable size was erected in the north of Italy not long since. It is located upon the Mincio River, at Valeggio. The station is now running regularly, and is supplying current over an extended region, both for lighting and motors. What is known as the Seriola Canal, leading from the river, furnishes the power in this case. The plant is controlled by a syndicate whose headquarters are located at Valeggio, and it intends to widen out its operations soon. The pole line will be extended so as to distribute current in many large towns, such as Villafranca, Veronese, Quaderni and others. A head of water of 10 meters is used in the hydraulic plant. The transmission is operated at 6,000 volts three-phase current and extends from Valeggio along the Mincio River.

The tunnel, which is to pass through the Loetschberg, is one of the most important of the Swiss enterprises at present. The tunnel is to form part of an electric railroad of some length. According to the most recent reports, the work upon the tunnel is advancing in a very satisfactory way. By the first of February 202 meters had been constructed, counting the north and the southern ends. There are no less than 4,500 men employed in this enterprise, and it is hoped to put the tunnel through in the least possible time so as to start the electric railroad without delay. Electric lines run to the tunnel from Schwytz, so as to furnish all the current which is needed for the lighting and power during the work.

At the much-frequented summer resort of Aix-les-Bains, in France, there is being constructed a new cable incline which is to be operated by electric motors. The line starts from the Bourdeau fort on the banks of Lake Bourget and rises up the slope to a point lying at 562 meters altitude. The difference of level is 310 meters, while the length of the track is 810 meters, thus giving a steep grade. Both passengers and freight will be carried upon the line.

A project is on foot for erecting a hydraulic plant in the Verona province of Italy, so as to secure a considerable amount of power. Here the stream known as the Vayo Pissate is to be employed. The stream descends from Monte Baldo to Ferrara. According to Engineer Stefani's project, a head of water can be obtained which will give 2,000 horsepower, and this calls for a dam and a storage basin upon the Vayo. The water will be taken by an open canal to a settling basin and will run from there in an underground flume of 1½ miles length, reaching a second basin, whence a penstock half a mile long will lead to the turbine house. It is intended to use Pelton waterwheels, direct-coupled to high-tension alternators, and the voltage for the line will be further raised by transformers.

Another project is headed by Milan capitalists, who propose to erect a hydraulic station upon the Tagliamento stream. It is expected to secure some 1,500 horsepower in the first plant. Another company proposes to utilize the power of the same stream at Cavazzo Carnico, where 7,600 horsepower can no doubt be obtained. These are not the only plants which are to be erected on this watercourse, for the Societa Cellina is taking measures to put up a 7,500-horsepower plant, while a Milan company proposes to build a canal of no less than 10 miles length, so as to secure a head of water of 223 meters. This will give about 11,000 horsepower for the plant.

Bids are to be received for the concession for a new electric street railway in the city of Madrid. The Madrid Tramway Company has already taken steps to secure the concession, and, as according to the law, the railway companies have the right of priority, it seems likely that it will succeed. Another tramway line for which bids are asked is the road which it is proposed to build from Baeza to the Hermitage of La Yedra, in the Taen province. There is also a line to be constructed from Barcelona to Hostafranchs. A. DE C.

Great Britain.

London, February 20.—The report upon the Woolwich (London) municipal electricity works, which has been prepared by Sir Alexander Kennedy, has revealed a condition of affairs which even the strongest opponents of the undertaking could not have anticipated. There is at the present time an overdraft upon the bankers of $275,000, and as the Local Government Board nor the London County Council will grant a loan to cover this, a rate of something like 24 cents in the pound has had to be levied. Sir Alexander Kennedy has solemnly stated his opinion that it will take nearly 10 years to put the undertaking upon a sound basis. Unfortunately, this fiasco has been largely brought about by incompetent engineering advice in the past. Since the Woolwich corporation acquired the local company, some years ago, an additional high-tension station has been erected costing thousands of pounds, and the only purpose it has served, according to Sir Alexander Kennedy, is to supply not the manufacturing portion of the area but an extremely small residential outlying district. The demand from this source is exceedingly small and the prospects of increase negligible. Hence it comes about that Woolwich sells fewer units per pound of capital expenditure lower than any existing electric supply authority in Great Britain at the moment. Bad commercial methods in dealing with the supply have also contributed to the present position, for the charges seem to have been reduced without any proper appreciation of what was really being done. It is satisfactory to note that the engineering staff now in possession is already making some economies, but as an example of municipal inaptitude the Woolwich electricity undertaking is without equal. The electric wiring and fitting department carried on has been discontinued, and it is curious that this should have taken place in the very year in which the London County Council, after many vain efforts, succeeded in getting a bill through Parliament making it lawful, without special powers, for all London councils to have a wiring department. Woolwich had special powers.

Yet another instance of a municipality failing to make its electricity department pay, after having bought out the local company, has happened at Bath. So unsuccessful has it been that an offer by the neighboring power company to purchase the works and utilize them as part of the larger scheme has been unanimously accepted.

To complete the story of troubles, it is gratifying to report that an agreement has been arrived at between the debenture holders of the South Wales Electrical Power Distribution Company and the committee of consumers which was formed some time ago to endeavor to arrive at a working basis. It will be remembered that the company through what may be termed a short-sighted policy originally found itself unable to carry on its affairs. A sum of $2,500,000 was quoted as being necessary to put the concern upon its legs once more, and this was guaranteed, provided in return the existing consumers, who numbered among them all the large collieries in the district, guaranteed a minimum consumption. As stated above, this has now been settled, and it is to be hoped that the company, with one of the best industrial areas in the kingdom, will prosper in the future.

The new wireless telegraph company recently formed here under the chairmanship of Lord Armstrong has equipped a postoffice installation across the Wash, in Lincolnshire, a distance of 15½ miles over sea. From the point of view of distance there is nothing remarkable about the installation, but inasmuch as the company in question owns patents here of both Markelyne and De Forest, some interest attaches. The service offered by the installation replaces nearly 100 miles of land lines, which are necessary to join up Hunstanton and Skegness, the towns on either side of the Wash. In both places the equipment is housed in the coastguard station, the masts being 120 feet high and constructed of treated deal planks. Current is provided by oil-driven sets.

So much opposition is being offered by various local authorities around London to the use of the overhead system of electric traction by the London County Council that in order to endeavor to save the many thousands of pounds which will be involved as compared with the conduit system the County Council is appealing to the Board of Trade. Unfortunately, several years ago when the council took over the trams an absolute veto was given to the borough councils as to the choice of system. It is for this weakness—for it was only done to save opposition—that the County Council is now suffering, and nothing but a fresh act of Parliament can, it seems, put the matter right.

One of the biggest instances of an electrically equipped mill is to be seen in the conversion of the Droylesden mills, Fairfield, Lancashire, from the old-fashioned drive to electric transmission. The mill in question contains 88,900 spindles and 900 looms. The new power house contains a turbo-alternator, and over 1,000 horsepower of motors have been installed.

Dominion of Canada.

Ottawa, March 2.—A scheme is now on foot to build an electric railway from Portage Bay to Cobalt, Ont. From Cobalt one branch is to go south, skirting Giroux Lake, and then to Haileybury, where it will join another direct line and proceed to New Liskeard. The power is to come from a waterpower development on the Montreal River.

While the report of the Hydro-electric Commission of Ontario as regards the available waterpower to supply energy for the municipal plant provided in the district around Ottawa has not yet been issued its contents are pretty well known. It is understood that three waterpowers within a radius of 10 miles are recommended by the engineers of that body. One is the Chat Falls, another the Gilmour & Hughson waterpower at Chelsea, both on the Quebec side, and the third at Britannia on the Ontario side. It is said the Chelsea power is favored, as it is nearer Ottawa, and transmission would not only cost less but involve much less loss.

The town of Pembroke, Ont., will in future be illuminated by electricity generated by the hydraulic power developed at the falls on the Black River, 14 miles from the town. The power station and plant have been completed. The electric power has to be transported across the Ottawa River by cable. The work of development has been carried on by the Pembroke Electric Company. Hitherto the electric power plant has been operated by steam.

The Bell Telephone Company of Canada is asking its shareholders to authorize an issue of $3,750,000 bonds.

The Hamilton Electric Railway Company is applying to the Ottawa government for an amendment of its provincial charter by providing for the extension of its line of railway from Mimico to some point within the limits of the city of Toronto; for authority to purchase, lease or amalgamate with the Brantford and Hamilton Electric Railway Company, the Hamilton, Grimsby and Beamsville Electric Railway Company, and any other electric railway running into the city of Hamilton; to construct a line of railway from Brantford through the counties of Brant, Oxford, Elgin, Kent and Essex to Detroit River at or near Windsor; to build and operate ferry steamers and to conduct a ferry system across the Detroit River; to extend its line of railway to Niagara River and to construct an international bridge over the Niagara River, or to enter into a contract for the use of any such bridge. W.

Winnipeg, Man., March 2.—The city of Wetaskiwin, Alberta, is preparing to spend $175,000 this year in improvements. Among the items is $30,000 for extensions to the electric-light plant. E. G. Chandler can give information.

During the coming summer Battleford, Sask., will spend $23,000 in improvements to the electric-light service. B. Prince is mayor.

R. H. Keeley, city engineer, Edmonton, Alberta, has recommended to the council the installation of a 600-kilowatt gas-producer engine, at a cost of $12,000.

The municipality of Wallace, Southern Manitoba, is being canvassed for subscribers for an Independent telephone system, which will be built by the municipality. Some 345 miles of pole line will be required.

The Springhill Rural Telephone System is one of the latest Independent organizations in Western Canada. When constructed it will probably be extended to the Bernie district. The farmers of Langford are also taking steps to build a rural system, and work on both lines will be commenced as early as possible in the spring. George R. Belton, Neepawa, Man., can give full particulars.

The municipal commission appointed by the Calgary City Council has estimated the cost of a municipal telephone system at $100,000, and during the next few weeks a by-law will probably be put before the people to sanction the construction of such a system.

Until March 13th, noon, Magnus Peterson, secretary of the Civic Board of Control, Winnipeg, Man., will receive sealed tenders for the supply of 200 arc lamps and cut-outs, two 100-light regulators, with necessary panels; also 12 lightning arresters. A check of five per cent. must accompany the bids. Specifications may be seen at the office of F. A. Cambridge, city electrician.

Cecil B. Smith, consulting engineer for the electrical power plant being built for the city of Winnipeg, at Lac du Bonnet, states surveys for the transmision line have been completed for 35 miles, and he hopes to have the remaining 25 miles finished before the end of the present month. R. R.

New England.

Boston, March 2.—The Massachusetts Gas and Electric Light Commission has authorized an issue of 24,200 shares of new capital stock by the Edison Electric Illuminating Company of Boston. The commissioners fixed the minimum price for the stock at $215 per share. The market price of the company's stock was $225 per share when the issue was authorized, and at that figure the new stock would aggregate $5,445,000. The par value of the stock is $100 per share. The proceeds are to be applied to outstanding promissory notes and meeting the cost of an addition to the company's plant.

The Lowell Electric Light Company reports for the month of December as follows: Gross earnings, $28,651, against $27,530 in 1905; net earnings, $13,534, against $12,961 in 1905; balance, $11,737, against $11,518 in 1905.

The Boston, Lowell and Lawrence Electric Railroad Company has petitioned for special legislation giving it authority to build elevated structures at Sullivan Square in the Charlestown district of Boston and at Lowell—the termini of the company's road.

The Stafford Springs Electric Light and Gas Company is planning to build a large power plant on the Willimantic River in Willington, Conn. The necessary land has been acquired and the town has authorized the closing of two highways which would be affected by the dam. The Willington Electric Light and Gas Company, which has asked for a charter, will build and operate the plant.

The Litchfield (Conn.) Electric Supply Com-

pany has changed its name to the Connecticut Electric Manufacturing Company of Litchfield.

The Stanley Works Company, hardware manufacturer, has purchased the Kent Furnace Company's plant in Kent, Conn., and plans the construction of an electric power plant there, the plant to have a generating capacity of 3,000 horsepower. The Kent company's property includes a fine water privilege on the Housatonic River. The current will be transmitted about 40 miles to New Britain, Conn., where the Stanley Works are located. The company has asked for legislation authorizing it to increase its capital from $1,500,000 to $3,000,000 and permitting it to carry out its power project.

The West Roxbury Citizens' Association has voted in favor of a minimum rate of $25 per year for a house telephone and a toll charge of five cents for a connection with Boston.

The Woonsocket Gas Company has bought control of the Woonsocket Electric Machine and Power Company, which has plants in Woonsocket, R. I., and Franklin, Mass. The price paid was $155.15 per share. The North American Company of New York bid $151.63. The Electric Machine and Power Company has a capital of $500,000 and it controls the electric lighting and heating in Woonsocket and Manville and a part of Cumberland, R. I., and it furnishes power for the electric railways running into Woonsocket. It also has a franchise permitting it to lay gas pipes in Woonsocket. B.

New York.

New York City, March 2.—An announcement just made by the Brooklyn Rapid Transit Company is causing considerable comment. President Winters has issued the following statement: "In order that the supply of electrical power and the maintenance of track, overhead work and structures of the railroads embraced in the Brooklyn Rapid Transit system should be under a concentrated management and therefore more economically administered for each of the railroad companies, those companies have contracted with the Transit Development Company (which already owns some of the principal power houses of the system) to furnish power and take charge of the maintenance and repair of the railway properties, including their equipment."

The Transit Development Company is incorporated under the business corporations law and is authorized to manufacture and sell power and to do general contracting work. All the stock of this company is owned by the Brooklyn Rapid Transit Company.

Taken in connection with the official notification by the Brooklyn Heights Railway Company that all power stations, sub-stations, repair shops, emergency crew stations, car-storage yards, docks and car barns owned by this company are leased to the Transit Development Company and that they have entered into a contract with this company for the maintenance and operation of their lines, it would appear that a general consolidation of all the transit properties, surface and elevated, under one management controlled by the Brooklyn Rapid Transit is contemplated.

The Delaware, Lackawanna and Western Railroad depot, first of the splendid new terminals made imperative by the ever-increasing traffic of the greater city to be completed, is now ready to be thrown open to the public. Besides being one of the greatest terminals on the Continent, the new structure surpasses all in water front facilities, having a frontage of 750 feet on the Hudson River. Over 21,000 electric lights will be used in the word "Lackawanna," which will shine across the river after nightfall.

The managers of Luna Park, Coney Island, who are indefatigable in their search after novelties, are making a number of experiments with a view to introducing wireless telharmonic music in the park this coming season. Thus far they have been seriously hampered by conflicting currents from passing ships that are equipped with the wireless system. However, they are sanguine that before the time appointed for opening the park arrives these troubles will be overcome and a new novelty added to their excellent list of entertainment.

A public hearing on Assemblyman Murphy's bill to raise the annual appropriation limit of the Brooklyn Institute of Arts and Sciences was given last week. At present the appropriation is $95,000, less than permitted by the city charter. The mayor, it is understood, will approve the bill.

At a meeting of the Citizens' Association that was held at the Colonial Club interesting addresses were made on the subject of "Transit Problems" by Herbert S. Worthley, president of the Flatbush Board of Trade, and F. L. Bartlett, the well-known civil engineer. Mr. Worthley advocated the Behr mono-rail system. He told of its advantages and pointed out that many of the accidents which had occurred of late could not have happened on a mono-rail road. Mr. Worthley said he believed the mono-rail road would be in course of construction within a year. D. E. P.

Michigan.

Grand Rapids, March 2.—The Legislature will be asked to give to Grand Rapids the right to own and operate street railways, and the Board of Public Works is to submit estimates of the cost of putting in a system in Grand Rapids. Senator Keys has introduced a bill to authorize any street-railway company now organized, or that may be hereafter, under the laws of this state, to sell, lease and convey its property and franchises to any other street-railway company, whether organized within or without this state.

A dispatch from Jackson states that a deal for the Jackson city street-railway system has been consummated between the Consolidated Traction Company and the Michigan United Railways Company, under which the Jackson lines will soon pass into the hands of the latter corporation.

Former Railroad Commissioner Theron B. Atwood of Caro has been appointed general manager of the Michigan United Railways at Lansing.

Papers have been filed at Lansing for the organization of a $15,000,000 telephone company, with central offices in Detroit and branch offices throughout the state. The company will be known as the Interstate Long-distance Telephone Company, organized for 30 years for the purpose of building a long-distance telephone system throughout Michigan, connecting the various Independent systems of Michigan and Ohio and points east and west. A large force of men will begin work immediately on 60 telephone circuits. The construction work will be done by the Marquette Construction Company. The incorporators are William B. Woodbury, Hugo A. Koehler, C. Marquard Forster, Max Koehler, Thomas H. Wagoner, Charles H. Wood, Sam B. Jeffries, George E. Lawson, Henry C. Potter, Jr., John M. Dwyer, William T. Barbour, Henry Koehler, Jr., William T. Grayson, J. J. Goodyear and Fred T. Moran. These will not only be directors in the Interstate Long-distance company, but will also form a part of the directorate of the Home Telephone Company of Detroit, and constitute the executive committee, which will control both companies. L. W. B.

Indiana.

Indianapolis, March 2.—The City Council of Fort Wayne has appropriated $25,000 for improving the municipal waterworks plant. It is stated that this plant, for 30 years under municipal ownership, has not even paid one dollar on the original bonded indebtedness of $260,000, and that the city is required to pay the interest on the debt.

The Indiana Legislature has reconsidered the bill passed a few days ago providing that city councils may fix the rates for electricity, gas, water and heat. The indications now are that the measure will fail. The rates are now fixed by franchise contract.

The Chemical Gas Company of Alexandria has incorporated with a capital of $1,000,000, to erect and equip a factory in Alexandria to manufacture a liquid fuel by a chemical process recently discovered by Dr. Littlefield, when he united denatured alcohol and crude petroleum. The company will also manufacture special burners patented by Dr. Littlefield, for domestic purposes.

A 24-inch water main which runs through the heart of Indianapolis has broken twice during the last month. The main is badly impaired by electrolysis, especially in the streets occupied by electric railways.

To increase the amount of direct current for downtown commercial lighting, the Indianapolis Light and Heat Company is proposing to build several new sub-stations outside the mile square. These sub-stations will each have a motor-generator capable of developing 1,000 kilowatts of current, besides a large storage battery to reinforce the sub-station now in use on Meridian Street. Other improvements are contemplated.

Great progress is being made on the power house of the Indianapolis, Newcastle and Toledo Traction Company at Newcastle. When completed this will be by far the largest power house in the state. The machinery is arriving and being installed.

It is officially announced that the South Bend Electric Company will make extensive changes in its present plant and will add a 1,500-kilowatt turbine and 1,600-horsepower boilers.

A bill is pending in the Indiana Legislature which authorizes the formation of companies for the sale and manufacture of electricity for heating, lighting and power purposes to towns and cities and to the public generally, with the right to condemn property for the use of such companies. The measure is intended to allow companies organized to build dams in White River and Tippecanoe River to condemn backwater land and own the land overflowed, the same as if acquired by purchase.

Holland Gardner of Wabash, Ind., graduate of Purdue University, has been sent to Manila, to take complete charge of the timber-testing laboratory conducted by the government. He will take charge of the work for a construction company which is building a railroad in China.

John L. Blee, Conrad Meyers and Thomas Tieman have been given important positions in the laboratory of the Fort Wayne Electric Works as meter testers.

D. G. Edwards of Cincinnati, traffic manager of the Ohio and Indiana merger lines, gave out the information that the electric railways at Indianapolis are now averaging 200 tons of freight traffic per day, and are proving a great convenience to the shippers, relieving the express companies of much business, since the traction service is more speedy, by reason of more trains.

The recent report that the Stone & Webster syndicate of Boston has accepted the terms of the big syndicate which has been merging electric-railway properties in Ohio and Indiana, and is building west from Indianapolis for its Terre Haute lines, is verified by the filing of articles of incorporation on March 2d, by the Terre Haute, Indianapolis and Eastern Traction Company. The purpose of this company is to complete a gap and to merge another group of interurban properties by the syndicate represented by the McGowan and Murdock syndicate. The properties absorbed by the new company include all the electric roads between Indianapolis and Terre Haute.

The Indiana Supreme Court has just rendered a decision in which it is held that "the danger, if any, to which the occupants of a farm and the stock thereon will be exposed" by reason of building an interurban railroad across it is too remote and speculative to be considered as an item of damages for the appropriation of a right-of-way.

A bill has been introduced in the Legislature prohibiting steam and interurban railroads operating in Indiana from selling tickets unless the distance between the points covered by the tickets and the amount of fare are printed on the face of a ticket. The railroad managers are making a vigorous fight against the bill.

In its report to the Legislature on recent disastrous railroad wrecks in Indiana, the State Railroad Commission scores railroad employes for disregarding rules; asks that railroad companies require a more thorough knowledge of the rules, and recommends a law compelling railroads to install improved block systems along their lines.

The Indiana Supreme Court has declared the employers' liability act of Indiana is unconstitutional and is invalid except as it applies to railroads, because it is in violation of the fourteenth amendment to the Constitution. S. S.

Illinois.

Peoria, March 2.—The stockholders of the Alton, Peoria and Jacksonville Railway Company held a meeting at Jerseyville and voted to increase the capital stock from $300,000 to $800,000, and a bond issue of $800,000 was authorized.

The McKay-Ayres-Bauerle Power Company of Chicago has taken out incorporation papers to produce and sell light, heat and power. Incorporators are Emil C. Wetten, Charles H. Pegler and Herbert J. Campbell.

The Heyworth Electric Light and Power Company of Heyworth has been incorporated to operate utility plants. Charles J. Crump heads the incorporators.

An interurban line from Hannibal to Jacksonville, with city lines in Hannibal, is rumored to be the latest project of the Illinois Traction Company.

Another bill to give municipal authorities power to regulate telephone rates and giving the Circuit Court of the county power of review over rates when considered unreasonable has been introduced into the state Legislature.

Negotiations between the street-railway employes and the Peoria Railway Company will result in a nine-hour day and the wages will remain about the same, only the men will work nine hours instead of twelve. This means four men to a car instead of six men to two cars as at present. The men now have a weekly day off, but this will be done away with by the new arrangement. V. N.

Northwestern States.

Minneapolis, March 2.—A bill is now being considered by the Minnesota Legislature providing for placing street-railway companies under the jurisdiction of the State Railroad and Warehouse Commission. The measure is being vigorously opposed by the councils of Minneapolis, St. Paul and Duluth, which want to retain their present power over the companies.

H. Rickel of Cedar Rapids, Iowa, and others have incorporated as the Central Iowa Illuminating and Power Company, with a capitalization of $300,000. The principal place of business is Carroll, Iowa.

There is talk of building a new interurban line from Iowa City to Fort Madison, Iowa.

The Beltrami Electric Light and Power Company has let the contract for the machinery to be used in the new power plant near Bemidji, Minn. A dam will be built across the Mississippi River early in the spring.

Steps are being taken for the construction of an electric railway from Keokuk to Columbus Junction, Iowa.

The Dakota Power Company has incorporated at Rapid City, S. D., and will erect a power plant on Rapid Creek. L. A. Richards is one of the leading stockholders.

The Sparta-Melrose Electric Railway and Power Company has filed articles of incorporation with a

capital of $300,000. G. S. Cromwell is one of the incorporators. It is proposed to build a trolley line from Sparta to Melrose, Wis.

P. P. Crafts of Davenport, Iowa, has accepted the position as general manager of the Fort Dodge, Des Moines and Southern road, now in course of construction. R.

Pacific Slope.

San Francisco, February 28.—The three companies which supply San Francisco with illumination have filed their annual statements with the Board of Supervisors. The San Francisco Gas and Electric Company, which is now a subsidiary corporation of the Pacific Gas and Electric Company, furnishes both gas and electric light and holds the public lighting contracts. The Mutual Electric Light and Power Company, which supplies electric current only, has been purchased by the Pacific Gas and Electric Company, but the final payment has not yet been made. The San Francisco Coke and Gas Company supplies gas light only. Two of the companies reporting for the year 1906 show a net loss, due to the fire of April 18th. The San Francisco Gas and Electric Company stated its receipts for gas as $1,899,824.04; for electric light, $1,521,033.09; from other sources, $209,113.77. The "costs" of lights furnished were, respectively, $2,202,981.47 and $2,069,256.14, giving a "net loss" of $642,256.72. For the San Francisco Coke and Gas Company the revenue stated was $49,060.65 and the expenses $177,778.79. For the Mutual Electric Light Company, receipts, $71,281.42 and disbursements $17,884, leaving a balance of $53,396.97. The present value of the Mutual plant is estimated at $1,024,057. The San Francisco Gas and Electric Company paid dividends amounting to $226,315.

The Allis-Chalmers Company, through its San Francisco agency, has closed a large contract for the complete mechanical equipment of a new cement mill for the Henry Cowell Lime and Cement Company. The new plant is to be installed near Concord, Cal., within 50 miles of San Francisco. The electric equipment is to be especially built, with starting-torque features for successfully operating cement machinery. There will be 18 50-horsepower heavy duty induction motors, 23 75-horsepower motors, and one 150-horsepower motor. These will be operated by current taken from electric transmission lines, 60 cycles, two-phase, and stepped down to 440 volts. Provision is also made for the purchase of a number of additional small motors that may be needed. The California Portland Cement Company of Colton, Cal., has closed a contract with the Allis-Chalmers Company for a complete cement-mill equipment, together with 32 induction electric motors, aggregating 1,750 horsepower in capacity, for driving the cement-making machines. Current for operating the motors at 440 volts will be obtained from the Edison Electric Company's transmission lines through a sub-station near the cement plant.

The Monterey County Gas and Electric Company is now in the market for a 1,500-kilowatt turbine engine and generator to supply the increased power that will be needed when the electric road is extended to Salinas.

The Northern California Power Company is having plans made in San Francisco for a fine office building, that will be erected in Redding, Cal. The building will be constructed of concrete, with fancy brick trimmings, in the old Spanish style of architecture.

Advices from Eureka, Cal., are to the effect that the La Grange Hydraulic Mining Company purposes to build an electric railroad over the mountains from tidewater to Redding.

E. L. Bumpus, Arizona manager for the Pacific Wireless Telephone Company, is authority for the statement that the company will have stations in Phœnix, Tucson, Bisbee and Prescott, Ariz., within a year. The company has its own manufacturing plant.

Although the official report of the findings of the arbitration board in the dispute between the United Railroads of San Francisco and the local Carmen's Union has not been made, the findings have been made public unofficially. The agreement expires May 1st. The agreement gives the platform men practically an increase of 20 per cent. in wages, covering a period of eight months back as well as in future, but the eight-hour day, which was the main point at issue, was not granted. The other unions involved in the strike last September, which was called off when the agreement to arbitrate was signed, were granted the desired advance and also the eight-hour day. The inside wiremen, car repairers, etc., are included among those granted the eight-hour day. There is said to be great dissatisfaction among the union conductors and motormen and wholesale desertions are predicted. Over 100 platform men have already resigned their positions since the news as to the award of the arbitration board leaked out.

The new electric cars which the United Railroads has been placing in service on the Valencia Street line appear to be an improvement on the heavy cars operated on Sutter Street. Sixteen of these new cars are already here, 35 more are on the way from St. Louis and a promise has been made of 15 a week to come from the factory till the whole 250 are here. These 250 cars cost $9,000 each, or a total of $2,500,000. The 50 Chicago-type cars cost $375,000 and the 12 new San Mateo suburban cars cost $144,000, making a total investment of approximately $2,750,000 in new cars ordered by the United Railroads since the fire.

Advices from Spokane, Wash., say that a power plant, which, it is asserted, will be the largest hydro-electric plant in the country except the one at Niagara Falls, is to be built by Spokane capitalists at "Z" Falls on the Pend d'Oreille River. Water rights and power sites are owned by David T. Ham, Wilbur S. Yearsley and Edgar A. Torrence of that city. Surveys are being made at the power site and preliminary plans prepared. A.

PERSONAL.

President Pritchett of the Massachusetts Institute of Technology is in the tropics seeking rest and recreation.

F. E. Koehler, who for several years was connected with the contract department of the Chicago Edison Company, has taken a position with the Grand Rapids (Mich.) Edison Company.

D. E. Hunt of the Norfolk (Va.) and Portsmouth Traction Company has resigned his position with that company to assume the management of the Harriman traction holdings in Salt Lake City, Utah.

David Scott Plume, treasurer of the Plume & Atwood Manufacturing Company of Waterbury, Conn., died on February 19th. He was officially associated with the company from the time of its organization and was highly esteemed.

William R. Huntley, eldest son of Charles R. Huntley, who is manager of the Buffalo (N. Y.) General Electric Company, was married at Atlanta, Ga., on February 20th to Miss Janie Speer of Atlanta, daughter of Mr. and Mrs. George Speer.

It has been unofficially announced that Manager F. E. Fitzpatrick of the Sacramento Gas, Electric and Railway Company is soon to become the general manager of the Bay Counties Power Company and that Charles K. McKillip will succeed to the position of superintendent of the Sacramento Gas, Electric and Railway Company at Sacramento, Cal.

ELECTRIC LIGHTING.

The city of Arlington, Ohio, will construct a municipal electric-light plant.

J. B. Palmer and others will install an electric-light plant in Wylie, Texas.

Pella, Iowa, will vote on the issuance of $70,000 in bonds for an electric-light plant.

The Yuma (Ariz.) Electric and Water Company will double the capacity of its plant.

Tecumseh, Neb., contemplates issuing bonds for an electric-light plant which will cost $12,750.

A new electric-light plant will be installed in Ryan, I. T. C. A. McBrian can give particulars.

The Central Light and Power Company of Amite, La., has been incorporated with a capital stock of $10,000.

The North Fort Worth (Texas) Cold Storage Company has made application for an electric-light franchise.

The Sioux City (Iowa) Gas and Electric Company will spend about $100,000 in improvements on its plant.

The city of Vale, Ore., will have an electric-lighting system. A 20-year franchise has been granted a company for that purpose.

The Wilmington (Del.) Candy Company will expend $75,000 in building a new plant. The company proposes generating its own electricity.

The Hennessey (Okla.) Electric Light and Power Company has been incorporated with a capital stock of $15,000 and will install an electric-light plant there.

The Atchison (Kan.) Railway, Light and Power Company proposes to build a new power house and to install a 60-cycle three-phase service. John H. Hackstoff is manager.

The town of Webster Springs, W. Va., will have an electric-light plant soon. The People's Electric Light and Coal Company, which has been capitalized at $15,000, will erect the plant.

The Merchants' Electric Light and Power Company of Gainesville, Texas, will in future be known as the Gainesville Electric Company. The capital stock has been increased from $25,000 to $50,000.

A current newspaper paragraph states that the city of Vienna, Austria, has installed what is perhaps the most remarkable electric or electrically lighted fountain in existence. It is situated in the Schwartzenbergplatz. Underneath the fountain in a huge cemented chamber are placed 27 reflecting lamps capable of producing 70 different luminous and colored effects. The light is transmitted through the waters of the fountain. The light power of the plant is estimated as equal to 900,000,000 candles.

C. S. and R. S. Moore are promoting a large power plant for Klamath Falls, Ore., the plant to be in operation within a year. The power will be utilized in operating sawmills, flour mills, and for lighting and street-railway purposes.

The Atchison, Topeka and Santa Fe Railway will install an electric-light and power plant at its shops in Streator, Ill. The company will also put into commission a large crane to be operated by electric power. All the buildings will be lighted by electricity.

The Bishop Light and Power Company of Bishop, Cal., contemplates extensive additions to its present plant of 500 horsepower. The company is in the market for two and three-phase 60-cycle generators, station equipment, line and service supplies, etc. J. M. Lennon is the engineer in charge.

Consul B. M. Rasmusen of Stavanger, Norway, writes that at a meeting of the City Council of Stavanger a resolution was adopted appropriating $298,123 for the construction of a municipal electric-light plant at the Olteddo Falls, according to the plan prepared by the city engineer and for the acquisition of necessary title and ground. American contractors and manufacturers of electrical supplies should take advantage of this information as soon as possible by communicating with "Elektricitets Kommitteen, Formandskabet," Stavanger, Norway.

ELECTRIC RAILWAYS.

The Mineral Wells (Texas) and Lakewood Park Street Railway Company has been capitalized at $25,000.

The Huntsville (Ala.) Railway, Light and Power Company has decided to increase the capacity of its power plant with $40,000 worth of new machinery.

A survey is being made for the proposed electric railway to be constructed from Superior, Wis., to Minneapolis, Minn. It is reported that the Great Northern Railroad is behind the enterprise.

Papers incorporating the Susequehanna Railway, Light and Power Company for $20,000,000 were recently filed at Hartford, Conn. Lucius F. and John T. Robinson of Hartford are among the incorporators.

The Wisconsin Valley Electric Railway Company is the name of a new corporation formed by H. E. Whitcomb, ex-president of the Wisconsin Central road; George A. Whiting of Neenah, Wis., and George Lines of Milwaukee. It will operate a line from Grand Rapids to Stevens Point, Wis., and eventually to Wausau and Merrill. While the capital is now given as $25,000, it is probable that the work of construction will ultimately require the expenditure of $1,000,000 or more.

The railroad commissioners recently took an important step in agreeing to take into consideration the possibility of electrolysis troubles, due to the laying of new trolley lines in and around Hartford, Conn. The matter came up at a hearing on the petition of the Consolidated Railway Company for approval of method of construction of a double track line from Norwich to Tafts. The city asked that it be saved free from any loss due to electrolysis and the commissioners agreed to take the matter under consideration, thus establishing a precedent.

The consolidation of the traction interests operating between Erie and Buffalo which has been in progress for a year or more has been practically completed, it is said, by the Buffalo and Lake Erie Traction Company, which takes over the Hamburg Railway and the Erie Rapid Transit Company. In all there are now five traction enterprises merged in the Buffalo and Lake Erie Company, and the latter has plans under way for the building of the links necessary to make the chain between Buffalo and Erie complete. The holding company is capitalized at $6,750,000.

The gross earnings of the Aurora, Elgin and Chicago Electric Railway Company for seven months ended January 31, 1907, show an increase of $77,248 compared with the same period last year, the net earnings and surplus increasing $33,311 and $21,218, respectively, during the seven months. The preferred stock of the company now pays dividends at the rate of five per cent. per annum. Beginning in April, travel usually increases very materially and operating charges are greatly reduced as compared with the winter and early spring months, so the officials feel that the surplus should figure nearer eight per cent. on the ordinary shares.

After a year's fight the Chicago, Evanston and North Shore Electric Company has been granted a 50-year franchise by the Evanston (Ill.) council to construct an electric railway from the north limits

of that city to Bowmanville. The compensation to be received by North Evanston is fixed in the ordinance at $66,250. The corporation agrees to allow the city the use of the trolley poles for electric lighting. Frank R. Grover and George G. Wilcox will build the new line, which will extend from the north to the south limits of Evanston in Torrence Avenue and thence to Bowmanville, where it will connect with the extension of the Northwestern Elevated Railroad out of Chicago.

PUBLICATIONS.

The Dayton Manufacturing Company of Dayton, Ohio, has recently issued catalogue No. 139, which describes and illustrates the company's armored-type batteries. Cells of nearly every type and description are listed. The book contains much valuable information and is attractively illustrated.

Bulletin No. 107 from the Electric Controller and Supply Company, Cleveland, Ohio, is a neat loose-leaf book thoroughly describing and illustrating the company's type G controllers. There are a number of tables of resistance fillings at various voltages and several interesting coil or cast grid resistance diagrams.

Joseph Dixon Crucible Company of Jersey City, N. J., has issued a handsome booklet, entitled "Crucibles. Their Care and Use." The author of the work is John A. Walker, vice-president, treasurer and general manager of the company. The purpose of the book is to instruct users of crucibles as to their proper use and the dangers of abuse of crucibles.

The Western Electric Company, Chicago and New York, is distributing three attractive bulletins exploiting and describing in detail the new lines of Sunbeam lamps being marketed by it. The bulletins include Sunbeam tantalum lamps, Sunbeam Gem 50-watt lamps and Sunbeam Gem high-efficiency high-candlepower lamps. Copies of any of these bulletins will be furnished on request.

A new catalogue of electrical protective devices for any voltage has been issued by The Sachs Company of Hartford. Besides describing in detail and illustrating the various devices the catalogue gives prices and general information. The name of "Sachs" has long been connected with the enclosed fuse development. Joseph Sachs, the president, is a pioneer of proved ability in the line mentioned.

Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1050, entitled "Alternating-current Generators, Waterwheel Type." It is a revision of previous bulletins issued on the subject. A good illustration is shown of the interior of the hydro-electric plant at Caliente, Cal., where five 3,000-kilowatt alternating-current generators, waterwheel type, were installed by Allis-Chalmers Company.

"Concrete Factories" is the title of an instructive 152-page book compiled by Mr. Robert W. Lesley, associate American Society of Civil Engineers, and published for the Cement Age by Bruce & Banning, New York. The book is an illustrated review of the principles of construction of reinforced-concrete buildings, including reports of the sub-committee on tests, the United States Geological Survey and the French rules on reinforced concrete. This material is viewed in the book from every aspect. The authorities consulted and opinions collated from many sources all seem to agree on the importance, value, durability and permanence of concrete and reinforced-concrete construction. The volume is not intended to be considered as authoritative in the field it sets out to cover; nevertheless, it embraces much that is of interest and value in the way of information on the present state of the art.

SOCIETIES AND SCHOOLS.

"Directory of Membership No. 6" of the American Institute of Electrical Engineers, revised to February 1, 1907, has been issued by Secretary Ralph W. Pope, 33 West Thirty-ninth Street, New York city. It shows a grand total of 4,224 members and associates, of whom 522 are members. New York state has 1,308 members and associates, or 31 per cent. of the whole; Pennsylvania has 412; Massachusetts, 291; Illinois, 246; Ohio, 191; California, 150; England and Scotland, 141; New Jersey, 130; Canada, 127, and other states and countries smaller numbers.

The Railway Signal Association will hold a meeting in the Great Northern Hotel on March 18th, beginning at 10 a. m. The following subjects will be discussed: general specifications for electric interlocking; installation and maintenance of storage batteries; signal lamps; interlocking and block signals.

The S. P. S. Electrical Club of the School of Practical Science, Toronto, Ont., reports very successful meetings. The club was organized in December last and meets every two weeks. It is made up of senior mechanical and electrical students who, in connection with faculty of applied science, discuss subjects of general interest, thereby increasing their knowledge and getting practice in speaking and debating. Willis Maclachlan is president and J. C. Armer, secretary.

It may be well to announce again that the general annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York city, on March 27th and 28th, beginning at 10 a. m. As in the past, all persons in any way interested in the requirements of the National Electrical Code governing the installation of electric wires and apparatus are cordially invited to be present and take part in the meeting, and it is hoped that the usual full and representative attendance may be present. C. M. Goddard, 55 Kilby Street, Boston, is secretary.

TRADE NEWS.

G. W. Tuggle & Co. of Beaumont, Texas, have sold their electrical supply business to T. E. Christopher.

The Jantz-Leist Electric Company of Cincinnati, Ohio, has started the construction of a new fireproof plant. The building will cost, together with the ground, $40,000.

The Columbus (Ohio) Electrical Works was recently incorporated with a capital stock of $25,000. The company will manufacture electrical machinery and supplies, also equip and repair electric power plants. Otto M. Spielman and others are the incorporators.

James S. Pennyfather, 116 West Thirty-ninth Street, New York city, has recently purchased the patent rights, patterns and tools for the line of switchboards formerly built by the Chase-Shawmut Company. Mr. Pennyfather will do a general business also in stage-lighting appliances, such as border lights, stage lamps, etc.

Owing to the increase of business the Massachusetts Chemical Company of Walpole, Mass., has been obliged to build a large addition to its factory, which has been equipped with the best of modern rubber machinery, doubling the capacity of the plant and enabling the company to handle orders much more promptly than heretofore.

The United States Circuit Court of Appeals in Chicago filed an opinion on January 31st last in the case of the Westinghouse Electric and Manufacturing Company against the Diamond Meter Company. In this suit, brought for infringement of Tesla patents No. 511,559 and No. 511,560, the court below granted injunctions against the Diamond Meter Company, stopping its manufacture and sale of certain alternating-current wattmeters commonly known to the trade as "Scheeffer meters," and the present opinion of the Court of Appeals affirms the action of the lower court in placing the Diamond Meter Company under injunction. This decision is the latest of a long series of favorable decisions, and appears to place the validity of these patents and their applicability to split-phase meters for power purposes beyond question. The opinion gives full credit to Mr. Tesla for the invention of the split-phase idea of operating meters, and its effect is seemingly to render impregnable the position of the Westinghouse Electric and Manufacturing Company and the General Electric Company and their associated companies as having exclusive right to manufacture and sell split-phase alternating-current induction wattmeters.

BUSINESS.

An attractive folder from the National Carbon Company of Cleveland declares that arc lamps that leave a heavy deposit on the inner globe give a light comparable to that of the moon when it hides behind a cloud. Clean globes and brilliant light are the result of using Columbia carbons, it is said. The folder promises that the company will send free to anyone enough Columbia carbons to make a test which will prove its assertion.

The Porcelain Electrical Manufacturing Company of Trenton, N. J., is no longer making the "P. E. M. Co. knob," which is the two-piece porcelain insulator formerly known as the "W. E. split-knob." The R. Thomas & Sons Company, 39 Cortland Street, New York city, now has the exclusive right to make and market this insulator, and will give all orders prompt attention. The insulator will now be known as the "Thomas T. P. I. knob."

The General Purchasing Company is a new Illinois corporation whose business consists mainly of cashing the daily sales of manufacturers and jobbers whose active capital would otherwise be tied up in accounts due some time in the future. This plan enables the man with a growing business to realize daily on his output at no greater expense, it is said, than the discount which would be allowed the customer if he paid for the goods the day they were shipped. This plan is used extensively in the East, it is asserted, and it is believed that there is a large field for it in the West.

Dynamo and motor manufacturers interested in the production of strictly first-class electrical machinery and hence paying particular attention to the technique of all improvements in methods of insulation will be interested to know that the Jeffrey Manufacturing Company of Columbus, Ohio, has recently made quite a large installation of the vacuum drying and impregnating apparatus of the J. P. Devine Company of Buffalo, N. Y., which institution operates under Emil Passburg's patents and processes. The Jeffrey company will apply the Devine system throughout all its electrical work. The Devine company is now making rapid strides in the electrical business and refers to a large number of the most extensive and progressive factories in the United States as users of its Passburg system and apparatus.

The Excello Arc Lamp Company of 24 and 26 East Twenty-first Street, New York city, recently installed a number of its lamps at the New York Postoffice and at the Erie Railroad terminal, Twenty-third and Chambers streets. The six 10-ampere Excello flaming arcs erected at the north mailing platform of the postoffice have taken the place of 10 ordinary enclosed arcs and some 80 clusters of 20 incandescents each, which composed the former illuminants, resulting, it is said, in a reduction equal to 60 per cent. of the current formerly consumed. The Erie Railroad Company's ferry slips, cab stands and concourse are now lighted with Excello flaming arcs. The M. Wineburgh Advertising Company, 452 Fifth Avenue, New York city, is now using Excello lamps in the illumination of bulletin signs. A large sign, 25 by 40 feet, is said to be efficiently lighted by the use of two such flaming arcs.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 26, 1907.

845,048. Storage-battery Plate. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company of New York, N. Y. Application filed August 14, 1906.

A battery plate comprises a number of active strips provided with registering holes and a supporting and enclosing framework having rods cast from the frame on to the strips in the holes.

845,051. Electric-resistance Apparatus. Rolf von Brockdorff, Bregenz, Austria-Hungary. Application filed December 6, 1906.

In the apparatus described there is a resistance member in the form of a metallic hose, the metallic skeleton of which constitutes the electric resistance material, which is formed of a spirally wound metal tape, the coils of which are insulated from one another.

845,053. Incandescent-lamp Bulb. David F. Campbell, Vancouver, British Columbia, Canada. Application filed November 15, 1904.

The bulb has a front and back portion, the front being formed of sheet transparent material in the shape of a spherical segment, the back being similarly formed and projected into the concavity of the front portion. One of the portions has flutes or corrugations. A ring filament is held within the bulb, between the front and back portions. The back portion of the bulb projects within the circle of the filament. (See cut on next page.)

845,056. Telephone System. Elmer R. Corwin, Chicago, Ill. Application filed October 20, 1906.

A common battery subscriber's line equipment includes a telephone line extending to the subscriber's station, a transmitter and impedance coil conductively included in the line circuit to receive direct current from the common battery, and a receiver in direct conductively continuous shunt of the impedance coil, the receiver being of high resistance with respect to the resistance of the impedance coil, whereby the flow of direct current therethrough is sufficiently eliminated to prevent polarization thereof, and the use of a condenser in circuit with the receiver to prevent its polarization is not required.

845,062. Telephone Transmitter. James M. Dempsey, Chicago, Ill., assignor of three-tenths to William B. Beckman, Fayetteville, Ark., and three-tenths to Harry T. Rogers and one-tenth to Madeline Dempsey, Chicago, Ill. Application filed November 30, 1906.

The device includes a cell containing a quantity of granular conducting material, a spring arranged to exert an initial compression upon the material in the cell, an electric circuit including the granular material, and means interposed between the diaphragm and the spring and adapted to reduce the pressure on the material through a movement of the diaphragm in the direction of the advance of sound-waves striking it.

845,077. Telephone Trunking System. Harry C. Goldrick, Indianapolis, Ind., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 17, 1902.

Combined with a trunk circuit extending between different switchboard sections adapted to connect telephone

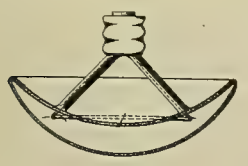
lines for conversation are a ringing signal for the incoming end of the trunk, the signal being actuated when connection is established with the called line, a relay actuated in the metallic line when the called subscriber responds to render the signal inoperative, the latter relay when actuated closing a path for current in shunt of the line to deprive the line of current.

845,091. Variable-speed Transmission. Francis P. Huyck, Swanton, Ohio. Application filed November 14, 1904.

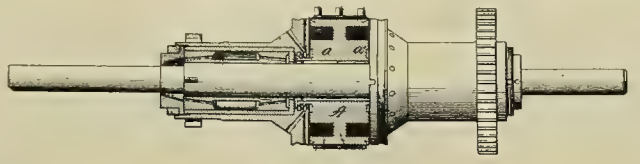
Combined with the driving shaft of a sewing machine are an electric motor armature freely mounted on the shaft and a motor field rigidly supported in proper relation to the armature.

845,101. Polarity Indicator. Paul Leo, Elizabeth, N. J. Application filed March 9, 1906.

The device which serves to indicate the polarity of a main circuit and which is adapted to be located in the circuit or a branch thereof having the like polarity comprises two oppositely wound electromagnets connected in series and mounted on a suitable base, binding posts for connecting the magnets with the circuit, a polarized armature pivotally mounted in respect to the magnets and an arm or pointer secured to the pivot of the armature to move with the same.



NO. 845,053.—INCANDESCENT LAMP BULB.



NO. 845,126.—MAGNETIC CLUTCH.

845,110. Car Fender. William T. McLaughlin, Jamaica Plain, Mass. Application filed November 16, 1906.

An electromagnet is mounted on the fender having an electric switch in circuit with it, both being in circuit with the electrical current. The fender is actuated by the magnet.

845,111. Circuit for Coin Collectors. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

In a telephone system are combined with a telephone line, including a source of current and a subscriber's set, a branch circuit thereof including an electromagnet, coin-operated mechanism controlled by the magnet, and a relay connected with the subscriber's set for controlling the continuity of the branch circuit.

845,112. Circuit for Coin Collectors. James L. McQuarrie, Chicago, Ill., and Henry M. Crane, New York, N. Y., assignors to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

Combined with a circuit are a relay in one of two branches of the circuit, roll-operated mechanism controlling at one point the continuity of the second branch, the relay controlling at another point the continuity of the branch, a source of current adapted to be connected with the circuit, and a signal associated with the circuit and responsive upon the closure of the second branch to current from the source.

845,126. Magnetic Clutch. Alfred W. Saville, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 24, 1906.

Combined with a double-ended clutch body provided with an energizing coil for each end are a conductor uniting the end of one coil with an end of the other coil, and a conductor uniting intermediate points in the two coils; whereby a current which magnetizes one end of the clutch demagnetizes the other end thereof. (See cut.)

845,153. Telegraph Sounder. Dennis A. Whitney, Holland, N. Y., assignor of one-half to William D. Huntington, Holland, N. Y. Application filed November 15, 1906.

In connection with a telegraph instrument, mounted on a support, are hollow drums arranged on the support, adjustable abutments on the supports engaging the outer faces of the drums, and spacing means interposed between the drums.

845,157. Composite Telephonic and Telegraphic Circuit. George M. Yorke, New York, N. Y., assignor to the American Telephone and Telegraph Company, a corporation of New York. Application filed January 7, 1907.

A composite telegraph and telephone system comprises line conductors provided with telegraph stations, intermediate bridge conductors connecting the lines and containing telephone instruments, the instruments having associated with them sources of steady current having access to the bridge conductors, earth branches joined to the bridges at each side of the telephone instruments, and means situated in the earth branches for preventing the passage of steady currents.

845,161. Car-controlling Apparatus. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company, a corporation of Maine. Application filed June 17, 1905.

In a car-controlling system there are a track comprising an insulated section, a track circuit for the section comprising a track battery, the opposite rails of the section, and a track electromagnetic device, a car provided with automatic controlling means, a magnet on the car for operating the controlling means, a circuit for the magnet, and a circuit branch arranged to be connected in the magnet circuit when the car has reached a predetermined point on the track, the circuit branch being controlled by the electromagnetic device of the track circuit.

845,188. Railway Signal System. Francis M. Myers, Windsor, Mo., assignor of one-third to Charles A. Draper, Windsor, Mo., and one-third to Philip H. Kilpatrick, Corinth, Miss. Application filed March 22, 1906.

In the block-signal system described, contact rails are arranged at a number of points in each block. Electro mechanical indicating means are carried by the locomotive for giving a danger signal.

845,219. Electrothermal Cut-out. Frank B. Cook, Chicago, Ill. Application filed April 16, 1906.

In the device described is an operable spring member electrically connected with one of two end caps secured to a thermal protector.

845,220. Block-signal System. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 16, 1904.

In the system there are a source of alternating current connected to a block, means for reversing the connections of the source to the block, a relay having two relatively movable windings, one of the windings being connected to the source and the other to the block, and a signal controlled by the relay.

845,225. Resistance Unit. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 26, 1906.

The unit comprises an enameled base, insulating supporting means embedded therein, and a resistance conductor running back and forth through the support above the surface of the enamel.

845,232. Weft-replenishing Mechanism for Looms. Christian M. Hansen, Vejle, Denmark. Application filed February 2, 1903.

In the mechanism is included an electrically actuated device contained in a normally open electric circuit.

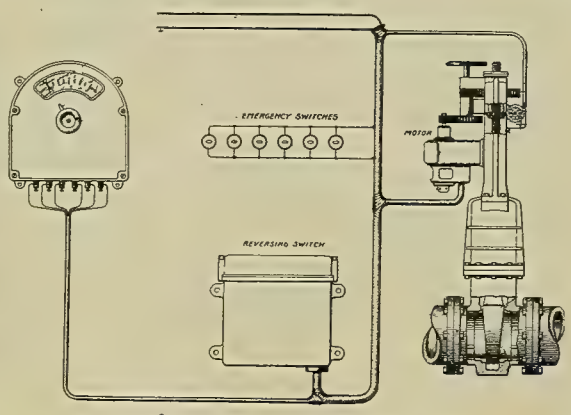
845,236. Cut-out. Edward M. Hewlett and Charles H. Hill, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed May 2, 1904.

Two sets of stationary contacts are mounted upon opposite sides of a tubular base. A longitudinally movable contact is adapted to engage the pairs of contacts.

845,242. Mast for Wireless Telegraphy and Other Purposes. Ludwig Leidl, Vienna, Austria-Hungary. Application filed August 1, 1906.

The mast comprises a number of detachable sections.

845,252. Ring for Connecting Wires. Ralph E. Noble, Chicago, Ill., assignor to the Morgan-Gardner Electric Company, Chicago, Ill. Application filed September 1, 1906.



NO. 845,281.—ELECTRICALLY OPERATED VALVE.

A ring at the branching point in trolley wires is adapted to receive the wires and to permit a trolley wheel to pass from one wire to another beneath the same.

845,256. Process for Utilizing Waste Ends of Carbons for Arc Lamps. Rudolf Peters, Heidelberg, Germany. Application filed January 16, 1905.

The process consists in forming from the waste ends a product which is adapted for use in the manufacture of colors, putties, etc.

845,268. Spring Terminal Clip. John Schade, Jr., Brooklyn, N. Y., assignor to the Fahnestock Electric Company, a corporation of West Virginia. Application filed April 28, 1905.

A fastening device for electrical conductors comprises a body member and a spring member, one of the members being slotted centrally to form a projecting hook-tongue adapted to coact with the opposite member to clamp a conductor.

845,281. Electrically Operated Valve. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 8, 1904.

In a system for controlling a reversible electric motor there are a reversing switch comprising two parallel bars of insulation, four contact clips on each bar, a rock shaft parallel with the bars, two pairs of connected switch blades carried by the shaft, and two pivoted electromagnets having their armatures pivotally attached to rock arms on the shaft. (See cut.)

845,282. Telephonic Current Reinforcer or Repeater System. Nathaniel G. Warth, Columbus, Ohio. Application filed April 23, 1906.

In a telephone repeater there is a primary or local circuit including the following elements: The primary of an induction coil, a source of current, and a transmitter and a receiver, in repeater relation.

845,288. Swivel Tip for Electric Conductors. William F. Barker, Somerville, Mass. Application filed April 17, 1906.

Combined with a tubular shell having an aperture in its closed end are a tip extending loosely through the aperture, and an electric conductor inserted and held firm in the opposite open end of the shell.

845,316. Means for Receiving Intelligence Communicated by Electric Waves. Greenleaf W. Pickard, Amesbury, Mass. Application filed November 23, 1906.

The detector comprises a solution of a good conducting metal, and a co-operating member of the same metal, the co-operating member having only a small part of its area exposed to the solution, in order to effectively concentrate at the junction of exposure the energy of the received signal currents. The solution has a high specific resistance, producing a high-resistance junction, to convert into heat an effective amount of the energy of the received and concentrated currents. The solution and co-operating member have a high thermo-electromotive force. (See cut.)

845,323. Trolley Pole. Charles F. Wensinger, Fremont, Ohio. Application filed October 31, 1906.

Details are described.

845,328. Party-line Lock-out. Mark P. Boone, Peru, Ind., assignor to the Peru Common Battery Lock-out Telephone Company, Peru, Ind. Application filed January 27, 1906.

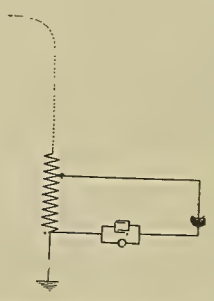
In a party-line telephone, in combination with the talking circuits thereof consisting in part of a pair of separable terminals, and means normally controllable by the user for permitting engagement of the terminals, are electrically controlled means for preventing contacting of the terminals, a switch in series with the terminals, and a condenser bridging the switch.

845,368. Interrupter for Magnetos. Theodor M. Mueller, Braintree, Mass., assignor to Willard E. Dow, Braintree, Mass. Application filed December 10, 1906.

Combined with the armature of a magneto are a laterally extending spiral spring fast thereon provided adjacent to its outer end with a contact, and a rigid arm also fast thereon provided at its outer end with a contact in position to co-operate with the spring-carried contact, the spring and arm being insulated from each other, and a fixed cam ring in position to engage and separate the spring-carried contact from the co-operating contact as the contacts rotate with the armature.

845,370. Coin Collector. Frank R. McBerty, Evanston, Ill., and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed January 23, 1903.

In combination with a telephone line extending from a sub-station to a central office are a magnet arranged to lock a manually operated refunding mechanism or operate a coin-transferring mechanism according to the current applied thereto, and means at the central office for applying current suitable for exciting the magnet for either of its functions.



NO. 845,316.—DETECTOR FOR RADIO-TELEGRAPHY.

845,383. Ear-massage Apparatus. Kelley M. Turner, New York, and Norton W. Johnston, Chappaqua, N. Y., assignors to the General Acoustic Company, a corporation of New York. Application filed August 25, 1905.

In the apparatus described there is a magnet having an armature formed of a single piece of iron bent upon itself and having a circuit-making clip.

845,391. Negative-pole Plate. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed April 5, 1906.

A negative-pole Planté plate has porous inert material incorporated within the active material.

845,405. Tractor for Electrical Towage Systems. Léon Gerard, Brussels, Belgium, assignor to the American Adhesion Traction Company, a corporation of Delaware. Application filed August 1, 1905.

In the tractor patented is an electric motor secured to the supporting frame beneath the track and between the end extensions and geared to the traction wheels.

845,406. Electrically Driven Fluid Pressor. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed April 27, 1905.

The apparatus comprises a portable base, a motor casing fixedly secured to the base, a pressor cylinder fixedly secured to the base independently of the motor casing and a crank-shaft casing interposed between and supported solely by the motor casing and pressor cylinder.

845,413. Electric-resistance Thermometer. Ernst Haagn, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed September 22, 1906.

The thermometer consists of a quartz glass rod, a platinum wire wound spirally over the rod, and an outer quartz glass layer, the rod and layer being fused together completely embedding the wire in the glass.

845,452. Telephone Trunking System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 23, 1902.

Combined with a trunk line are a cord circuit to connect with its outgoing end and a called-subscriber's line with which its incoming end is connected, a disconnect signal for the incoming end, means operated by current flowing over the called subscriber's line when connection is made therewith for placing the signal in condition to operate, and further means controlled by the connection of the cord circuit with the trunk for rendering the signal inoperative.

845,459. Elevated Electric Railway. James M. Gilstrap, Oakland, Cal. Application filed July 31, 1906.

Bands or straps encircle the car at different points. Upper and lower carwheels are connected to the tops of the bands and travel on the upper trackway. There are also upper and lower carwheels traveling on the lower trackway.

845,476. Switch Mechanism for Electric-lamp Sockets and the Like. James P. Neilson, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed July 25, 1906.

An electrical switch device has a spindle and a contact piece connected with lost motion to the spindle, and directly operated by the latter with means tending to keep the parts in the same positions with relation to each other rotarily.

845,478. Box for Illuminated Signs and Transparencies. Georges E. Rainaud, Vincennes, France. Application filed September 26, 1905.

The box for incandescent lamps has one or more transparent designs in relief upon the front face.

845,496. Insulated Rail Joint. George W. Whiteman, Philadelphia, Pa. Application filed September 14, 1905.

Splice bars connect the rails and there is insulating material embracing one of the rail ends and confined by the splice bars.

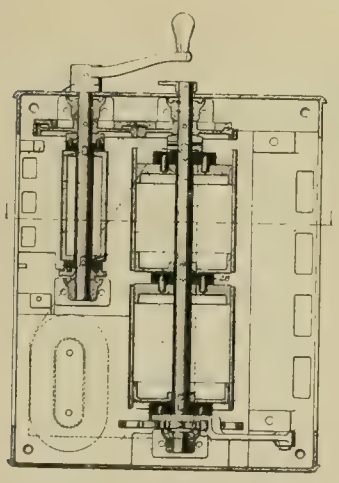
845,497. Insulated Rail Joint. George W. Whiteman, Philadelphia, Pa. Application filed April 11, 1906.

This patent is a modification of patent 845,496.

845,522. Automatic Signal Attachment for Telegraph Registers. John C. Carmody and Walter K. Pulsifer, Fitchburg, Mass. Application filed April 28, 1906.

In the device described is a weighted arm carried by one of two shafts acting in conjunction with the other shaft for holding the former shaft against rotation until the catch is released.

845,528. Controller. William Cooper, Cincinnati, and Charles W. Johnson, Norwood, Ohio, assignors to the Bullock Electric Company, Cincinnati, Ohio. Application filed October 13, 1903.



NO. 845,528.—CONTROLLER

Combined are multiple-voltage mains, a motor, a field resistance, a controlling switch and connections, the controlling switch comprising a contact drum, a second contact drum out of alinement with the axis of the first drum, and means controlled by a single device for actuating both of the drums. (See cut.)

845,533. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 7, 1903.

In combination with a telephone line having a number of testing contacts are a cord circuit, a relay associated therewith to control the continuity of the portion of the testing circuit associated with the cord circuit, the relay being initially actuated over a local circuit independent of the talking circuit and a supervisory relay associated with the cord circuit and adapted to control the circuit of the first-mentioned relay.

845,542. Incandescent-lamp Socket. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed May 17, 1906.

A cap for incandescent lamp sockets has a slitted neck threaded on its inner face and conically compressed.

845,543. Electrical Attachment Plug. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed January 7, 1907.

The plug comprises a cap carrying connecting pins with a cup containing chambers on its upper side, contacts for the cap pins mounted in the chambers and carried by the cup, and a chamber on the under side of the cup containing a plate electrically connected to one of the contacts on the upper side.

845,544. Wiring Knob. Waldo C. Gordon, Windsor, Vt., assignor to the Electric Good Manufacturing Company, Maine. Application filed November 20, 1905.

The knob comprises a base having a straight groove for a wire and a cap having a circular grooved surface for engaging the wire, the surface crossing the straight groove at two points.

845,546. Telephone Magnet. Aaron E. Harrison, New York, N. Y., and Crowell M. Haslett, Jersey City, N. J. Application filed September 9, 1905.

The magnet comprises magnetic members and pole pieces mounted thereupon, the pole pieces converging toward each other so as to concentrate the magnetic lines of force within a comparatively small area, and spool ends mounted upon the pole pieces and inclined relatively to the general length thereof.

845,585. Carbon Electrode and the Method of Producing the Same. Truman P. Sharts, Readsboro, Vt., assignor of three-fourths to others. Application filed March 6, 1905.

A hard carbon stick comprises layers of carbon formed with integral coherency from the burned products of the hydrocarbon. The process of making the electrode consists of burning hydrocarbon oil and collecting the carbonaceous products in a mass and moving the mass to produce successive homogeneous layers.

845,609. Electric Conductor. Sidney G. Brown, London, England. Application filed June 16, 1902.

Combined with an electric cable having balanced capacity and self induction, and an artificial cable comprising a core, are an earth plate and a self inductively wound resistance surrounding but insulated from the earth plate.

845,614. Pot-head. William Callahan, South Bend, Ind. Application filed May 10, 1905.

The device is for use in distributing boxes for wires and cables.

845,629. Burglar Alarm. Joseph Gaynor, Barre, Vt. Application filed August 25, 1906.

The alarm includes a normally open alarm circuit and spaced contact strips forming the terminals of the circuit and being forced into engagement by a trigger.

845,637. Watchman's Electric Time Detector. Otto E. Hausburg, New York, N. Y. Application filed December 3, 1904.

Combined are perforators for a record sheet, holders for the perforators, the perforators sufficiently sloping so that the record sheet as it moves will cam the perforators free from the sheet.

845,652. Illuminated Showcase. Maximilian E. La Berge, Los Angeles, Cal. Application filed May 23, 1906.

Electric-lamp supports are placed on a tube extending between the reflector strips, and electric-supply wires extend through the tube and have connections to the lamp supports.

845,655. Automatic Circuit-breaker. Harry W. Leonard, New York, N. Y. Application filed March 21, 1901.

Combined are two independently movable switches, an electroresponsive device for automatically and simultaneously effecting the opening of both of the switches when excessive current flows, and a second independent electroresponsive device for effecting independently of the first device the opening of only one of the switches under an abnormal condition of electromotive force upon the circuit.

845,656. Electric Circuit Controller. Harry W. Leonard, Bronxville, N. Y. Original application filed December 20, 1904. Divided and this application filed April 6, 1906.

In combination with a motor rheostat having a spring pressed arm are a coil for controlling the circuit, a contact at or near the initial position of the arm for effecting the current in the coil, and restraining means for the arm at its resistance-all-out position.

845,671. Means for Creating a Vacuum. Percy H. Thomas, East Orange, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed June 14, 1904.

An electric current is passed through the enclosed chamber containing mercury and a material capable of amalgamation with it.

845,682. Car Motor. Benson Bidwell, Chicago, Ill. Application filed July 5, 1906.

Combined with a stationary car axle, having wheels mounted thereon, are a casing secured to the wheels and revolving therewith, an armature and commutator mounted upon the axle, and field magnets and brushes secured to and revolving with the casing.

845,683. Signaling System for Electric Railways. Charles P. Breese, Norfolk, Va., and Adoniram J. Wilson, Westfield, N. J., assignors to the Hall Signal Company, a corporation of Maine. Application filed May 5, 1902.

In the system are combined a continuous-feed conductor connected with an electromagnet, an intermediate supply conductor divided into blocks insulated from one another for conveying the current from the feed conductor to the cars, a return conductor, and electric means including a resistance coil controlling the signal connected with the continuous-feed conductor and connected with the intermediate supply conductor of the block, all so arranged that the presence or absence of a car upon a block will change the electrical condition of the electric means of the block, and thereby change the condition of the signal.

845,712. Attachment Plug. Charles J. Klein, New York, N. Y., assignor to Ralph Abraham Schoenberg, New York, N. Y. Application filed April 21, 1906.

The plug comprises two separably and swivelly operatively connected body members jointly provided with means for maintaining electrical circuit conditions, and locking means detachably uniting the body members and comprised within the means for maintaining electrical circuit conditions.

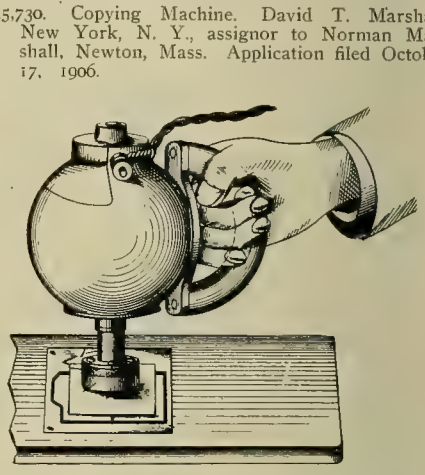
845,722. Protecting Device for Vapor Apparatus. Percy H. Thomas, East Orange, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Substitute of application filed July 23, 1904. This application filed July 30, 1904.

In a vapor electric apparatus are combined with a lead wire, a liquid electrode around the same, an outer pocket for holding the electrode, and a cup-shaped receptacle immediately surrounding the lead wire for holding a portion of the liquid in contact therewith at times of sudden jar.

845,725. Means of Driving Paper-making Machines Electrically. Albert Aichele, Baden, Switzerland. Application filed July 12, 1906.

Separate electric motors are employed to drive the individual parts or sections of the machine. There are means on the electric motors for maintaining them at the same working speed independently of the load, and shunt windings connected with the motors for varying the speed of the separate motors within small limits.

845,730. Copying Machine. David T. Marshall, New York, N. Y., assignor to Norman Marshall, Newton, Mass. Application filed October 17, 1906.



NO. 845,730.—MOTOR-DRIVEN COPYING MACHINE.

One claim describes a copying device comprising a motor adapted for manual manipulation, a rotary head connected with the motor, an annular raceway in the face of the head and balls in the raceway projecting beyond the face of the head. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 4, 1907:

422,419. Armature. C. D. Jenney, Indianapolis, Ind.
422,438. Automatic Switch for Regulating the Power of Electric Batteries. G. B. Pennock, Brooklyn, N. Y.
422,445. Supporting Frame for Electric-railway Motors. E. D. Priest, Lynn, Mass.
422,446. Arc Lamp. G. C. Pyle, Indianapolis, Ind.
422,456. Carbon for Electric Lamps. W. F. Smith, Philadelphia, Pa.
422,457. Treatment of Storage-battery plates. C. Sorley, New York.
422,504 and 422,505. Secondary Battery. S. C. C. Currie, Philadelphia, Pa.
422,511. Dynamo-electric Machine. R. Eickemeyer, Yonkers, N. Y.
422,512. Electromagnet. R. Eickemeyer, Yonkers, N. Y.
422,533. Secondary Battery Plate. W. P. Kookogey, Brooklyn, N. Y.
422,550. Compound Insulating Layer for Electric Coils. E. Thomson, Lynn, Mass.
422,556. Electric Motor. H. E. Walter, Schenectady, N. Y.
422,577. Apparatus for Speaking Telephones. T. A. Edison, Menlo Park, N. J.
422,578 and 422,579. Telephone Repeater. T. A. Edison, Menlo Park, N. J.
422,645. Electric Railway. S. H. Short, Cleveland, O.
422,654. Electric Time-alarm and Annunciator. N. H. Suren, Fort Worth, Tex.
422,746. Electrical Induction Apparatus or Transformer. M. von Dolivo-Dobrowolsky, Berlin, Germany.
422,755. Electromotor Engine. S. Z. de Ferranti, Hampstead, County of Middlesex, England.
422,765. Telephone Switch System. C. C. Gould, Batavia, N. Y.
422,773. Electromagnetic Annunciator. C. J. Hamilton, Philadelphia, Pa.
422,855. Pulsating Electric Generator. C. J. Vandepoele, Lynn, Mass.
422,856. Pulsatory Current Motor. C. J. Vandepoele, Lynn, Mass.
422,857. Alternate-current Pulsating System. C. J. Vandepoele, Lynn, Mass.
422,858. Converting Continuous into Pulsating Electric Currents. C. J. Vandepoele, Lynn, Mass.
422,859. Pulsating Current System. C. J. Vandepoele, Lynn, Mass.
422,860. Multitple-current Pulsating Generator. C. J. Vandepoele, Lynn, Mass.
422,862. Regulating Current Motors. G. A. Washburn, Cleveland, O.
422,863. Armature for Dynamos, etc. G. A. Washburn, Cleveland, O.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Cazadero Plant of the Portland Railway, Light and Power Company.

By C. M. Hyskell.

The fourth and largest electrical power plant of the Portland (Ore.) Railway, Light and Power Company was formally opened with becoming ceremonies in the presence of 200 prominent Northwest business men and capitalists on February 26th. The new plant is at Cazadero, on the Clackamas River, 40 miles from Portland. It is laid out for developing 25,000 horsepower. With the machinery now installed 15,000 horsepower is developed in three units of 5,000 horsepower each. Two more units will be installed within a short time. In one bound the electrical current available for use in the city of Portland is doubled.

Interior pictures of the new Cazadero plant are shown in Figs. 1 and 2, while Fig. 3 is a general view of the exterior of the plant.

The company now operates four substantial power plants as follows: The Cazadero plant, laid out for 25,000 horsepower; station B at Oregon City developing 12,000 horsepower from the Willamette River Falls; station E, a steam plant opened in Portland last year, developing 11,000 horsepower and using sawmill refuse for fuel, and station F at Boring, on the company's electric road between Portland and Cazadero, developing 2,500 horsepower. The company owns and operates approximately 200 miles of street railway in Portland and standard-gauge electric interurbans, besides furnishing all the electric light and power for the city of Portland and suburbs.

At Cazadero a reservoir constructed on a bench of the mountain 125 feet above the power house supplies water to the wheels. Fig. 4 is a view of the forebay wall inside the reservoir before the latter was filled. When the water passes through the forebay gate openings, which are nine feet in diameter, it enters penstocks (Fig. 5) eight feet in diameter resting on a concrete web and cross-wall arrangement and inclined at an angle of about 45 degrees down the hillside to the power house, where they are connected to three pairs of Platt Iron Works horizontal double turbine wheels, regulated by Lombard governors.

Each pair of waterwheels, under a total head of 125 feet, will develop 5,000 horsepower. As they are now installed they have a head of 138 feet at low water with reservoir full, or 13 feet greater than the pressure for which they were designed. As the water comes down through the tubes from the forebay gates it divides on each wheel, half acting in one direction along the shaft against one wheel and the other half acting in exactly an opposite direction along the shaft and against the other of the pair of wheels; yet through the influence of the directing curves of the small gates, controlled by the governor, the entire body of water tends to rotate the shaft in one direction.

Attached to each waterwheel shaft is a 2,500-kilowatt 33⅓-cycle 11,000-volt Allis-Chalmers generator and a 125-volt dynamo of 75 kilowatts capacity used as an exciter for the generators. Besides having a governor each wheel is provided with a safety device for the prevention of breakage or damage from "water hammer." As is well known, water is practically incompressible, and when the flow of water in an enclosed channel is suddenly checked, as would be the case were the governor to suddenly close the small gates on the wheels, the pressure behind the obstruction would rise to such an extreme point as to endanger the iron casing. The governors are actuated by belts driven by the wheel shafts, but are further sensitized by motors driven by power taken from the control panels of the switchboard. The switchboard is shown in Fig. 6.

The wheels and generators are set on a massive concrete foundation and there is very little vibration when they are all running at full speed. Electrical construction and operation of the plant is in charge of O. B. Goldwell, operating engineer of the company, while the work of constructing the lines for the transmission of current to Portland is in the hands of H. S. Sladen, transmission engineer of the company. F. G. Sykes, general manager of the department of electricity, is in general charge of all the plants of the company.

A feature of the power house is a 20-ton Niles traveling crane electrically operated on steel tracks laid on pilasters in the walls and 22 feet above the floor.

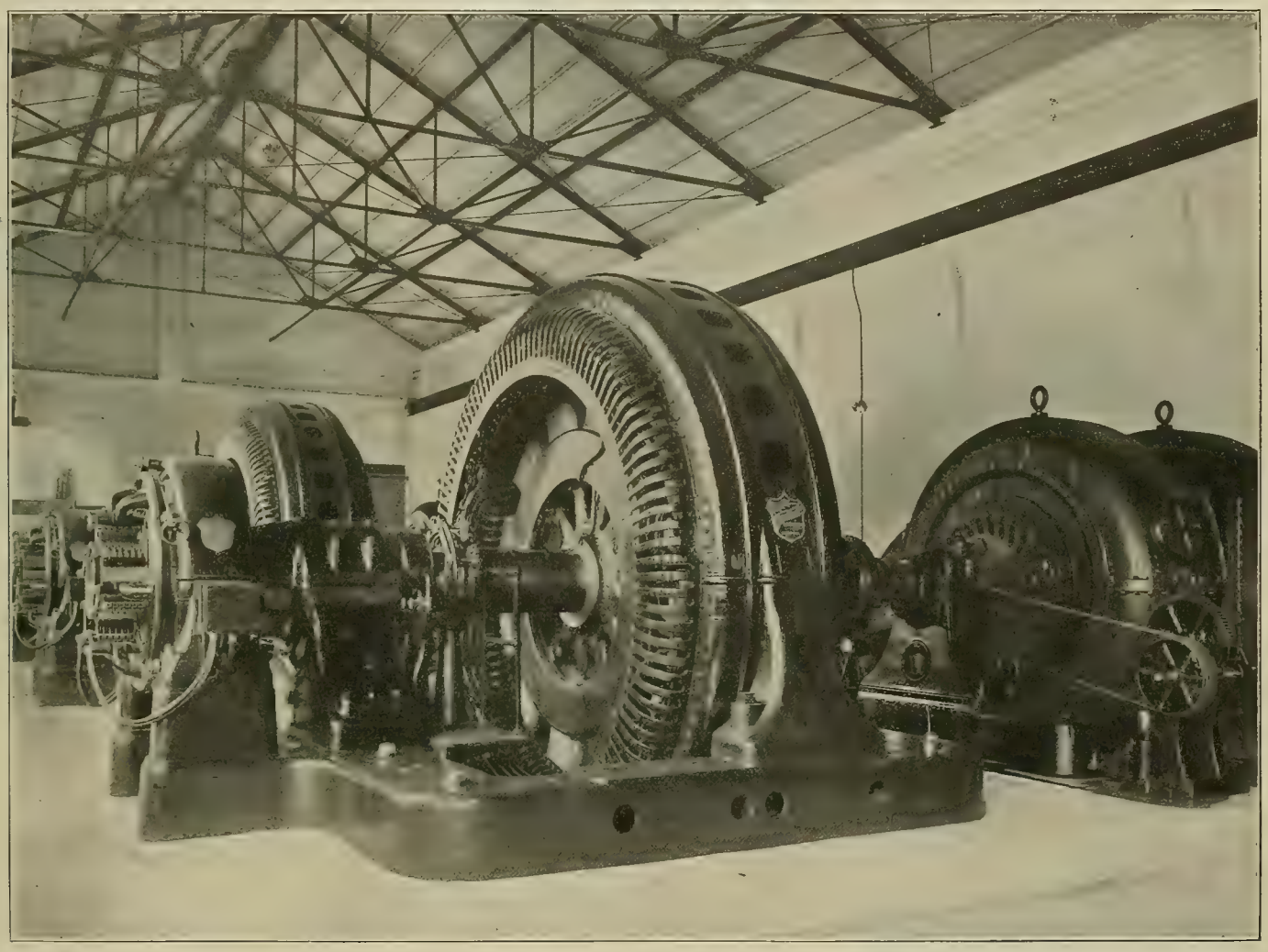


FIG. 1. INTERIOR OF CAZADERO POWER HOUSE OF THE PORTLAND (OREGON) RAILWAY, LIGHT AND POWER COMPANY.

The current passes through General Electric type H oil switches over three lines crossing the Clackamas River to the transformer house, where it is stepped up to 30,000 volts and is carried to Portland over two No. 00 copper lines. In the city it is stepped down to 10,000 volts for commercial distribution. There is also a No. 1 copper 10,000-volt line leaving the power house and following the railway to Portland. The various sub-stations along the road receive their power from this line.

Waterpower Development.

From a dam in the Clackamas River, nearly two miles above the power-plant site, water is taken in flume and canal to supply the reservoir. This dam, originally constructed wedge-shaped, of rough logs about two feet in diameter laid across and lengthwise of the stream in such a way as to form vertical pockets from 10 to 20 feet square, filled with broken rock and clay, was subsequently reinforced by means of a rock fill and crib work after a section of the dam had been washed out by a flood. The length of the main body of this new crib is 120 feet and the bottom width is 40 feet. It is 65 feet high and rests on bedrock, to which it is securely anchored. The dimensions of

FIG. 2. ANOTHER INTERIOR VIEW OF THE CAZADERO POWER HOUSE.

the dam proper are 176 feet width of base, 200 feet long on base, and its length over all is 400 feet.

The water spillway between the bulkheads is 153 feet wide and 51 feet high above low water. The dimensions of the bulkheads confining the water to the spillway are 60 feet long and 43 feet wide for the one on the east side and 57 feet long and 35 feet wide for the one on the west side.

The flume is built on crushed rock foundation

FIG. 3 POWER HOUSE AT CAZADERO, OREGON, OF PORTLAND RAILWAY, LIGHT AND POWER COMPANY.

and follows the contour of the hillside along the river a distance of 2,622 feet, where it empties into a ditch through a concrete outlet. The bottom of this ditch is 35 feet wide, its depth 22 feet, its total length 2,890 feet to its outlet into the reservoir. About one-half the length of the ditch from the flume there is a stretch of flume 360 feet long, with concrete inlet and outlet, built with the idea of eliminating eddies.

The reservoir covers an area of 50 acres when

FIG 4. FOREBAY WALL OF CAZADERO POWER PLANT BEFORE RESERVOIR WAS FILLED

filled to an average depth of 20 feet. When filled to this level it would supply power sufficient to run the wheels to their capacity six hours after the gates at the upper dam had been closed.

Steel gates admitting water to the penstocks are set in a massive forebay wall of steel concrete built on the top edge of the river bluff. The spillways are provided with sectional gates so that it is possible to keep the lake level at whatever height desired. This concrete wall, eight feet thick at the top and 20 feet thick at the bottom, rests upon a foundation 47 feet wide, of steel concrete construction and built upon sandstone bedrock. A steel concrete core wall four feet thick at the bottom and two feet thick at the top, extends from the main dam or wall for 40 feet into the earth embankment of the reservoir. The distance from the top of the main wall to the foundation is 33 feet and the length of the main wall is 290 feet. At one extremity it joins the reservoir embankment, while at the other end it enters the hillside rock. The foundation upon which the main wall rests extends up stream 27 feet beyond the gates, which slide vertically against the up-stream face of the wall. These gates are arranged to be operated either by hand or by electric power controlled from the power house.

Provision has been made for the operation of five units of wheels and generators. At present, however, but three units are in use, the two remaining gate openings having been closed with

FIG. 5. A CORNER OF CAZADERO POWER HOUSE, SHOWING PENSTOCKS.

timber gates. To prevent carrying drift and other foreign matter into the wheels, iron racks have been placed in front of the gates.

OTHER FACILITIES OF THE PORTLAND RAILWAY, LIGHT AND POWER COMPANY.

Station B, the Oregon city plant of this company, is at present capable of developing 12,000

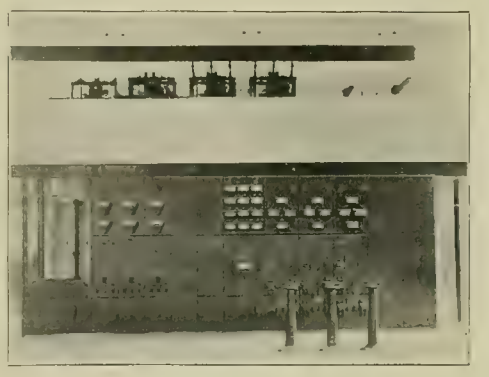


FIG. 6. SWITCHBOARD IN CAZADERO POWER PLANT.

horsepower. When the ultimate hydraulic capacity of the Willamette Falls is developed an additional amount of from 30,000 to 40,000 horsepower will be available at Oregon City. Figs. 7 and 8 are, respectively, exterior and interior views of station B at the Falls of the Willamette, Oregon City.

A new feature of the company's service in Port-

FIG. 7. STATION B OF PORTLAND COMPANY AT THE FALLS OF THE WILLAMETTE, OREGON CITY.

land, as noted in its bulletin, is the Complaint Department, established for the quick remedy of any cause of complaint. The department is located in the lower hall of the First Street entrance to the company's offices, and is readily recognized by the sign, "Lighting and Power Complaints."

It is the duty of the man in charge to receive

F. G. SYKES,

General Manager, Department of Electricity, Portland Railway, Light and Power Company.

all complaints against the Light and Power Department of the company.

In conjunction with the Complaint Department there has also been established an information desk, and it is the duty of the man in charge to give quick response to any inquiry. The work of the company is so extended, however, that it is impossible for any one man to be familiar with the procedure of all departments. It will be, then, the duty of the man at the information desk to ascertain and to convey the desired information "at the promised time." If it takes longer to ascertain than was at first estimated, then this will be stated and such explanation made as may be necessary. The aim is to spare no effort to save the customers from annoyances or inconveniences of every nature by prompt investigation and quick and ready attention to their wants.

The Portland company is preparing to put into operation a central steam-heating system. Portland

FIG. 8. INTERIOR OF STATION B, OREGON CITY.

is not considered an ideal place for a steam-heating plant on account of the comparatively mild temperature, and heat is not required for more than six months of the year. For this reason it is particularly advantageous to the people to be enabled to secure steam heat from a central plant, thus avoiding the necessity of individual boiler plants, attendants and other expenses. The service will not be confined to large buildings, but as with light it will be available to everyone, and the schedule of rates charged, most moderate, thus placing the service within the means of all classes of customers.

The intention is to install the service throughout the business district as quickly as possible, and then to extend it as rapidly as the population and growth of the city warrant.

Steam heat will be sold on meter basis, the customer paying only for the amount used. The company will erect a brick central steam-heating station building near the center of the city, from which main pipes will run and the service be supplied. The initial investment will be from $250,000 to $300,000.

Cornell University Branch of Institute.

The regular March meeting of the Cornell University branch of the American Institute of Electrical Engineers was held in Franklin Hall, on March 8th. The secretary presided in the absence of the chairman. The feature of the evening was an original paper presented by Mr. J. S. Codman, rates specialist of the General Electric Company, and located in Boston, Mass. Mr. Codman's paper was a masterly analysis of the principles underlying equitable rates. The synopsis, given elsewhere, which was distributed at the meeting, gives an excellent idea of the scope of the paper. The attendance at the meeting was 70. After the formal part of the exercises an opportunity was given for the members to meet Mr. Codman, and a number took advantage of the opportunity for further discussion of the topic. The paper was fully discussed by local members, and a number of difficult points were thus explained and illustrated.

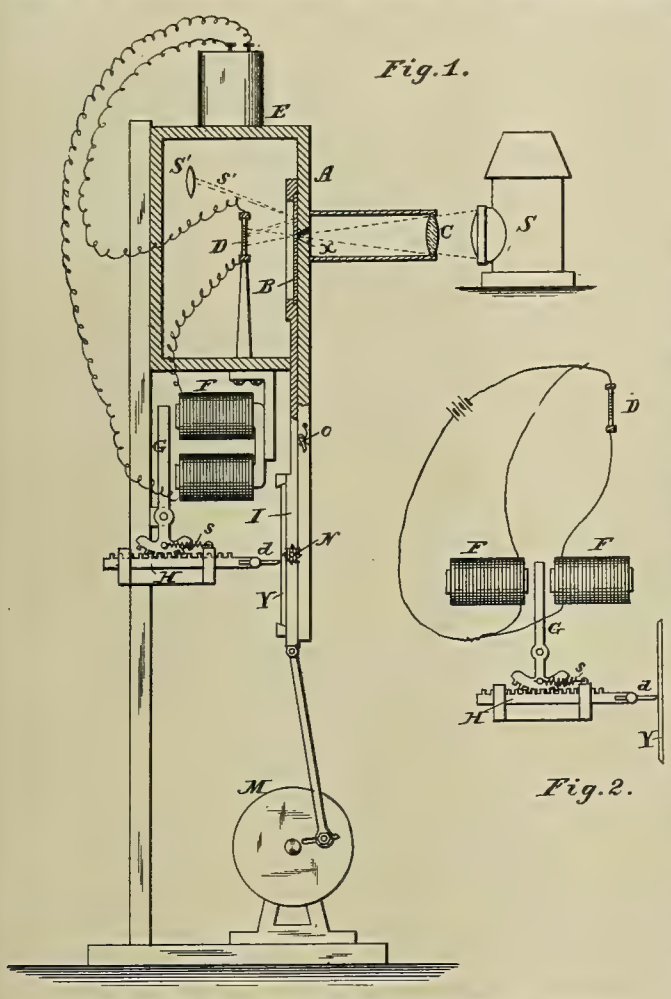
At the preceding meeting the executive committee was increased by the addition of Mr. R. L. Stone, an undergraduate associate of the Institute, who will represent the students' interests on the committee.

Transmission of Pictures by Electricity.

By Forée Bain.

The article which appeared in the Western Electrician of February 16, 1907, under the title, "Korn System of Transmitting Pictures by Electricity," has reminded me of a similar system which I devised and patented in the year 1883.

The broad principles involved in the two systems are practically the same in the method of producing and transmitting electric impulses corresponding with the lights and shadows of the picture to be reproduced at the receiving end. There appears this difference, however, in the results produced: In the Korn system, it seems, a photographic negative from a chemically sensitive film is reproduced at the receiving end. In the Bain system an engraved block, capable of reproducing the picture by means of a printing press, is produced at the receiving end. In the system of 1883 a cutting or engraving tool is made responsive to variations of electric current coming over the line, from a distant point if desired, by means of which a plate, made to move in synchronism with the movement of the film or photographic negative at the transmitting end, is engraved.



BAIN'S PATENT OF 1883 FOR TRANSMITTING PICTURES BY ELECTRICITY.

When the plate has been finished by the receiving instrument it is ready to be put into the printing press, and, without further manipulation, pictures, corresponding with the picture or negative used at the transmitting end, may be printed in daily papers, magazines or other periodicals very much as when a plate or block for a halftone is used to reproduce a photograph.

The patent specification discloses the system and its mode of operation. The receiver and transmitter are shown in the drawings mounted on a single frame. It is obvious that when synchronism of movement of the transparent or translucent photographic film or plate and the block to be engraved is established, they may be separated any desirable distance—25 miles or probably a much greater distance.

In view of the recent activity in this art, it is interesting to read this old specification and to examine the drawing. The following is quoted from the patent specification, dated November 13, 1883:

"In carrying the invention into practical effect I use a pattern (a photographic negative or positive, or any polished or transparent or translucent plate or sheet having upon it a pattern formed by lines or shades) which will to a greater or less extent obstruct the transmission or reflection of rays of light or heat from a flame, or heated or luminous body. In passing the rays to or through said pattern plate I prefer to use a lens that will focus said rays upon the plate, and to then pass the latter back and forth, or otherwise move it so that every portion will in succession be subjected to the rays. It will be obvious that if the rays passed thus from a pattern plate of varying opacity are thrown upon a substance or device which will respond to the varying intensities of the rays, the latter may be made the means of effecting the adjustment of a cutting tool traversing the surface of or traversed by the object to be cut in unison with the movement of the pattern plate. Different appliances, depending upon the character of the work to be performed, are used in carrying out this mode of operation. In producing intaglio or relief a burr or drill or milling tool may be used. For engraving, a gouge, chisel or cutting tool is employed. In any case the tool traverses the object to be cut; or the latter moves beneath the tool in unison with the movement of the pattern plate, and the position of the tool, determining the depth or character of the cut, is regulated by the intensity or quantity of heat or light rays passing from the traversing pattern.

"In Fig. 1 of the drawings is illustrated an apparatus for automatic engraving, in which (A) is a case, closed, except at one point, where an opening (x) permits the passage of rays of light or heat emanating from a source, as (S), in this case represented as a lantern focused upon a pattern plate (B) (in this case a photographic negative or positive), by means of a lens (C). Fig. 2 shows a modification in which two magnets or solenoids are used in branch circuits, one branch including the selenium cell.

"The rays passing through the pattern plate are received upon a block of selenium or a selenium cell (D), which forms part of an electric circuit, the resistance in which will therefore be proportioned to the amount of light or heat to which the cell is subjected. When a pattern plate is used adapted to reflect more or less light, according to the design upon the plate, the radiant energy may emanate from any source, as (S'), and be transmitted to the face of the plate and reflected therefrom to the selenium or other circuit-controlling medium, as indicated by dotted lines (s'). As shown, the circuit includes a battery (E) and electromagnet (F), the armature (G) of the latter being pivoted and extended to form a lever geared or connected with an arm (H), carrying a graver (d). A spring (s), capable of having its tension nicely regulated, is arranged to lift the armature from the magnet.

"The plate (v) to be engraved moves beneath the graver in unison with the pattern plate (B). As shown, both are upon a slide (I), which is reciprocated longitudinally, and moved laterally step by step, so that gradually all parts of the pattern plate are traversed by the rays and all parts of the plate (I) are carried beneath the graver. The slide may be caused to partake of any of the movements common to engraving-machine slides or plate holders, the means of providing such movements being too well known by those skilled in the art to need particular description. In the drawings, for an example, however, I have illustrated one of the most primitive, the longitudinal reciprocation being produced by a crank or slotted rotating disk (M) and the lateral step-by-step motion by a screw rod having a ratchet (N) on one end connected to the slide and engaging with a spring pawl (O) on the bed or frame of the machine. As the strength of the current increases and decreases with the intensity of the rays received upon the selenium cell, there is a corresponding variation in the power of the electromagnet, and the armature thereof is subjected to a varying force tending to draw it to the magnet against the power of the spring, so that the graver is withdrawn from and pressed against the plate, according as the heat or light rays are less or more obstructed in their passage through the pattern plate. The depth of the cut is thus regulated and caused to correspond with the varying influence of the radiant energy, inasmuch as in proportion as the passage of the rays is interfered with by the increased opacity of the pattern the strength of the current will be varied and will produce a corresponding variation in the adjustment of the tool.

"The above-described apparatus illustrates the invention somewhat crudely, and for many operations would be variously modified. It, however, serves to illustrate the principle of my invention, and those skilled in the arts to which it appertains will readily see the various modifications necessary to adapt my invention to the various kinds of work. Without attempting to set forth all the modifications that have suggested themselves, I will mention a few that are obvious to everyone skilled in electricity. Thus a solenoid may be advantageously substituted for an electromagnet; or two solenoids or two magnets, one in a main and the other in a shunt circuit (see Fig. 2), may be arranged to operate simultaneously in opposite ways upon the armature or movable core, securing an increased effect, as in the regulating magnets of electric lights. A galvanometer may be used instead of an electromagnet, in which case the movement of the needle is made the means of intensifying or decreasing the magnetic action of a magnet or solenoid. Other means may be used where a weak current is made the means of operating a switch regulator or other device, the movement of which throws in or cuts out other and stronger motor currents, in the same manner as a relay. The magnet (F) may have a core of soft iron; or the core may be polarized, and the conductor may be so wound as to intensify or reduce the magnetic action. An equivalent of the selenium cell in some cases would be a thermo device, as a thermopile generating its own current of greater or less intensity under the varying quantity of heat rays, and controlling the operating magnet directly or indirectly, as before described. Any desired means may be employed to secure a coincidence of movement of the pattern and the object to be operated on. These means will differ with the difference in the character of the work to be done. In some instances the object operated on will be curved or cylindrical, and will revolve as the pattern slides. In other cases, while there is a unison and coincidence of motion, the degree of motion will differ, the duplicate in such case being proportionately larger or smaller than the pattern. It will therefore be understood that my invention may be embodied in various different apparatus, but that the principle of operation is the same—to wit, the governing of the position of the cutting or forming tool by the varying action of heat or light rays transmitted through or to and from a pattern plate of varying opacity or reflecting power."

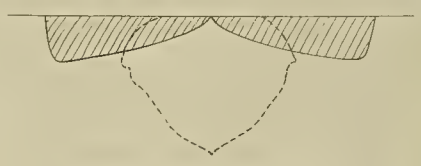
There are many refinements not shown in the patent, of which this system is susceptible, and there can be no doubt in the mind of a practical person skilled in the art, that by this system a picture may be taken, substantially transmitted to a distant point and a block made ready for the printing press within a very short time.

[A further reference to Dr. Korn's apparatus is given in the Paris letter in this issue of the Western Electrician.—Ed.]

Light Distribution from Street Lamps.

By Albert Scheible.

In noting the recent discussion of street lighting by the Chicago section of the Illuminating Engineering Society the Western Electrician of March 9th mentioned the light-distribution diagram shown



CURVES OF LIGHT DISTRIBUTION.

at that meeting by the writer. As this was afterward mentioned by a number of other speakers, your readers may be interested in the reduced copy herewith.

This diagram is simply a combination of the curve of light distribution calculated for an ideal street lamp by Dr. Hugo Kruess of Hamburg, and that actually measured from a Beck flaming arc lamp by Professor Wedding of Berlin University. The shaded "bat-wing" part shows the ideal light distribution toward which we must aim in order to get the highest efficiency for street lighting, while the acorn-shaped figure shows the excessively downward light distribution from one type of flaming arc lamp. Other lamps as now on the market for outdoor lighting show curves ranging between these extremes and while none of them as yet can match

the ideal bat-wing distribution curve, several are approaching it, much to the satisfaction of all interested in economical street lighting.

London County Council Generating Station and Greenwich Observatory.

(From the London correspondent of the Western Electrician.)

The full report of the committee appointed to inquire into the alleged interference by the generating station of the London County Council at Greenwich with the work of the famous Observatory there is a more interesting document than the conclusions (given editorially in the Western Electrician of March 2d) would lead one to suppose. The investigations that have been made have an interest greater than that attaching to the case in point. I therefore refer to them somewhat at length.

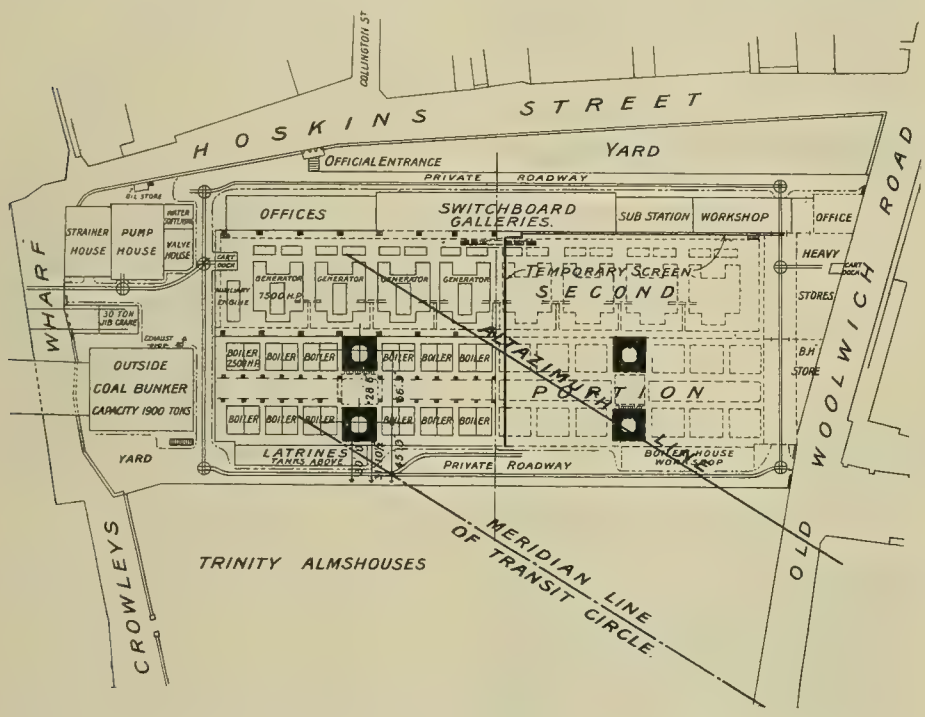
The generating station lies directly north of the Royal Observatory at a distance of half a mile. The first portion of the station, which is now completed, contains four reciprocating-engine generating sets normally developing 3,500 kilowatts, but capable of working up to 4,250 kilowatts on an overload. Although normally only three of the sets are simultaneously at work, all four engines have been run together to enable the full vibration effects of the four engines to be examined. The engines of these sets take steam from two banks of boilers, the furnaces of which are connected, respectively, to two chimneys which rise to a height of 250 feet above the stoking floor, or 271.88 feet above ordnance datum (259.38 feet above Trinity high-water mark). Their tops are 100 feet above the horizon of the Observatory. The Greenwich meridian, viz., the meridian of the main transit circle, passes about 15 feet to the west of the westernmost of the two completed chimneys, while the meridian of the altazimuth instrument passes to the east of both of them, but intersects one of the uncompleted chimneys which form part of the second portion of the station.

The second portion of the station, which is partly built but not yet equipped with machinery, is planned to be of the same size as the first portion. It is intended to equip this portion with turbo-alternators having a total capacity of 20,000 kilowatts, in 5,000-kilowatt units. The two unfinished chimneys of the second portion already rise to a height of 191.38 feet and 193.68 feet above Trinity high-water mark, the former height being just 68 feet short of the height of the completed pair. The meridian of the altazimuth passes nearly diagonally through the group of four chimneys, intersecting the westernmost of the incomplete pair.

The general arrangement of the station and the position of the meridians with respect to it are shown in the accompanying plan.

Dealing with the question of the vibration, the investigation of which has been confined to the existing portion, the committee states that it has clear evidence that the engines do cause vibrations of the ground, which are felt at the Observatory. The effect is perceptible when one engine is running and becomes augmented when the number is increased. It constitutes a novel disturbance, distinct from and additional to anything that the Observatory has hitherto had to contend with. It is clearly seen in the saucer-shaped trough containing mercury, which is used in the adjustment of a transit telescope, in observations when the cross-hairs are sighted along with their image as reflected from the trough. The reflected image moves in such a manner as to show that the mercury is undergoing oscillations whose period agrees with that of the impulses due to the inertia of the reciprocating masses in the station engines. The vibrations due to the engines are of a comparatively long-period type and altogether different from the tremors due to a passing train or road traffic, the latter being more or less intermittent and their effect counteracted by means of a mercury trough.

The vibrations due to the reciprocating engines are never wholly absent, but by substituting for the saucer a trough in which the mercury takes the form of a thin film lying on an amalgamated metal surface whose curvature is so slight that the depth of mercury is less than half a millimeter at the center of a circle 15 centimeters in diameter a perfectly steady reflecting surface is secured, which is not affected by the vibrations even when the maximum effect of four engines is in question.



PLAN OF GENERATING STATION AT GREENWICH, SHOWING RELATIVE POSITIONS OF MERIDIANS.

This affords a complete solution of the difficulty so far as the important question is concerned of enabling observations to be carried out by reflection in mercury notwithstanding the vibration of the ground. With regard to interference with the accuracy of astronomical work, the committee expresses no definite opinion, but seems to favor the idea that this will not be so.

Inquiring into the question of how the vibrations originate the report states that the type of engine is one which admits of very complete balance, but unfortunately the engines have been designed without regard to this. It would have been comparatively easy in construction to have arranged them so that there would be no vibration of the kind they actually produce, but to alter them now in such a way as to eliminate vibration would be expensive and difficult. Prof. W. E. Dalby has submitted a special report upon this particular aspect of the case.

Each of the four engines consists of two like parts or elements, situated 30 feet apart and connected to one shaft, in the middle of which is the generator. Each element consists of a vertical (high pressure) and horizontal (low pressure) cylinder, with pistons driving on the same crankpin. The crankpin of one element is 135 degrees in advance of that of the other. Taking each element separately, if the reciprocating masses had been made equal and if a suitable revolving mass had been used for balancing, a complete balance as regards primary vibrations would have been obtained and the effects now experienced would have been entirely avoided.

But no attempt was made to secure this absence of primary vibrations and the result is that in each revolution of the engine the inertia of the parts causes unbalanced forces to be applied to the foundation block. These forces are equivalent, for each of the two elements of each engine, to 23 tons weight acting vertically up and down alternately and to 40 tons weight acting horizontally to right and left alternately of the line of the shaft. Each of these forces is reversed 94 times a minute. It is scarcely surprising therefore that with these immense unbalanced forces at work, causing oscillation of the engine bed, effects are transmitted to the ground which are felt as far off as the Observatory.

Professor Dalby in his special report indicates (1) how the vertical forces alone might be neutralized by introducing a certain revolving balance weight, and (2) how both the vertical and horizontal forces could be neutralized by increasing the former, viz., by adding enough mass to the vertical piston to make it equal to the horizontal piston, and at the same time introducing a larger revolving balance weight. It appears, however, that the size of the engine frames makes the second proposition scarcely practicable, and that the cost of the partial cure (1) would be about $12,500 for each engine.

The committee, from its investigations, however, does not feel justified in recommending either of these cures to be applied for the present.

In coming to the decisions upon which the recommendations given recently were based the committee expresses the opinion strongly that there should be no further extension upon the present site. In its judgment the station should not have been placed there at all. The matter has gone so far now that to remove the station or to stop the completion of the second portion would involve a much greater expense than the circumstances warrant. Whatever care be taken to avoid vibration, the discharge of large volumes of smoke or hot air into the atmosphere constitutes a danger to the work of the Observatory which must necessarily increase with any further augmentation of the power.

Hot air, smoke and tremors of the ground are more or less unavoidable in a town, and an observatory in a town has, in the ordinary way, to take its chances. But a site near the Greenwich Observatory is the last place that should be chosen for the exceptional development of heat and power required in carrying out a scheme of distribution over the metropolitan area. Instead of further enlargement on this site, a suitable site should be selected elsewhere for any extension that may be required, and the possible ultimate removal to it of the existing plant should be kept in view.

It should be pointed out that neither the result of the committee's investigations nor its recommendations are to be held as expressing the opinion of either the Admiralty or the London County Council, nor as binding those departments in any action recommended. G.

Electricians of Paris on Strike.

The city of Paris, France, was very greatly inconvenienced on March 8th, according to newspaper dispatches, as a result of a strike by employes in the electric-light and power plants of the city. The streets, cafes, hotels and houses using electricity were in darkness and many industrial plants using electric power were shut down. Only one of the large papers was able to get out its regular issue, having an isolated electric plant of its own. After a day and a night of great inconvenience the men returned to work.

It is said that the cause of the dispute was the City Council's rejection of the plan for the municipalization of the electric plants of the city, the granting of a new concession for 22 years to a private company and the subsequent refusal of the company to place its employes on the footing of the men employed by the city in the matter of hours, wages and pensions.

The strike did not receive the support of any section of the press. Both the central government and the municipality are blamed, though the strike was called by employes of private companies which hold concessions. But in all berating of the government there has been no demand for municipalization. The deplorable telephone service in Paris alone is doubtless enough to prevent going to so extreme a cure.

A request was recently received, and complied with, at the headquarters of the American Institute of Electrical Engineers for the name of an electrical engineer who is also a good baseball pitcher.

Telephone Dictating Apparatus.

Messrs. Kelley M. Turner and William F. H. Germer of New York city and Hoboken, N. J., respectively, have been granted a United States patent (No. 843,186) on a telephone dictating machine which they term a "dictograph," being a telephonic system or apparatus by which a person—for example, the manager of an office—may dictate letters to any one of his corps of stenographers without requiring them to leave their places at their own desks.

"By the ordinary telephone system," say the inventors, "a central operator is able to talk to any selected persons on connecting lines, but the conditions are not at all the same as if the communicating persons were in the same room and directly speaking to one another. The first point of difference is that the speaker has to direct the sound closely into the telephone transmitter. For best effects the speaker is about two inches from the mouthpiece, so that his action resembles talking into a speaking tube more than the act of general conversation in a room. The second point is that the person at the receiving end has to listen with the receiver at his ear. The third point of difference is that both cannot very well talk at once, since the sound goes over a single pair of line wires. Also the receivers at each station are in circuit with both transmitters, so that either receiver gets not only the sound transmitted from the other station, but sound at the transmitting station.

"By our invention we make use of what we shall term a 'loud earpiece,' or, in other words, a 'loud-speaking telephone receiver.' This is in itself not a novel feature, since loud-speaking telephone receivers are well known; but we also employ a special form of transmitter which obviates the necessity of the operator standing anywhere near the mouthpiece. In addition to this we so arrange the circuits as to avoid delivery of the sound spoken at each end into the receiving instrument at that end of the line.

"The invention also has in view many incidental features—for example, the connection of any individual stenographer and certain indicating means to indicate when the stenographer is ready and means for conveniently putting into circuit either the loud earpiece or an ordinary receiver, a special calling system, a switch in constant reach of the operator's or manager's fingers by which the ordinary receiver or the loud earpiece may be thrown into action, and many other features which we have worked out so as to obtain all the conditions of a manager dictating to a stenographer directly at his desk, while, in fact, the stenographer is at a remote point."

Referring to the drawings, (1) in Fig. 1 indicates the manager's instrument, which is convenient in the form of a rectangular box or casing or any sort of adjustable arm attached to the manager's desk. This instrument has in its face an acousticon transmitter (2) and a loud earpiece (3), which for certain practical reasons is separated quite widely from the transmitter. A specially constructed telephone receiver (4) is hung upon a permanent or fixed hook. Annunciator drops (6) may be of the ordinary sort employed in telephone switchboards, and (7) indicates apertures for an ordinary plug or jack by which certain connections are made. (8) is an ordinary push-button, and (9) a switch, which serves certain functions hereinafter described; (9') designates an ordinary call-bell.

Referring now more particularly to Fig. 2, the various devices above mentioned and forming part of the manager's instrument, together with the circuits and connections therefor, are all illustrated beneath the dotted line (A A). Above the line are indicated three branch lines, which correspond to separate stenographer's instruments. The stenographer's instrument includes an acousticon transmitter (10), adapted to receive spoken sounds at any reasonable distance therefrom, and an ordinary telephone receiver (11); (12) indicates an ordinary telephone hook by which the receiver is hung up,

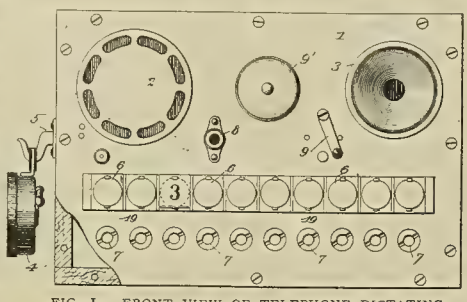


FIG. 1. FRONT VIEW OF TELEPHONE DICTATING APPARATUS.

and (13) indicates the usual call-bells; (14) denotes a push-button or switch conveniently disposed at each stenographer's instrument.

For the purpose of supplying the necessary current, a number of batteries (15) (16) and (17) may be used, and which are conveniently situated at the manager's end of the line, about or within his desk or about his office. As will be seen from the diagram of circuits in Fig. 2, each annunciator drop (6) is adapted to close a special circuit at the points (18) whenever an annunciator drop falls to expose the number beneath. In practice this connection is made by a lever or blade at the point (19), Fig. 1, although the connection may be made to occur in any way so as to be completed whenever the annunciator drop falls.

The diagram of circuits, Fig. 2, shows the apparatus in its normal or passive condition, when no one is talking. Suppose the manager wishes to dictate a letter to the stenographer at station No. 3. Under these circumstances he takes the plug (7') and inserts it in the aperture (7) of station No. 3. He then presses the push-button (8), completing the following circuits: From battery (15) at station No. 3, downward through wire (m'), spring contacts (m^2), with the wires (m^3) (m^4), push-button (8) (depressed), wire (m^5), connection (m^6), contact (m^7), wire (m^8), stenographer's call-bell (13), hook (12), wire (m^9), back to battery. Thus the call-bell of station No. 3 rings, and the stenographer takes her receiver off the hook and presses the button (14). This completes the following circuit: From button (14), through wire (n'), battery (17), wire (n^2), annunciator (6), which is the third one on the manager's instrument, causes it to drop into the dotted position shown, wires (n^3) and (n^4), back to the push-button (14).

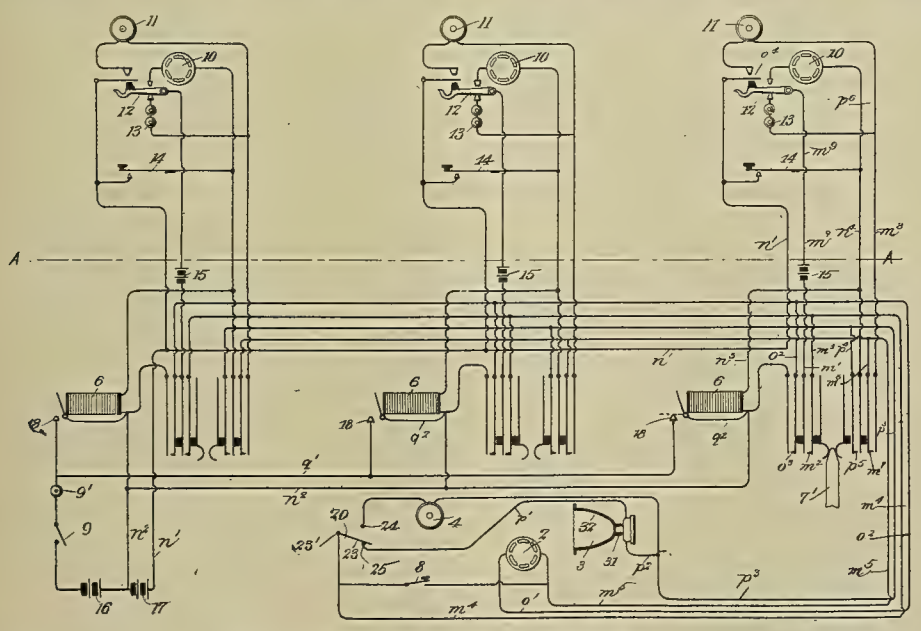


FIG. 2. DIAGRAM OF CIRCUITS OF THE DICTOGRAPH.

In this way the manager learns that stenographer at station No. 3 has correctly received his signal and is ready to take his dictation. He accordingly proceeds with the dictation in an ordinary voice and without any necessity of placing his lips close to the transmitter. This is on account of the fact that an acousticon transmitter is used, so that the manager may dictate at his desk or in any convenient manner, exactly as suits his habit of dictation when a stenographer is present in the room. The talking circuit under these circumstances is completed as follows: From acousticon transmitter (2) through wires (o') (o^2), contact (o^3), wire (n^2), battery (17), wire (n'), contact (o^4) (now completed), stenographer's receiver (11), wire (m^8), contact (m^7), and wire (m^6), back to the acousticon transmitter (2). This is therefore a closed circuit, including the transmitter, a battery, and the stenographer's receiver, as required.

The dictation proceeds in the usual way, and under these circumstances the stenographer will frequently desire to ask about the nature or spelling of a word or name, or ask to have a sentence repeated or further data given, and under these circumstances it is merely necessary for her to remark the facts in an ordinary tone, without placing her lips to the transmitter or in any way removing her attention from the notebook before her.

The stenographer's remark is received in the acousticon transmitter (10) at her station and is received in the loud earpiece at the manager's instrument by an entirely separate circuit from the manager's talking circuit. This circuit is as follows: From the stenographer's acousticon transmitter (10), through hook (12), wire (m^9), battery (15), wire (m'), connection (m^2), and wires (m^3) and (m'), switch blade (23), wire (p'), loud earpiece (3), wires (p^2) (p^3) and (p^4), connection (p^5), wire (n^4), connection (p^6), back to the acousticon transmitter (10).

It will be observed that in this circuit a different set of line wires is traversed than in the case of the managers talking circuit. In this way there is no interference of the messages and no confusion. It will also be seen that the manager's talking circuit does not include his own receiver, nor does the stenographer's talking circuit include her receiver. This also obviates the confusion which would otherwise occur on account of the loud transmitters and loud earpieces, which are, of course, an essential with a dictograph.

While the instrument is particularly designed for the purpose of dictating to the corps of stenographers, it is also adapted for communication with various heads of departments about the building in the same way as an ordinary telephone.

Death of Eugene H. Lewis.

The sudden death of Eugene Howard Lewis in New York city on March 1st removes one of the last of the men who were connected with the legal side of the early development of the Edison light and power business and the collateral interests connected therewith. Mr. Lewis besides being a most delightful companion and one of the truest of friends was a brilliant lawyer. His connection with the early development of the Edison light and power business resulted from his partnership in the law firm of Messrs. Eaton and Lewis. Major Eaton, who is now living in Europe, was elected to the presidency of the Edison Electric Light Company in the days when the Edison light was but a laboratory experiment, and when the company opened its offices at 65 Fifth Avenue, New York, in February, 1881, Major Eaton assumed active control of the business.

It was at this time that Mr. Lewis became connected with the Edison incandescent-lamp litigation. He first had charge of the Freeman case, in which one Freeman tried to prove priority of invention, and Mr. Lewis is entitled to the credit for the defeat of Freeman. At the time the case was quite a famous one. As the business developed, in addition to being very closely identified with the legal work of the parent Edison company, Mr. Lewis had charge for a number of years of the legal affairs of Mr. Thomas A. Edison. He was also counsel of the Edison Electric Illuminating Company of New York up to the time of the sale of that company to the present owners.

For a number of years Mr. Lewis was honorary counsel of the Association of Edison Illuminating Companies. When the Edison General Electric Company was formed Mr. Lewis was the most active counsel of that company, and during the time that Mr. Samuel Insull had charge of the company's affairs as second vice-president he was Mr. Insull's personal legal adviser. In addition Mr. Lewis was the counsel of the Sprague company, of Bergman & Co., and later of the General Incandescent Arc Light Company. After the formation of the General Electric Company he was prominent among the legal advisers of that company. Mr. Lewis is survived by a widow and three children.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Iowa Electrical Association (annual meeting), Lafayette Inn, Clinton, Iowa, April 18th and 19th.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

X-RAY APPARATUS is highly useful, of course, particularly to the medical profession, but it seems curious that it should be the subject of an interpellation in the British House of Commons. It is alleged, however, that not only the Army Medical Department but all other X-ray laboratories and hospitals in Great Britain are dependent on foreign makers for their vacuum tubes. A member of the House considered this fact of sufficient importance for official scrutiny, and last month he asked the secretary for war what steps he proposed to take that the United Kingdom might not be dependent on foreign countries for its supply of tubes in case of war with a continental power. In his answer Mr. Haldane, the secretary for war, admitted that the X-ray tubes required for military hospitals are purchased from contractors in Great Britain who obtain many of their supplies from continental manufacturers. The few glassblowers in Great Britain who make X-ray tubes are unable at the present time to produce tubes in sufficient number to meet the demand or to equal in quality and price those manufactured abroad. As these articles would be used for the relief of the wounded, Mr. Haldane did not anticipate that they would be considered as contraband in the event of war with a continental power.

Very likely the continental power referred to is Germany, for in that country excellent X-ray tubes are produced. It would be of some interest to ascertain what proportion of the tubes used in the United States are imported from Germany, although it is not likely that the question will be raised at the next session of Congress.

APARTMENT BUILDINGS in cities present an opportunity for the use of electric light, power and heat which is of great extent and only partially realized by owners, architects, builders, and even the central-station companies themselves perhaps. Chicago, for instance, is a city where tens or hundreds of thousands of the householders of moderate incomes live in apartments or flats. And yet what proportion of them use electric light, although the rates are now very reasonable. Probably a small one. The proportion of apartments where electricity is used for power, as for domestic applications, sewing machines, fans or elevators, is much smaller, while the number utilizing electric-heating devices is still less. There are several reasons to account for the existing state of affairs. The principal one is the greater cost of electricity, real or imagined, as compared with gas and other competitors. But there still remains a large class of apartment dwellers amply able to afford to pay a little more for electricity to secure its admitted advantages, even at a slightly greater cost, although nowadays it is not conceded that the cost is greater. This class of tenants does not demand electrical facilities largely through apathy or indifference or lack of attention to the subject. It is to this class, therefore, that much attention may well be directed in the educational campaigns now carried on by electric-light companies in nearly all American cities.

AN INTERESTING report on the effect of electrical discharge on the flame of acetylene was made by C. F. Lorenz at the Chicago meeting of the Physical Society a short time ago. It resulted from the observation that the brightness and whiteness of the light emitted by a flame of ordinary illuminating gas was increased slightly by the passage through it of the discharge from an induction coil. This led to experiments with various carbon-containing flames in order to bring out this effect in a more pronounced manner. It was found that in the case of a cylindrical jet of acetylene issuing under considerable pressure from a small hole the light could be increased about fivefold. The formation of soot, at first troublesome, was avoided by placing the pointed brass electrodes in the invisible mantle of vapor surrounding the flame out of contact with the luminous part, one being placed near the base and the other near the top or middle of the flame on the opposite side. Simultaneous measurements of current, candlepower and voltage were made on a flame having an initial candlepower of 7.5, flame height of 50 millimeters and electrode distance of 24 millimeters, the rate of flow of gas being 0.34 cubic foot an hour. There was a linear increase of candlepower with current up to a limiting value of 38.0, the current being then 45 milliamperes and the difference of potential between the electrodes 2,700 volts. The difference of potential first increased with increase of current, as in the case of an ordinary resistance, and then decreased, as in the case of an arc, the maximum value, amounting to 3,000 volts, occurring when the current was about 10 milliamperes, this being long before the beginning of appreciable arcing at the electrodes. Observation of the flame in a rotating mirror shows that it shortens and brightens each time the discharge passes. The flame emits a humming sound. On employing direct current, obtained from a number of small generators in series, an almost noiseless, steady light resulted.

Perhaps useful applications of such a current-carrying acetylene flame can be made, and the subject is worthy of further investigation.

CABLE FAULTS are considered in a practical paper by Charles E. Phelps bearing the title "Underground Transmission and Distribution of Electrical Energy" and presented two months ago at a meeting of the Baltimore branch of the American Institute of Electrical Engineers. The author gives the faults in underground cables as (1) defects in the cable itself, (2) injury received during installation, (3) faulty workmanship, (4) mechanical injury, (5) electrolytic action, and (6) certain external injuries, the cause of which may not be conclusively established. The first three of these should be guarded against by the breakdown test which is invariably applied to a completed cable before putting it into continuous service. This test usually requires that at least double the ordinary working voltage shall be applied to the insulation of the cable—that is, between conductors and ground—for various periods of time, depending upon the judgment of the purchaser and acquiescence of the contractor. Mr. Phelps thinks that this test should never be pushed to a point where the insulation is liable to be pin-holed by the strain of the test voltage, and he says that experience has generally pointed to the continuance of the test voltage for from one to two minutes duration, instead of 30 or more minutes, which have often been specified. Under this test the defect should be developed and the obligation should, by contract, be imposed upon the contractor to make it good. The remaining faults enumerated are entirely of external cause.

The author gives a tabulated record of faults in a variety of underground electric cables in Baltimore, covering a period of seven years, ended December 31, 1906. The total number of faults was 148, or 0.018 fault per 1,000 feet of cable. Mechanical injury caused 55 per cent. of the faults; electrolytic action, 20 per cent.; damage in installation, 16 per cent., and defective cables, two per cent. Five and one-half per cent. of the faults were due to unknown causes.

Mr. Phelps points out that faults due to installation of cables are in general due to (1) defective conduit structure, (2) reckless or improper methods of pulling cables into ducts, (3) rough handling or too sharp bends in manholes, and (4) badly made joints. The enumeration of these causes suggests the remedies. Only skillful and careful workmen should be employed and especial attention should be paid to the manhole, so that it contain sufficient room for the cables and for the men to work in it. The manhole should be kept clean and well drained.

One sensible recommendation is made by the writer of this paper which can be cordially indorsed. All cable faults may be to a large extent anticipated. Therefore, records of the performance of underground equipment are particularly valuable. If such records were exchanged among cable-using companies, the result could not fail to be of particular value. Such co-operation is shown by the Bell telephone companies and possibly by the Edison companies, but is not general elsewhere. An interchange of sets of data of this sort for the benefit of the central-station industry would be highly desirable, and the work could easily be done by a committee of the National Electric Light Association, which may well consider Mr. Phelps' suggestion at its next convention.

Codman on Rates of Charging.

At the meeting of the Cornell University branch of the American Institute of Electrical Engineers on March 8th J. S. Codman of Boston presented a valuable original paper on "Rates of Charge for Electricity and Their Effect on Cost." The following synopsis of the paper will give an idea of the treatment of the subject.

Only small part of cost of producing electricity is proportional to output of plant.

Very large proportion of fixed expenses a peculiarity of the electrical business.

Capacity of plant determined by maximum load on plant, not by output.

Definition of load factor.

Ideal condition, 100 per cent. load factor.

Effect of improved load factor on cost per kilowatt-hour.

Methods of improving load factor:
- (a) Encouraging use of electricity for a variety of purposes.
- (b) High-efficiency lamps.
- (c) Scientific rates.

Rates designed to improve load factor:
- (a) The load-factor system.
- (b) The "two-rate" system.

Simple form of load-factor system consists of charge on maximum demand for current, combined with charge on consumption.

It is a combination of the two oldest methods of charging, viz.:
- (a) The contract or flat-rate method.
- (b) The uniform meter-rate method.

Undesirable effect of old method.

Improvement of the uniform-meter-rate method.

Usual modifications of load-factor systems:
- (a) The wholesale discount.
- (b) The service charge or minimum bill.
- (c) Fixing a maximum rate per kilowatt-hour.

Wright's load-factor systems.

Reasons for fixing a maximum rate of kilowatt-hour:
- (a) Fixation by law.
- (b) Fixation by custom.
- (c) Fixation by theory.
- (d) Fixation for simplicity.
- (e) Fixation to satisfy public opinion.

Method of determining customer's
- (a) Consumption, an easy problem.
- (b) Maximum demand, a difficult problem.

Maximum demand:
- (a) Assumed equal to connected load.
- (b) Estimated.
- (c) measured rental of power.
- (d) Measured and estimated.
- (e) Limited.

Justifiability of load-factor system.

Misconception of the public.

Doing away with special rates.

Wiring for 250-500 Volts.

"How to wire for 500 volts" is what the fire-insurance companies are concerned about just at present. It is declared that, owing to the special rules for potentials of over 300 volts being scattered throughout the low-potential rules of the National Electrical Code, many contractors and wiremen are quite ignorant of them and, as a result, are doing non-standard work. Desiring to improve these conditions the insurance companies are issuing a list of special rules and exceptions for 250-550 volts and some general suggestions for better work, so that life and property may be more effectually safeguarded. Among these suggestions may be noted the following:

The service wires from pole to building are to have a weatherproof or rubber-covered insulation, in standard condition, supported entirely on petticoat insulators. The leading-in wires from the last support outside to the main fuse are to have a standard rubber-covered insulation, the joints to be well soldered and taped.

All fuses are to be of a standard pattern and installed in standard cabinets with barriers as required by rule 24a of the Code. Fuses are to be provided for each group of lights requiring 660 watts or less or for each group of lights controlled by a separate switch.

All switches are to be standard 500-volt knife switches and should be enclosed in standard cabinets with barriers as required by rule 24a of the Code where more than one switch is installed in the same cabinet.

Approved reinforced portable cord may be used where absolutely necessary, but its use should be avoided as far as possible.

No fixtures will be approved on this voltage. See rule 24y.

Molding may be used if the wires are run in separate strips, separated at least four inches. See rule 24m.

No finished work will be approved and concealed wiring should be avoided as far as possible.

Signs stating the voltage and the danger resulting from the misuse of the system are strongly recommended, to be posted on or near each cabinet, motor, etc.

No sockets or lamp receptacles have been approved for use on over 250 volts, but the hazard will be greatly reduced by the use of waterproof devices of porcelain or approved composition with no accessible connections and with the leads soldered directly to the circuit wires, but supported independently of them.

The insurance companies add this: "The suggestions above noted are designed to reduce the electrical hazard to the minimum when the use of the 500-volt current appears unavoidable, but such service for lights is not within the code for safety from fire."

Incandescent Lamp with Straight Filament.

To the question, "Has anyone who has electrical experience had any experience with the Moore or O'Brien lamps?" at a recent meeting of the Philadelphia section of the Illuminating Engineering Society, the following answers were given:

J. E. Eldredge: The O'Brien lamp is simply a 16-candlepower lamp filament put into a tube before it is trimmed to put into the regular lamp, which makes it about one-half inch longer than the ordinary 16-candlepower filament. They have a lamp with two filaments in one tube, which gives an extremely powerful light. The reflector is of "Belgian" glass.

C. O. Bond: Could one be made two feet long?

Mr. Eldredge: Yes; it can be made as long as it is possible to make a filament.

Mr. Bond: Would it be possible to curve the glass tube into any shape?

Mr. Eldredge: No; because the filament cannot be curved.

J. D. McIlhenny: What is the efficiency?

Mr. Eldredge: The efficiency may be the same as that of the regular incandescent lamp with a four-watt filament or a 3½-watt filament. The tantalum filament may be used if it be anchored.

B. L. Cates: Is the life of the lamp as long as that of an ordinary 16-candlepower lamp?

Mr. Eldredge: At the present day, it is not. The glass they have been able to get in Philadelphia has been so porous that it would not last so long; the lamps broke. In San Francisco they have had some that burned from 500 to 600 hours. Some burn 7,000 hours.

Mr. Cates: The maker of another incandescent lamp told me that a long straight filament could not stand the vibration of buildings.

Mr. Eldredge: The filament could be extended through that tube and stand the vibration without injuring the filament. They have been used on three Italian battleships, and to test them the heaviest 12-inch guns have been fired to see what the effect would be, and perhaps some of you know what the vibration would be like. It had no apparent effect. At one end the platinum leading-in wire is in the form of a spring which takes up the vibration.

C. H. Hunt: Did you say this was a Belgian glass reflector?

Mr. Eldredge: That is what they call it. I suppose it is heavy opal glass. The other is a common incandescent lamp with a mirror reflector.

Purdue Branch of the Institute.

The Purdue branch of the American Institute of Electrical Engineers met in the lecture room of the electrical building of the university, Lafayette, Ind., on the evening of March 5th to discuss the paper by Messrs. Stillwell and Putnam on "The Substitution of the Electric Motor for the Steam Locomotive." There was a good attendance, including many members from the department of mechanical engineering. The discussion was opened by Prof. H. T. Plumb of the electrical engineering department, who gave a review of the paper. Dr. W. F. M. Goss of the mechanical engineering department followed, giving a discussion of the subject from the view of the mechanical engineer.

Dr. Goss pointed out that the general conclusions drawn by the authors were based on the assumption that all steam roads were electrified. He called attention to the fact that this is a condition that will not exist for a long time to come and that therefore it is doubtful whether a single road, or a number of roads, when electrified would show the economy which might be expected.

Dr. Goss stated that the problem in steam operation of railroads was not so much one of motive power but of operating conditions. He did not believe that one-half the number of electric locomotives would be able to do the work of the present number of steam locomotives, even though the electrics have double the tractive effort. A freight locomotive operated by steam shows a small yearly mileage, not because it is in the shops so often but because so much time is wasted on sidings. The same conditions would mitigate against electric locomotives in freight service.

Prof. J. W. Esterline of the department of electrical design discussed the effect of the frequency upon the design of the motors and generators for railway work.

Electric Towage on British Canals.

After sitting for many weeks, the Royal Commission which is considering the whole question of the canals of Great Britain and their reorganization, has at last reached evidence as to the advantages of electric haulage. Prof. W. E. Marchant of Liverpool University has taken a great interest in this subject and placed his views very fully before the commission. Professor Marchant is well informed on all the canal electrical installations in the world. In order that a system of electrical haulage may be financially successful a good and regular traffic along the canal must be maintained, for, unless a fairly heavy traffic is to be anticipated, the capital outlay in equipping a canal with electrical haulage may not be warranted. Professor Marchant found it difficult to say definitely when an electrical haulage scheme becomes economically desirable on a canal, as the results depend very largely on local conditions, but on the Teltow Canal in Germany the conclusion arrived at was that the adoption of electrical haulage saved money when the traffic exceeded 2,000,000 tons per annum. This result applies, of course, solely to this canal, which, by the way, is thought too elaborately equipped, the total cost, including generating stations, with a tractor track laid on both banks, being about $30,000 per mile.

An interesting estimate was put before the commission of the cost of equipping a section of the Leeds and Liverpool Canal with electric tractors, together with an estimate of the cost of haulage by this method. This canal may be regarded as typical of a great many English canals, and the estimate, which has been prepared by the Siemens-Schuckert Company of Germany, has been made in order to obtain data with reference to the smaller canals which are common in England, since the general character of an electrical installation would be considerably modified from that used on the Teltow Canal, with its 600-ton barges, or on the French canals, where the barges carry nearly 300 tons each. There would be 56 miles of track, 56 miles of return conductor, 80 locomotives, five sub-stations, three rotary converters and transformers, etc. The total capital cost is put at £208,310, maintenance at £2,999, and depreciation at £8,179.

The electrical energy is assumed as purchasable for two cents per kilowatt-hour at high pressure. The total working expenses work out to £42,600, or 0.0912d. per ton per mile, assuming a traffic of 2,000,000 tons per annum. A general impression, from the questions put by the commissioners, is that they are not favorably disposed to electric traction; in fact, one member expressed the belief that horses could beat it from the point of view of expenses per ton per mile.

American Patent Specifications Criticized.

Answering R. A. Fessenden of Washington, D. C., who criticized portions of the book of Dr. J. A. Fleming of London on "Electric Wave Telegraphy" as unreliable, the latter defends himself with vigor in a recent issue of the London Electrician. In doing so he pays his respects to the manner of drafting United States patents—a complaint which in respect to some patent specifications, it must be confessed, is not without a reasonable foundation. Dr. Fleming writes:

"I have in my boxes over 200 United States specifications for electric-wave telegraphy in the four names of Fessenden, Stone, De Forest and Shoemaker alone. In these there are literally thousands and thousands of combination claims. How many of these cover real inventions? In drafting a United States specification it does not always seem to be the object of the writer to give the most compact, lucid or detailed description of his invention that is possible. Far from it; it often seems as if the effort were made to pad it with unnecessary information, indefinite descriptions and broad generalities, and then to pile up combination claim upon combination claim which may not represent any invention at all, but merely the ingenuity of the patent attorney in juggling with the combinations and permutations of n things taken m at a time. This may have the effect of deceiving the very elect among the Patent Office examiners into a belief in its novelty and value, but it does not follow that its real scientific worth is thereby established. The British and German custom of formulating compact and tersely worded claims is much more conducive to a facile comprehension of the true meaning of the specification, and, in consequence, to a true appreciation of the patentee's achievement."

It is stated that an Englishman has invented a means of ripening bananas to order. The bunches are hung in an air-tight glass case, in which are a number of electric lights. The artificial light and heat hasten the ripening process in proportion to the number of lights turned on. Records have been made, it is said, which enable the operators to make delivery of any desired quantities at any agreed date.

Lighting of Offices and Office Buildings.

At the regular monthly meeting of the New York section of the Illuminating Engineering Society, held in the Edison Auditorium, New York city, on March 8th, four papers on office and office-building illumination were read, portions of which follow:

Lighting of the Offices of the Consolidated Gas Company, New York.

BY WM. J. CLARK.

The buildings which gas companies occupy for office purposes are either rented premises not specially designed for such purposes, or buildings owned by the companies, the building of which antedates the advent of the illuminating engineer, so that we approach the lighting problem with one of its chief difficulties very apparent, that of the irrevocably fixed points at which the radiants must be placed.

In the remodeling of the offices of the Irving Place branch of the Consolidated Gas Company, some years ago, evidently no thought was given to using large-unit radiants, as no provision was made for ceiling pendants, the lighting being done from a purely utilitarian point of view, and the means being two-arm standards on the individual desks. The general illumination was poor, the light being reflected downward by metal shades from a plane about five feet from the floor.

The desk standards at one time were equipped with Welsbach lamps, one on each arm, but the difficulty of maintaining them, owing to the constant jar caused by the handling of large, heavy ledgers, led to their discontinuance, and the flat-flame burner was again installed. These are now largely out of use by reason of the installation of gas arcs, the equipment consisting of six groups of four four-light arcs hung from eight-inch-diameter iron columns. The candlepower yield of the radiants is approximately 200 candles for each lamp, or in all approximately 4,800 candles, giving, if equally diffused, a yield of, say, 1.47 candles per square foot of floor space.

Of course, much of this light is wasted in the grouping of the arcs, and the actual spherical candlepower of the cluster would not hold up to this rate of efficiency. In the Forty-second Street office of the company are installed 31 gas arcs, with a candlepower yield of about 6,200 candles, or approximately 0.639 candle to the square foot.

We have tried one or two intensified-pressure systems, with more or less satisfaction, noticeably the Sugg system, burning the gas under a pressure of eight inches of water, with a candlepower yield of upward of 30 candles per foot of gas consumed. This system is largely in vogue in London and is an active competitor of the electric arc for the illumination of large areas both indoor and out. With this and the Keith intensified lamps many electric installations have been displaced. These systems are very little used in this country as yet, but their projectors look upon this as a promising field for promotion.

Comparison of Methods of Office Illumination.

BY EDWARD A. NORMAN.

The object of this paper is to show results obtained by three different methods of office illumination, to compare the relative efficiencies of the different methods, and to present results secured

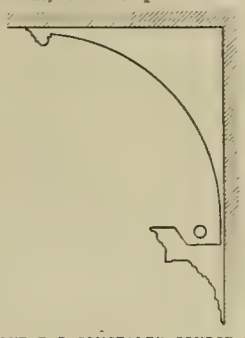


FIG. 1. COVE FOR CONCEALED SOURCE OF LIGHT.

by arc lamps of the concentric-diffuser type in a drafting room.

The two places selected for these tests were the Harlem district office of the New York Edison Company, illuminated by means of cove lighting and Holophane clusters, and the drafting room at the general office of the New York Edison Company, lighted by diffuser arcs.

The cove, of special type, shown by Fig. 1, is placed four feet nine inches below the level of the ceiling, on the side walls, and contains 280 16-candlepower clear lamps, 140 on each side. The wiring is run in conduit with condulets, every eight inches supplying the lamps, which are placed with axis horizontal. The conduit is in sections and may be lifted entirely out of the cove to facilitate repainting or cleaning. Six Holophane clusters of a special type, two of which were equipped with 100-watt Gem lamps and four with standard 16-candlepower lamps, were installed, not so much with the idea of increasing the illumination as to give direction to the light.

The comparative tests were confined to the rear of the office on the mezzanine floor. Tests in the front of the office were made simply to show diffusion. In order to make a comparison of the cove lighting with one of the most efficient forms of incandescent lighting known, two rows of incandescent lamps, 42 in each row, were strung temporarily along the ceiling, tip downward, equipped with Holophane concentrating reflectors.

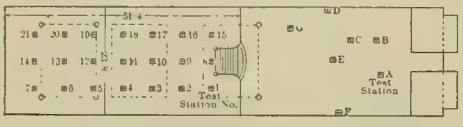


FIG. 2. PLAN OF HARLEM OFFICE, NEW YORK EDISON COMPANY.

Floor plan, Fig. 2, shows dimensions of room and location of test stations, represented as quartered rectangles. Those in the front of the room are lettered and are located with no particular design; those in the rear of the room are located in the centers of approximately equal areas.

The illumination produced by the cove lamps was measured when all lamps were burning, and again when 184 lamps were burning. These corresponded in location to the ceiling lamps, both being placed over the rear of the room in which systematic measurements were made. The intensity of illumination produced on a horizontal plane 30 inches above the floor was measured. During test the line voltage at the lamps was noted. Samples were afterward removed from the installations and tested at the laboratories to determine the candlepower.

While diffused lighting by the cove method is very attractive, and while undoubtedly it possesses the virtue of not offending the eye by a high intrinsic brilliancy at any one point, it is nevertheless trying to a certain extent, due, possibly, to the fact that no matter where the eye rests the same uniform illumination prevails. For instance, when one looks up from a book or paper, it is impossible to rest the eye by gazing at any dark portion of the room, due, possibly, to the inability of the eye to focus properly, as distances are very deceptive. It was noticed that the walls were rela-

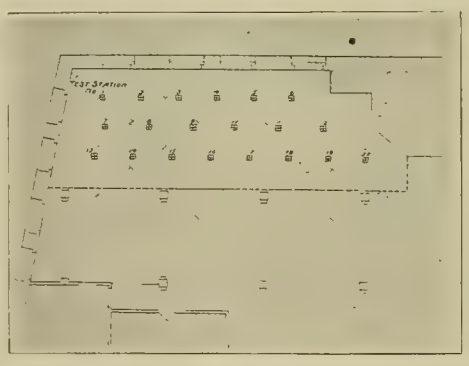


FIG. 3. PLAN OF DRAFTING ROOM, DUANE STREET OFFICE, NEW YORK EDISON COMPANY.

tively brilliant under the diffused lighting as compared to the effect produced by the ceiling lighting, due to the fact that the office is narrow. When we enter a room where the illumination is so well diffused that the source is concealed and shadows do not exist, we experience a strange feeling that is not easily overcome, due to the fact that we have been accustomed in ages past to associate a shadow as well as a source with all light.

The chief objection to direct lighting, although well diffused, is due to the fact that the glare of the lamp is offensive to the eye. Much higher illumination is also necessary, as the iris of the eye contracts under the glare of the direct light, consequently the general illumination must be increased. We have all experienced the temporary blindness caused by gazing directly at the sun; the same effect is produced, in a lesser degree, to be sure, in an installation where an illuminant of high intrinsic brilliancy is visible. Much less illumination is needed where the source is concealed and the light well diffused, as the eye can better accommodate itself.

It cannot be denied that there are advantages and disadvantages in both systems. Several remedies suggest themselves: (1) To use what might be called direct indirect lighting; that is, to place the lamps in the ceiling in bays behind ground glass, so that the light is well diffused, although the source is not concealed. (2) To use deep reflectors where the light itself is not visible. Where the ceiling is high and the lamps are out of the line of vision it is possible to use a more shallow reflector. (3) In my opinion, for incandescent lighting, a combination of the direct and indirect methods forms an ideal condition. There one has the advantages of both, while the combination of the two forms would to a great extent remove the objections that hold when each is used singly. Possibly the use of lower candlepower lamps in the cove, leaving the major part of the illumination to more direct methods, would produce not only a pleasing effect, but would tend to increase the efficiency of the installation. The diffused lighting would have a softening influence upon the glare of the direct lighting. During the day illuminants of high intrinsic brilliancy are not objectionable to the eye. To a certain extent this same result may be obtained by means of diffused lighting.

Fig. 3 shows a plan of the drafting room in the Duane Street office of the New York Edison Company. Encircled crosses in the illustration indicate the location of arc lamps. In addition to those in the space selected for the test, the other lamps shown were burning, and to some extent influenced the intensity of the illumination in the test space. The intensity of illumination was measured on a horizontal plane 45½ inches above the floor at points indicated by the quartered rectangles in Fig. 3. The line voltage was noted at intervals throughout the test. The current flowing through five of the arc lamps was also measured.

To obtain additional information at one point in each of the two installations, measurements were made with the test plate horizontal, vertical and at intermediate angles of 15 degrees intervals.

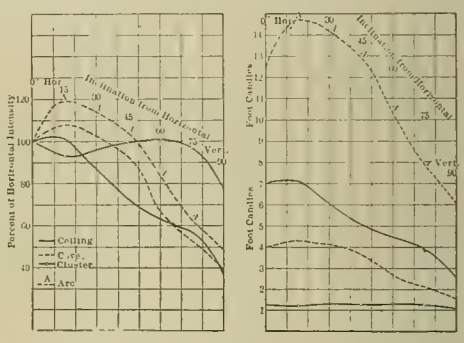


FIG. 4. INTENSITY OF ILLUMINATION ON A SURFACE INCLINED AT VARIOUS ANGLES.

The results are shown diagrammatically in Fig. 4. The curves on the left of this diagram show variations in intensity of illumination when the test plane is placed at various angles, the results being expressed in percentage of the horizontal illumination value. On the right of the diagram the same results are expressed in foot-candles. Each curve, with the exception of that applying on the arc-lamp installation, is the mean of two series of values obtained by inclining the test plane first toward the north wall (bottom of Fig. 2), and then toward the east wall (left of Fig. 2). When inclined toward the north wall with the cluster installation, the plate was favorably disposed with reference to one of the clusters; hence the relatively high intensity of illumination at the angles of greater inclination.

It will be noticed by referring to the left half of Fig. 4 that the cove and arc-lighting curves are similar. The clusters, on account of the fact that they are much below the level of the ceiling, show a different curve. It is interesting to note the similarity of the "foot-candles per watt" of the arc and of the ceiling lighting. No direct comparison, however, can be made of the arc lighting with the other forms, on account of their different environments.

The Lighting of Office Spaces.

BY S. B. BURROUGHS.

The lighting of the office of the Brooklyn Edison Company is a good example of the way to light a large office which does not have partitions. Before the office was made into one space the several departments occupied separate rooms which were lighted by incandescent units, both for general and placed lighting, and the present arrangement has done away with much of the eye strain which usually accompanies desk lighting. Concentric diffuser arcs are hung 10 feet from the floor, one to every 225 square feet of floor area. The foot-candles have not been measured, but in this class of illumination from two to four foot-candles are permissible, preferably lower than four foot-candles. Localized lights should not be used with arc units, as the incandescent lamps would be overpowered by the white light from the arcs, and it would be unnecessary, with four arcs, to use local lights.

The lighting in a room in the People's Trust Company of Brooklyn is a good illustration of a type of illumination used where the artistic phase must be considered. We have in this instance the general illumination of the public space and localized lighting to consider and also the effect of the illumination on the decorated walls. The general illumination is by means of concealed lights around the dome, and the globe lighting on the partitions illuminates the lower part of the space and brings out the general line of architecture. The office is a well-illuminated one, and the general effect is very pleasing. The units on the partitions

are 16-candlepower clear lamps with frosted outer globes. The concealed units are 16 candlepower, the light being reflected by the white surface of the coping.

The local lighting is by means of eight-candlepower frosted units with standard porcelain reflectors, white inside and green outside. It can be readily seen that arc lamps could not be used in this class of illumination, first, because of the coldness of the light, and secondly, the lamp does not lend itself to artistic treatment; also, where the local incandescent lights are used it is not permissible to use the arc.

To sum up, the general result seems to be as follows:

In large, open offices the concentric diffuser arc is very efficient and satisfactory where the artistic sense is not considered, and with this unit no desk lighting is necessary; in partitioned spaces smaller units should be used, and placed units can be well utilized with a desk illumination of from two to four foot-candles; in spaces where the lines of the building must be brought out and a soft general illumination is necessary, the incandescent unit is the best to use, as the arc and other large units do not lend themselves to artistic arrangements.

Lighting of an Office Building.

BY CHARLES M. COHN.

The chairman of the New York section has requested a description of the lighting of the office building recently erected by the Consolidated Gas Company of the city of Baltimore, though there are no features that are especially novel. Among the buildings erected in Baltimore shortly after the great fire of 1904 was the office of this company, whose former office building was destroyed on the first day of the fire.

In the rebuilding of the burnt district, now almost completed, the company took advantage of the opportunity for the improvement of the system of house-piping, and was successful in having generally adopted by builders and architects the specifications formulated and recommended by the American Gas Light Association. The arrangement of the house piping in the new building of the company was done in accordance with these specifications, which merely embody the ideas we advocate.

In the lighting of the offices of the company, the economy of the arrangement was carefully considered, but the matter of economy was subordinated to the broader questions of good illumination and ornamental lighting. The efficiency of the mantle burners made the matter of light absorption by suitable shades a matter of little importance. The mantle burners were used exclusively throughout the building, and the cylindrical shape of the mantles themselves aided greatly in the decorative features of the lighting. The first floor, which is used by the public and by the office force coming directly in contact with the public, handling orders passing to and from the distribution department, is satisfactorily lighted by side brackets attached to the six pilasters at the sides and the three columns in the middle and side of the room. On each of the pilasters a five-arm bracket is placed, and on each of the two columns in the middle of the room four three-arm brackets and on the column on the side of the room two three-arm brackets are used. The approximate number of square feet in this room is 1,900, the height of the ceiling is 15 feet three inches, and the lights are about nine feet above the floor.

The generally recognized objections to the extended use of mantle burners—the unpleasant whiteness and glare—were overcome by the use of amber-tinted shades, sand-blasted inside. It was to remove these disagreeable features that considerable effort was made to find shades that had a soft amber, yellow or pink tint, and in trying to procure shades of this character we communicated with a number of glass manufacturers and burner manufacturers, and we were told that nothing could be had at a reasonable price excepting the gaudy etched shades that are found so often in connection with cheap fixtures. It is a remarkable fact that so little progress has been made in suitable glassware for incandescent gas burners. We were, however, finally able to persuade a well-known glass concern to make up for us some special samples carrying out our ideas, and from these samples we found an amber-tinted shade so satisfactory that we at once secured a large number of them for our own use as well as for the use of our gas consumers. While we find this shade absorbs from 30 to 35 per cent. of the light, it is very desirable and popular.

In the planning and laying out of the piping of the building an abundance of outlets were allowed, and upon the completion of the building such of these outlets were used as were deemed necessary for good illumination. Practical experience was largely followed, with the result of an abundance of light throughout the building and a pleasing and attractive effect from the arrangement of the lighting and fixtures.

Discussion.

E. L. Elliott: There are one or two points that attracted my attention during the reading of the papers. One is in regard to the lighting of the drafting room of the New York Edison Company. I see by the table given that the foot-candles run from 8.6 up to 16.2. This seems to me an exceedingly high intensity, although the reader of the paper assures us that those working under the light have no complaint to make. The case in point seems to me a higher intensity of illumination than any case I remember to have found in testing, with one exception, and that was in a small public library in Brooklyn, where I found 15 foot-candles on the reading table, and from my own judgment of the thing, the intensity was absolutely unfavorable. The watts per square foot of this illumination, I read, is practically 8.01. That, of course, is an excessively large amount of current per square foot, though, perhaps, not excessively large for the large amount of illumination they get. Mr. Burroughs speaks of an illumination in an office in which they use two watts per square foot, but in that case there is special illumination provided. It has always seemed to me that for special use, such as reading rooms or drafting rooms, special illumination was the better illumination. All illuminating engineers do not agree in this. Many attempts have been made to provide a sufficient general illumination in a room, so that no special illumination would be required. Personally, I find such illumination very tiresome, and would much prefer a moderate special illumination exactly on the work at which I was employed.

Mr. Cohn speaks of the amber tint as giving an absorption of some 30 to 35 per cent. I am not at all surprised it would give an absorption as high as that, for amber-tinted glass has something all through it; the color is largely due to smoke, and is produced by throwing in sugar, oats, sawdust, straw, or anything the glass man happens to fancy, and throwing a little into the pot, the carbon distributing through the glass, and giving off the amber tint. There is, however, a tinted glass that can be produced which has the exact tint necessary to reduce the light of the Welsbach burner to the color of the common incandescent lamp; and fortunately this color is a color which absorbs in glass. The difference between this glass with the dissolving color in it and the amber glass would be the difference between light coming through a solution and light coming through metal, or an emulsion, for instance.

Edward A. Norman: In reference to the first remark which Mr. Elliott made, I would say that at the Duane Street drafting room the lighting is not as objectionable as the cove lighting in the Harlem office, which is only 3.48 per candle. I think the most interesting part of the matter is the average foot-candle per watt. At Duane Street the height of diffusion is below 11 feet, and the foot-candle per watt is 0.0011. In the Harlem office, with the ceiling lighting, Holophane shades at a height of 23 feet, the average foot-candle per watt is 0.00131.

W. D'A. Ryan: I notice particularly the comparison between figures on the basis of watts per mean spherical candlepower per cubic foot. That candlepower per cubic foot really means the candlepower or the watts per cubic foot in terms of the average watts per mean spherical candlepower on a certain definite level. In order to make that clear, the point I make is, that there is no basis of comparison. It is very interesting, of course, but the principal thing we lose sight of in connection with interior illumination is that the well-known law of inverse squares does not quite apply. Light does not vary inversely as the square of the distance, when you begin to use reflectors or work from coves. For example, we place a lamp in the center of this building under a certain reflector which will confine the light to a point three feet above the floor. Now, we are illuminating a certain area; the light is spread over a certain amount of surface. There is just so much light, and we have it. Now, let us suppose that same lamp was placed at twice the height, and that a reflector was used; it still confines the light to exactly the same surface. The lamp is now double the distance away, and in accordance with the law of inverse squares you would have only one-quarter of the illumination. As a matter of fact, the light is the same, as you are still confining the light to the same area, disregarding any laws that may be due to the angle that the light strikes the reflector coming out, provided you can confine the light to the same surfaces in both cases. Notwithstanding the light is twice as high, the illumination is the same from this reflector. That law of inverse squares only applies where you permit the light to go on as far as it reaches, without changing its natural direction.

Respecting the cove referred to by Mr. Norman, if it were built more like the cove in this meeting room, out into the room, and swept down, it would give entirely different results for precisely the same energy. I observe the energy was eight candle-feet. If I remember rightly, that is an old installation, put in eight or 10 years ago. I do not think any attempt was made to realize any ideals of the illuminating engineer. It is merely a nice exhibition of a whole lot of light put in a place where people could see that the lighting company was not afraid to practice what they preached. But there is another point. If I remember correctly, that place is fairly well lighted in the daytime, and it is particularly true that the better the daylight illumination, the stronger must be the artificial illumination to suit the people who work there.

From 1¾ to 2½ watts per foot is all that is necessary for first-class work, and that will give somewhere between two and four foot-candles, depending somewhat on the conditions.

J. E. Woodwell: Taking up the paper of Mr. Clark, I would call attention to the fact that clusters of lights in general suffer somewhat from interference; their efficiency is somewhat reduced by the interference of light from one to the other. It is fair to admit that the losses by interference in the light from one lamp to another occur at angles at which the light is not especially useful. In listening to the paper by Mr. Norman, I noted that the comparison made was not particularly favorable to the cove lighting. The method of lighting by concealed lights should be encouraged. With regard to the illumination of the drafting room, I have been somewhat criticized for making this illumination 10 candle-feet, on the ground that it was excessive, but here we have something which is over 60 per cent. above that figure. I think this is good advertising for central stations, but not much recommendation for illuminating engineering. It is true that the lighting of this particular place is not accompanied by any objectionable eye strain, which shows the important part the diffusion plays in the illumination of drafting rooms, or, in fact, all these spaces in general, so we can use higher values than we have been accustomed to, safely, if we secure the proper diffusion. In other words, if we work with light sources of low intrinsic brilliancy, or if we properly conceal and shade those sources, we can do away with the eye strain. I think, however, that five foot-candles at the outside would represent the ordinary working values for the drafting-room illumination, and the figure of 10, which I first named, I consider myself a rather upper limit. I wish to say that I think the use of the diffusing amber shades referred to by Mr. Cohn, is very commendable. The loss of 35 per cent. appears rather high at first thought, but I think the gain is fully justified by the lower intrinsic brilliancy of the light source, and certainly the architectural and esthetical effects must be improved to a marked extent.

A. A. Pope: In regard to the question of lighting the Harlem office, the criticism of Mr. Ryan appeals to me, because I feel I had something to do with the lighting of that office and with the design. The office was originally taken for exhibition purposes. We had a room in it about 24 feet across and 28 feet in the clear. The problem was to get the most effective, artistic lighting, as well as useful lighting. It occurred to us that the best thing to be done was to utilize as much of the cove as we could, as long as it was there.

The question which Mr. Ryan brought up on the excess of lighting in the drafting room in Duane Street is correct. That installation has been worked up to its present point. When the room was first arranged there were six outlets marked at certain centers, relative to the building—that is, between the arches—and in there were placed the arc lamps. I think Mr. Ryan knows we cannot use anything less than the standard arc lamp with any efficiency; a three-quarter arc lamp would hardly go. In the case of a building where there is no other building to interfere with the blue sky in the distance, and you get a good north and east light, and the workman gets a beautiful daylight, you have at least 15 watts there in daylight to reach with your arc light. When the diffuser came in, of course it was put over these lamps. The moment they were put over the lights that was just what the draftsman wanted, and that accounts for the seemingly excessively lighted room. I was glad to note the reference to the question of the colored globes. I believe there is a great field for the amber-colored globe. Of course I was a little surprised at the absorption being as high as 30 or 35 per cent., but still I believe for the artistic effect that is a very good point and one which will be enlarged upon later with good effect.

Dr. A. H. Elliott: I have had something to do with the manufacture of glass. It is exceedingly easy to get amber glass. Amber glass as it is manufactured today in the shape of bottles and things of that kind is the cheapest glass that is made and is made particularly with a coarse common sand. The reason for putting in the chaff, etc., that Mr. E. L. Elliott spoke of is simply to make what we consider is carbide of iron. There is no doubt that the carbon of these organic materials is essential for the iron. The reason for it is not known very well. It is a well-known fact that sand contains a good quality of iron, that a good dose of carbon will give you practically a black glass. The Mississippi Glass Company today is making glass washboards for the laundries, of black glass, absolutely opaque even in thin pieces. It is only the thinning out of that material that gives you the amber glass.

Dr. C. H. Sharp: I want to say a word about direct and indirect lighting, cove lighting, and call attention to one point; that is, where indirect lighting is used for the purpose of reading or drawing, or anything of that kind. Now, in the case of light by the indirect system the brightness of the ceiling

is going to be greater than the brightness of the thing you are looking at. Consequently when you raise your eyes from work and want to rest them for a moment by bringing them up against something that is still brighter than the thing you have looked at, it is quite disagreeable. So where you have a purely indirect lighting system you have something which it seems to me must necessarily be a system very fatiguing to the eye. You cannot get away from the brilliantly lighted surface. Not only that, but in comparison with the brightness of the ceiling, the brightness of the working table seems somewhat dull and dim, and you want more light; in other words, the bright ceiling equals the brightness of the surface which you naturally desire to have bright. So it seems to me when it comes to the question of illuminating the surfaces upon which work is done, while we may have a certain amount of indirect illumination to brighten up the room, yet we want our principal illumination on the work, so that we can look away and rest the eyes from that light.

E. Y. Porter: I simply want to enter my word in the case of lighting large spaces, particularly office spaces, and where work is done on desks, drafting rooms, etc., in favor of making the general lighting sufficiently bright for all purposes and avoiding the use of desk lamps. Whenever I go into a large office and see a lot of desk lamps in front of the noses of every operator or clerk I have a sort of pity for them, knowing that the glare of the lamp just in front or above, or at least close to them, is very trying to the eyes. I was talking to the head of a department in a dry goods store the other day, and he spoke of the sudden effect upon a prospective customer in going into a room and finding it a little gloomy. It takes all of the purchasing spirit out of the customer, whereas if a customer goes into a room which is bright and cheerful, with plenty of light on the floor and ceiling, walls and everything, he unconsciously is in a better mood, and this mode of advertising and its effect upon the public and business is something of very great advantage in places where a considerable amount of illumination is used.

W. B. Sanford: I have two curves worked up on tests made on individual stores at the Electrical Testing Laboratories. They were made from cases found in actual practice. The layout was a room 16 feet wide, 60 or 70 feet long, lighted originally with five-ampere arc lights based on about nine-foot centers. Including whatever reflection there would be from the wall, which of course will even this curve up somewhat, the illumination is between 1¾ candle-feet at the wall and 3¾ to 5.5 candle-feet at the center of the room, the location between lamps. I might say that the flickering of the arc lights has been complained of by the employes, which will be overcome by the use of the tantalum lamps. We have found that necessary in the case of rolltop desks in order to use the individual lights. There is a point I want to have on the record, and that is that a commercial luminometer would be a very great help to everybody. I have not heard of any such instrument within the means of ordinary companies. I would ask also if there is any information for laying out illumination from the Cooper Hewitt light.

Mr. Ryan: How were the arc lamps equipped?

Mr. Sanford: With opalescent inner globes, metal shades, 16-inch metal shades.

Mr. Ryan: Ordinary shades?

Mr. Sanford: Regular shop lamps, opalescent inner globe, no outer globe.

Mr. Ryan: The equipment of the arc lamp referred to by the last speaker was not quite what it should be for a drafting room. In a room 25 feet wide, with the lamps installed 10 feet above the floor, with the usual work level, the lamp as he describes only puts 22 per cent of its total flux on that level. If you go up eight feet on the side walls you are still using only one-third of the flux of the arc lamp. The proper way to illuminate a large area is to get away from the small unit about as far as you can. If you can place one lamp in the center of the whole floor and light the place with reasonable diffusion and reasonable absence of shadows you would have only one unit to take care of and have solved the whole lighting problem.

G. L. Hunter: It does not seem to me that the question of general illumination has been kept sufficiently distinct from that of local illumination. The Astor branch of the New York Public Library, I think, is the worst lighted public building I have seen. They have 16-candlepower lights, tinted shades with green tops, and no general lighting. Above it is simply darkness. It is not only the lack of beauty, but the light is not useful; the light jars the eye. The readers look up from their books and rub their eyes. If the shades had been porcelain so that a certain amount of light would have gone through them there would have been no direct trouble. As to this question of grouping lights it seems to me for general illumination the units should be as large as convenient, and for local illumination as small as possible. I think the average desk light is much too strong and the average light for general purposes is apt to be too small.

P. S. Millar: I have seen the office of the Baltimore Gas Company and I think the globes are certainly handsome and harmonize well with the gas fixtures. The obstruction to the light is certainly small, and thinking it would probably be of interest to the gentlemen connected with illuminating engineering I figured two cases of absorption of the globes, and they ran from 40 to 65 per cent. in the case of the gas globe.

W. J. Clark: We know there is a great loss of efficiency in the clusters described in my paper. The lamps were hung on the columns because there was no provision made for hanging the lamps anywhere else in the office. The office had not been illuminated at all and we had desk lights on the lighting plane. That was the only way out of it to get these lights on the columns.

QUESTIONS AND ANSWERS.

Paint for Switchboard.

E. J. S., Bradley, Ill.: Will you please give me the name of some non-conductive black enamel or compound suitable to paint an old 110-volt slate switchboard?

ANSWER.

Any hydro-carbon paint which has the right consistency to give a good surface should be satisfactory for this purpose. In other words, a paint which has the proper "body" and which will "run" fairly well when applied on the cold slate should be sought. An ordinary air-drying black japan is frequently used for this purpose. Insulating paints are to be had from the manufacturers and from dealers in electrical supplies.

Disks for Static Machines.

P. E. P., Aurora, Ill.: In the book by S. R. Bottone on "Radiography" he gives instructions for making a Wimshurst static machine with two 18-inch plates or disks, in which he advises the use of ebonite one-eighth or three-sixteenths inch thick. Please advise me if glass could be used and give good results and if so, just what kind and thickness would be best suited. If not, could you advise me where this ebonite can be obtained and what would be the approximate cost of two such plates?

ANSWER.

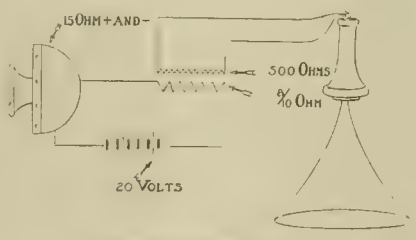
Why not send your inquiry as to the use of glass in this particular machine direct to the author of the book? He is the best authority on possible variations from the machine he has in mind, although it would seem that glass could be used. Ebonite is a name applied to a hard, tough compound of rubber and sulphur and possesses high insulating properties and high specific inductive capacity. As to price, inquire of manufacturers of insulating compositions or hard rubber. Mr. Bottone may be addressed in care of Bottone & Son, Wallington, Surrey, England.

The Transmitophone.

R. B., Jackson, Mich.: Would it be possible to get a diagram and a short explanation of how a "transmitophone" should be constructed to operate as satisfactorily as the one described in Western Electrican, November 3, 1906, page 363?

ANSWER.

The manufacturer of the device in question answers that with the transmitter and receiver of the type mentioned in the article cited the connections for a transmitophone to operate satisfactorily are on a local-battery circuit and as shown by the accompanying sketch. The transmitter is built with



TRANSMITOPHONE CIRCUIT.

a resistance of 15 ohms plus and minus, and is in series with 0.8 of an ohm on the primary side of the induction coil and also in series with a 20-volt battery. For the latter purpose dry batteries are the most convenient. The receiver, with megaphone attachment, is connected in series with the 500-ohm secondary of the induction coil. If more than one receiver is used on a circuit, they are connected in series. These figures and the diagram apply only to the apparatus of the manufacturer mentioned in the previous article.

Restrictive Clause in Insurance Policies.

G. L., Oak Park, Ill.: Please give a copy of the restrictive clause required by insurance companies to be attached to policies covering electric light and power stations and telephone exchanges.

ANSWER.

The electric-light permit and dynamo clause required by underwriters is as follows:

"Permission is hereby granted for the use of electricity for lights or power in the premises mentioned herein, provided the electrical equipment is in full compliance with the National Electrical Code. If dynamos, exciters, lamps, switches or motors are insured by this policy this insurance excludes any loss or damage to them, such as may be caused by electrical currents, whether artificial or natural, and will be liable only for such loss or damage to them which may occur in consequence of fire in the building herein described.

"Note.—This electrical permit is issued with the full understanding that it shall not (in whole or in part) be held, implied or construed to mean that dynamos, exciters, lamps, switches, motors or other electrical appliances or devices are insured unless specifically mentioned in form of policy."

Safety of Train Operation by Electric Locomotives.

Since the disastrous accident of February 16th to an electrically operated train of the New York Central Railroad in the suburbs of that city and the following verdict of the coroner's jury severely censuring the company, as already mentioned in the Western Electrician, the New York Central and Hudson River Railroad Company is anxious to have it known to the general and technical public that it took all conceivable precautions in the design, construction and testing of the new motive power. This is no doubt the simple truth, and all readers of the technical press are aware of the elaborate and careful nature of the preparatory and testing work.

The coroner's jury did not find any electrical fault, but, in effect, charged that the train was run around a curve at unsafe speed and that the tracks were not properly reinforced for the sort of traffic which the heavy electric trains imposed.

On the subject of track testing the following statement is made on behalf of the railroad company:

"Correction is needed of a wrongful impression given by the public press that the testimony regarding the shifting of the track in the ballast on one of the curves in the experimental track at Schenectady during high speeds was an indication of something wrong about the electric locomotive. Exactly the contrary deduction should be drawn. The electric locomotive was purposely driven at speeds of 75 miles an hour around a curve that was elevated for but 60 miles an hour, so as to accentuate any tendency that might exist with the locomotive to spread the gauge. This very high speed caused a centrifugal force sufficient to move the ties in the gravel ballast, but there was absolutely no widening of the gauge under such extreme conditions, thus demonstrating that even with such excessive speeds around insufficiently elevated curves, producing a centrifugal force sufficiently great to shift the track in the ballast and distort the curvature, would still not cause a widening of the gauge on this inferior track. In other words, this test demonstrated that the method of spiking curves in ordinary practice was sufficient to meet even abnormal conditions."

As a result of continued actual observation of the electric locomotives under all the conditions above described, the vice-president of the New York Central Railroad in charge of electrification and his associates and the representatives of those who were to use the locomotives in regular service all unite in the belief that the electric locomotive is equal or superior to modern steam-passenger locomotives under like conditions.

The question has been raised as to whether the high center of gravity of the steam locomotive used previous to the electric locomotive, 71 inches above the top of the rail, is not less severe on track from impact due to minor irregularities, than similar effects with the low center of gravity, 45 inches, on electric locomotives. The answer to this is that it is believed by many that the severe lurching effect with the high center of gravity on the steam locomotives is even more severe than the lack of the lurching effect with the lower center of gravity of the electric locomotives. Moreover, it is believed that the twisting effect from reciprocating parts on steam locomotives and also the hammer blow from counterbalancing is more destructive than with the electric locomotives, which have not these disadvantages.

With 600 volts at the motors and in still air on level tangent track, the possible maximum speed of one electric locomotive running light is as follows: Controller in full-service notch, 30 miles

an hour; controller in full-service parallel notch, 55 miles an hour; controller in full parallel notch, 90 miles.

Considering the matter of curve and super-elevation of track such as at the scene of the accident as they affect the two types of locomotive, this statement is made:

It appears that the electric locomotive imposes equal or less unbalanced stresses than the steam locomotive on the three-degree curves properly maintained, with super-elevation of 4½ inches, and that the shearing force of spikes, one on the outside of the outer rail in each tie, with tie plates, is far within the limits of safety for speeds in excess of the so-called "equilibrium speed" of about 46½ miles per hour, to which the super-elevation of 4½ inches corresponds.

An interesting contribution to the discussion is contained in a letter from Mansfield Merriman, dated in New York city, March 4th, to Chief Engineer Kittredge of the New York Central Railroad. Following is a copy of this letter:

"In compliance with your request of February 28th, I have made a careful examination regarding the circumstances of the train accident at a curve on track No. 3 near Woodlawn Bridge. I have visited the curve and inspected the four tracks, noting the behavior of the rails and cross-ties under the passage of both steam and electric locomotives. I have examined the three computations made by Mr. Anderson, Mr. Carpenter and Professor Swain regarding the pressures exerted by the wheels of the electric locomotive against the outer rail of the track, and have also made computations of my own.

"All these computations agree in regard to the total centrifugal force exerted by the locomotive and in regard to the diminution of this due to the super-elevation of the outer rail, but they differ materially in the results obtained for the pressure which causes the skewing of the locomotive wheel-base. This is due to different assumptions made by the computers as to the position of the center of rotation of this wheel base, as to the influence of the movable front axle, and as to the values of the coefficients of friction.

"The problem of the forces required to skew a rigid locomotive wheel base around a curve is one of great complexity. I have seen in print only one discussion of it, namely, that given in Wellington's 'Economic Theory of Railway Location,' but this discussion states general principles only without formulas or numerical computations. In my opinion, a definite solution of this problem, on which all experts can agree, cannot be possible until experiments and measurements have been made to determine the facts which now must be roughly assumed.

"The computations which I have made or examined indicate that the front outer driving wheel of the electric locomotive may have exerted a pressure against the outer rail on the 3° 5′ curve of from 5,000 to 10,000 pounds at a speed of 60 miles an hour. Taking the higher figure, using 17,000 pounds for the ultimate shearing strength of a spike, as determined by Professor Lovell, and considering the pressure as distributed over two spikes, the factor of safety is 3.4, which is satisfactory. These computations thus indicate that the accident must have been due to some other cause than the radial pressure developed under the normal action of the locomotive.

"In justification of the assumption that the pressure was distributed over two spikes, I note that all bridge specifications consider the weight of a wheel to be distributed over three ties, indicating that experience has shown this to be true. Also, when tie plates are not used, track specifications require rail braces to be placed against the outer rail of a three-degree curve on every third or fourth tie, indicating that experience has proved that the radial pressure under a wheel is distributed over at least three ties.

"As a professor of civil engineering for 28 years, it has been my duty to instruct students in the principles of railroad construction and maintenance. I have always presented to them the theory of centrifugal force on a curve and of the super-elevation of the outer rail, but have never given a discussion of the resistance of the spikes against shearing. I have never seen in print a discussion of the resistance of spikes on the outer rail of a curve and have never heard that such computations have been made by engineers of maintenance of way. Practice in this matter appears to have been the result of experience alone. I do not consider myself negligent in having omitted to present this topic to my classes and I do not think that omission to make such computations should subject any railroad official to the charge of negligence."

It is said that a syndicate has been organized by J. J. Wetmore to develop the Cumberland Falls in Kentucky. The plan contemplates the expenditure of some $3,500,000 in erecting a dam across the Cumberland River which will back the water up for a distance of 25 miles. It is proposed to generate 20,000 horsepower. This is only one of many projects to utilize the extensive waterpower resources of the southern states, including Virginia, the Carolinas, Georgia, Tennessee and Kentucky.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

VII.—Dynamo-electric Machinery.

Design of Alternators.

The commutator, described in the preceding chapter, which is a characteristic feature of all direct-current machines, is not used in machines generating alternating currents. The armature windings of alternating-current generators are of a number of types, depending upon the character of the machine, but the simplest winding will be understood by reference to the following diagram of a simple alternator. The field consists of a circular yoke, from the interior of which a number of poles project inwardly, marked (N) and (S). The armature is shown in section, and consists of a metal ring with projecting teeth, which, in the case illustrated, coincide in number with the pole-pieces. The fields, which are excited from some source of constant-current supply, have a field winding shown diagrammatically at (A), while the armature winding consists of a coil surrounding each pole, as at (B).

The elementary horseshoe magnet will still be recognized in this design, the magnetic circuit be-

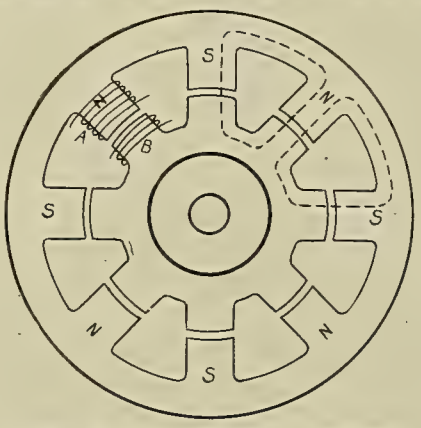


DIAGRAM OF SIMPLE SINGLE-PHASE ALTERNATOR.

ing indicated by the dotted lines, and the armature winding cuts a varying number of lines of force as the core passes from each north pole to each south pole. The windings about each tooth of the armature core are connected in series so that the armature winding in a simple alternator forms one continuous winding, whose two ends are brought out to two collector rings made of metal and mounted upon the shaft of the machine. These rings are thoroughly insulated from the shaft and from each other, and current is taken off these rings by means of brushes, and thus led off to the outside circuit.

The currents generated in any two adjacent coils of such a machine have opposite electromotive forces, which tend to oppose each other, and to overcome this the connections of each alternate coil are reversed. As these coils are all in series, the electromotive force at the collector rings is the sum of the electromotive forces generated in each of the armature coils.

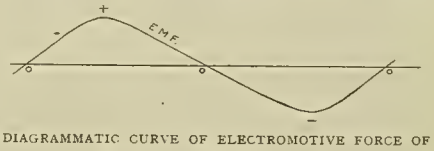
In this type of machine the armature winding consists of a few heavy coils of wire, and is known as the concentrated winding. In other armatures there are a much larger number of teeth, and the armature wires are arranged in a greater number of smaller coils. The latter is known as a distributed winding.

In alternating-current generators of large capacity and having distributed windings, it is common practice to reverse the arrangement just described; that is, to make the armature the stationary part and the field, the revolving part. The field in machines of this kind is similar to the core of a ring-type armature, with poles projecting radially outward, and the armature stands stationary outside of the revolving field, and therefore offers not only more room for the armature winding, but, on account of being stationary, also leaves the winding less liable to mechanical injuries. These machines are known as revolving-field alternators, and the majority of large alternators are of this type.

Polyphase Windings and Connections.

There are two other methods of armature winding for alternate-current generators which are widely used today. These are the two-phase and the three-phase windings, which are commonly known as polyphase windings, in distinction to the single-phase winding described above.

In the single-phase alternator the electromotive force of each coil varies according to the accompanying diagram. When the coil is in a position in which it is not cutting lines of force, its electromotive force will be zero. As it passes from

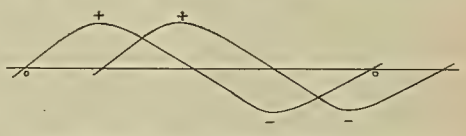


DIAGRAMMATIC CURVE OF ELECTROMOTIVE FORCE OF SINGLE-PHASE GENERATOR.

a south to a north pole its electromotive force increases gradually to a maximum when it is cutting the greatest number of lines of force, and falls off again to zero when it is in a position where it does not cut any lines of force. It next passes from a north to a south pole, and here the electromotive force increases from zero to maximum in the same way, but is a negative instead of a positive value. Each coil completes a cycle when it passes from one north pole to the next north pole, and the time in which this cycle is completed is called a period.

Let us now turn our attention to two-phase windings. In order to understand these two-phase windings, let us assume a machine having one field frame and two exactly similar armatures mounted side by side within it upon the same shaft. Each of these armatures has the same number of slots and the same winding, but one is turned past the other, so that the slots of one core are midway between the slots of the other. In such a machine, when the coils of one armature are cutting the maximum number of lines of force, the coils of the other armature would be cutting no lines of force. Consequently, when the electromotive force in one armature was at its maximum, the electromotive force in the other armature would be zero. We thus have two independent phases of electromotive force in such a machine, one of which is one-quarter of a period in advance of the other, as illustrated in the following diagram, and such a machine is known as a two-phase generator.

In practice, instead of having two independent armature cores within one field frame, two-phase generators are made with a single core having twice as many slots as the single-phase machine and two entirely distinct windings, which terminate



DIAGRAMMATIC CURVE OF ELECTROMOTIVE FORCE OF TWO-PHASE GENERATOR.

in four collector rings. The currents taken from these collector rings by means of brushes are carried out to two separate and distinct circuits, in the case of the two-phase, four-wire system. In the case of the two-phase, three-wire system, one of the collector rings is omitted, and the connection between the two separate windings is brought out to a single ring. In this case we have one collector ring connected to one end of one winding and a second collector ring connected to one end of the other winding, and a third collector ring common to the two remaining ends of both windings. One complete cycle of a single-phase curve of electromotive force is taken at 360 degrees, and therefore the two phases of a two-phase alternator are 90 degrees apart.

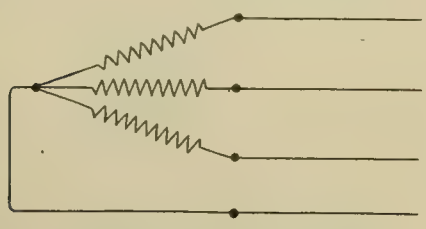
An idea of the three-phase armature winding may be gained by following a similar course of reasoning as in the case of the two-phase. Suppose that within a common field frame three similar armatures are mounted side by side, each with the same number of slots and the same winding. The first armature is located so that one of its slots falls directly under the center of one pole-piece. We have seen, in the case of the single-phase armature, that a period is the time in which the coil passes from one north pole to the next north pole. The second and third armatures of the three-phase machine will be spaced so that the coils are each one-third of a period apart, or, con-

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

sidering the cycle of 360 degrees, each of the coils will be 120 degrees apart.

In practice, the three distinct windings on the three armature cores are all placed upon a single core, having three times as many slots as one of the single cores, and these windings are practically distinct from each other. They might be kept entirely independent and distinct circuits by bringing the six ends of the coils out to six collector rings. The usual arrangement, however, is to connect the three windings together in what are known as the star connection, or the delta connection.

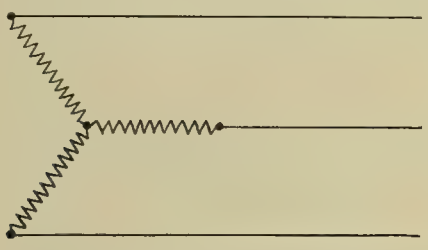
When the loads on the outside circuits are equal



THREE-PHASE FOUR-WIRE SYSTEM.

the system is said to be balanced. If the loads on the three phases are unequal, and the system is unbalanced, then four collector rings would be required, one of which would be used for a common return wire for the other three circuits. The latter arrangement is illustrated in the sketch given above, and constitutes a four-wire three-phase system, while either the star or delta-connected winding forms a three-wire three-phase system.

With the star connection, illustrated herewith, the three ends of the coils are connected together in a common point, and the other three ends are

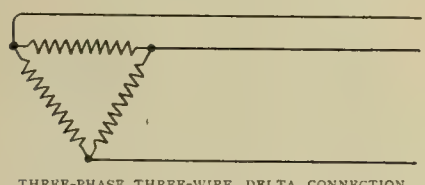


THREE-PHASE THREE-WIRE STAR CONNECTION.

led out to collector rings, as shown. This point of connection of the three ends is known as the neutral point.

The other method of connection for the three phases of a three-phase generator is known as the delta connection, and is illustrated underneath. In this case the two ends of each coil are connected to separate rings, and each ring is used as the junction point for two coils.

The difference between the two methods of connection, from an electrical viewpoint, is that in the star-connected windings the current is equal to the sum of the currents in the different windings, and the electromotive force is the electromotive force of one phase multiplied by the square root of three. In the delta-connected winding the electromotive



THREE-PHASE THREE-WIRE DELTA CONNECTION.

force of the outside circuit is equal to the electromotive forces of the different windings, while the current in each outside line from a delta-connected armature is equal to the current in each winding multiplied by the square root of three.

The extra complication of the two-phase and three-phase windings over that of the single-phase winding is made necessary from the fact that motors driven from a single-phase winding are not self-starting, and therefore the single-phase machine is not well adapted to the operation of electric motors. With both the two and three-phase machines, self-starting motors may be operated, and this is practically the chief reason for the existence of the two-phase and three-phase systems.

[*To be continued.*]

The Youngstown and Ohio River Railway and Light Company has been reorganized as the Columbina County Light and Power Company. The new company has taken the franchise granted to the old company to construct and operate a light, heat and power station at Salem, Ohio.

Proportions of Storage-battery Plates.

By G. P. Hutchins.

Other things being equal, the capacity of the positive storage-battery plate varies with its exposed area of active material. As battery makers have striven to keep down as much as possible the volume and floor space occupied by the cells, the consideration of maximum capacity has produced a great variety of plate formations, such as grooving, scoring, laminating and pressing, all of which aim to increase the superficial area of the plate in order to produce a maximum surface for the formation and adhesion of active material, considering now only the Planté types of plate. Consequently, if capacity were the only consideration, the most nearly perfect plate would be one in which the lead were so disposed as to expose the greatest number of square inches of surface for unit weight of lead.

Such a construction, however, would carry with it intolerable defects. The subdivisions of metal would become so fine that a few formations of make-up peroxide would consume them, causing the whole grid to fall apart as sediment. Again, the new active material must be formed only as fast as the old is consumed, and must be kept from growing unduly thick.

In ideal conditions the transition between the peroxide and the metallic lead consists of a very thin zone of peroxide, the pores of which contain a certain amount of lead sulphate, being little affected by either the electrolyte or the evolved gases of decomposition. Thus this zone acts as a protector against local action which cannot take place without decomposition of the electrolyte, and as a barrier against new encroachments of the acid on the underlying lead. It should be no thicker than may be necessary to this double purpose, as it is dead material as regards electrolytic action. The layer of active material between this zone and the electrolyte should be just as deep or thick as will allow free access and diffusion of the electrolyte through all its pores. Any greater depth would produce local discharge between the outer layers and the metallic lead, as well as between different layers. Any less depth would decrease the healthy capacity of the plate.

These considerations show that in designing plate proportions there is a fine balancing between the opposing interests of capacity, requiring maximum surface, and active material condition, renewal and support, requiring substantial ribs and wide intercostal spaces which cut down the available surface. The precise point at which these conflicting demands are best satisfied can be determined only by trial and error, by experimenting with a great number of differently proportioned plates.

In the development of the Gould positives on original lines and by constant observation of many cells in actual use, it has been found that in the plates first put out too much lead had been "spun" into peroxide-forming area. In service newly formed active material, which in this type of plate is peculiarly adherent to its mother-rib, soon filled the narrow 0.012-inch grooves, bridging over the space between the parallel-sided ribs. In action, particularly at low rates of charge and discharge customary in secondary-battery practice, this impacted mass increases in volume with the formation of lead sulphate. If no room for expansion is provided for, the swelling active material must press against the confining surfaces, causing the grid to buckle, even breaking off ribs, besides producing much sediment by the falling off of squeezed unsupported matter. By such action the life of the plates was reduced. To correct these defects V-shaped ribs 0.05 inch wide at the base, tapering to 0.008 inch at the end and separated by oppositely tapering V-shaped grooves of precisely the same dimensions, have been substituted for the former 0.020-inch ribs and 0.012-inch grooves of rectangular shape.

Blanks of chemically pure No. 17 sheet lead rolled to great density are spun into a ribbed and grooved girder-like "bridge" structure and brought to a markedly increased density by the very process of spinning the parts between rigidly spaced wedge-like circular formers. The blanks are placed in steel frames and reciprocated between rollers, consisting of revolving shafts on which are strung steel disks, separated from one another by alternate washers. The width and shape of the groove depend on the gauge and form of the spinning disk, while the width and outlines of the rib are determined by the gauge of the washer.

The composite rollers are gradually brought together and held up by uniform air pressure against the face of the sheet lead, which they form into ribs and grooves, the latter progressively assuming their designed shapes as the knives proceed further into the blank. While the blank is spun into by the disks, no lead is cut away. The lead yields to the pressure, and by "cold flowing" rises up into ribs between the forming disks. No lead is removed. It is pressed, burnished and spun into shape. A small unspun portion is left at each end. This unchanged bridge anchors the ribs in place. On large plates, by rolling the plate in four or more sections, a number of transverse vertical and horizontal unspun portions are left, forming strengthening bars of solid conducting material.

By this process all the advantages of minute and extensive subdivision are secured without sacrificing the mechanical integrity and electrical uniformity of an integral, one-piece plate. At the same time the design enables the charge to be evenly distributed over all, while the large masses of unspun strengthening bridges insure unobstructed and uniform delivery of the current from all parts of the grid on discharge. By electrochemical action active material is caused to sprout from each rib-face as a matrix, forming, with its underlying surface, a contact as intimate as that of a branch growing out of a tree trunk. When completely formed the plate is about 0.45 inch thick.

Compared to the former proportions, these plates have grooves almost four times wider at their outer ends and ribs about 2½ times thicker at the base, with corresponding reduction of superficial area. The V shape of grooves and ribs makes an ideal distribution of metal, active area and active-metal retaining spaces. When swelling by sulphation the active material finds a natural easy outlet for expansion along the prescribed lines of least resistance, while the broad surface at the mouth of each groove forms an excellent retaining or adhering base for preventing loss by dropping off of material temporarily in excess.

One can picture to himself the material alternately crawling out from and into its recess on discharge and charge, pressing and bending endwise into the electrolyte space and laterally against the adjoining ribs. Thus all danger of breaking ribs or buckling the plate is eliminated; new active material is formed only when needed to replace peroxide which has dropped off after having wholly used up its useful life in actual current production, and local action is minimized by keeping the active material bed down to the thickness which permits free diffusion. This construction also disposes the greatest amount of lead in the rib at its base, strengthening its connection with the supporting parts, while reducing the ohmic resistance between ribs and the grid skeleton.

It will be noted that where the active material pocket is thickest is nearest to, and exposes the greatest surface to, the electrolyte, and that new material forming at the base of the groove readily pushes out the wornout material into the electrolyte space. Thus the plate wears out all over by a process of sloughing off its skin, retaining until completely sloughed out throughout its various component parts its shape and current-storing capacity.

So many advantages were found in practice in this design that the Gould negatives are made in the same way. They are smaller in area, because the electrolytic action is not as intense as it is on the positives, and because the spongy lead can be kept much thinner than the peroxide. It has been demonstrated that the thinner the layer of active material on the sponge-lead electrodes, the greater is the capacity for a given weight of element.

To counteract the shrinkage characteristic of all negative active material the Gould negatives are now formed 100 per cent. above their rated capacity at the three-hour rate of discharge, in order to supply enough initial excess of capacity to discount the inevitable shrinkage, so that at the end of years they will not have fallen below their rated capacity. When the shrinkage has reduced the plates below this point, they may be reversed, whereby the active material is revitalized and reunited to the support plate, bringing the grid back to its original capacity of double the rating.

Storage batteries composed of V-grooved plates of the improved proportions here described have in active service, under commercial conditions, fully justified the expectations of the designers. In connection with the well-known advantages inherent to the "spun" plate, the readjustment of shapes and proportions has produced a plate which, as nearly as possible, comes up to the aim of the Gould company to provide watt efficiency and original capacity high in proportion to the weight of lead used, and to retain that capacity until, after an extremely long life, the grid is wholly consumed in all its parts.

Westinghouse Storage Battery.

The Westinghouse Machine Company (storage-battery department) of East Pittsburg, Pa., has issued a catalogue of more than usual interest, entitled "The Westinghouse Storage Battery for Stationary Use." The new battery is offered as the result of many years of systematic study of all well-known and many comparatively unknown types. It is asserted that exhaustive and elaborate tests during the development of the Westinghouse battery have shown the superiority of the pure-lead sulphuric acid type if properly designed and constructed. The Westinghouse positive and negative plates are made of purest lead, without tin, antimony or other alloy, with the active material formed from the lead itself by a Planté process, with sulphuric acid as an electrolyte.

The plate, including frame and leaves, is of chemically pure lead, compressed into one homogeneous piece, without joint or weld of any description. Upon the laminated surface is formed, from the lead itself, the active material—peroxide of lead. This coating of peroxide entirely surrounds each

lead leaf, which remains a core of pure lead of sufficient size to furnish active material for replacing that gradually deposited in the bottom of the cell, and is also of sufficient section to provide ample conductivity during the long life of this type of battery.

Advantages asserted for the Westinghouse storage battery are long life, maximum efficiency and freedom from injurious sulphation.

Electric Power Systems in Some European Cities.[1]

By P. Junkersfeld.

Electric Lighting.

In Great Britain 240-480-volt distribution systems using 240-volt lamps are employed to a very large extent, while in America such systems have thus far failed to become permanently successful. One of the several reasons is the general use of a poorer quality of incandescent lamps. The lighting companies ordinarily do not furnish lamp renewals; there is no general lamp-testing bureau and the individual customer buys his own lamps as best he can, which is often in a hardware store. Such lamps usually take 3.5 to four watts per candle, and very often even more. Under this condition there seems to be very little incentive for the lighting companies and municipalities to maintain a high grade of electrical service.

In London the electric-lighting industry is carried on by a large number of small companies and municipalities, each operating in its assigned territory. This has resulted in wide differences in engineering development and in lack of standardization. Two-wire and three-wire direct-current and alternating-current systems are used. The lamp voltages vary from 100 to 250 volts and the frequencies for lighting service through an equally wide range. With such a multiplicity of comparatively small lighting systems, each with its own power house, and many of which are no longer modern, the best economy in the generation and supply of electricity of course is impossible. At each of the last two sessions of Parliament bills were presented asking for rights to generate and sell electricity in bulk from two or three large new modern power houses, but failed to pass. Additional bills will undoubtedly be presented in the future. In the meantime, however, electric lighting and general power development are practically at a standstill in London.

In Paris the wholesale supply of electricity has been arranged and is well under way. The company operating the new St. Denis Station has started a wholesale supply and a second large wholesale supply power house in South Paris is under construction. However, the franchises of many of the retail distributing companies, who in Paris also operate each in an assigned territory, are about to expire, and thus far have not been renewed. These local disputes in some parts of Paris have greatly retarded electric-lighting development and have given gas lighting an advantage which has been promptly and effectually followed.

In Berlin practically all of the electric power needed for electric lighting and general power is supplied by the Berlin Electricity Works from its very extensive central-station system. In the central portion of the city 110-volt lamps are used, the distribution being 110-220 volts. In the outlying portion 220-volt lamps and 220-440-volt distribution are used. All of the above is direct current. In the suburbs of Berlin alternating current is distributed to individual customers. The electric-light industry is progressing very rapidly indeed. While the company does not furnish lamp renewals, there is ample opportunity for testing of lamps, and the average customer seems remarkably well informed on electric lighting and illumination. The ordinary incandescent lamps were all 3.1 watts per candlepower. We also found a large number of the more modern incandescent lamps in use, all of which were operated on direct current. Among these might be mentioned the Nernst, osmium and tantalum lamps. The wolfram or tungsten lamp was given its first public exhibition last June and created a considerable stir in engineering circles. This new tungsten lamp is probably the most important advance that has been made in the electric-lighting industry in the last 25 years. The gas lighting in Berlin seems to have also reached a very high standard. In fact the art of electric and of gas illumination seems to have been given perhaps more attention in Berlin and in Vienna than in any other two large cities in the world.

Power House Equipment.

One of the distinctive features of European power houses is the almost unversal use of economizers, and as a result of this the use of electric instead of steam-driven auxiliaries. One of the principal reasons is the higher cost of coal, which in Berlin during the past year has averaged about $5 a ton for a grade of coal having 12,000 B. T. U. and 10 per cent. ash. The power houses in Great Britain more nearly resemble American practice than do those of Germany and France.

Water-tube boilers and automatic stokers are now being used quite generally, especially in the larger power houses. In Great Britain overhead coal bunkers are frequently provided, but in Germany and France, where steel construction is more expensive and where power houses seem to be located on less expensilve real estate, the coal is stored in separate coal storage houses or stored in the open. A very large portion of the coal used in power houses is transported by water instead of by rail.

The number of power houses using turbines exclusively is still comparatively few. Out of 15 power houses visited, eight employed reciprocating engines, four had both engines and turbines, and only three had turbines exclusively, the last mentioned being the Chelsea Station in London, the Carville Station in Newcastle and the St. Denis Station in Paris. Among the latest and most promising turbine installations at the time of the writer's visit might be mentioned the 3,000-kilowatt Curtis type, installed by the Allgemeine Electricitäts Gesellschaft in the Oberspree Station of Berlin, the 5,000-kilowatt Parsons type installed by Brown, Boveri & Co. in the St. Denis Station of Paris, and the 3,000-kilowatt Parsons type installed by Willans & Robinson in the Port Dundas Station in Glasgow.

Leading engineers did not seem to be particularly enthusiastic over gas engines. They are apparently very little used in the larger cities.

There is, however, considerable discussion about chemical processes in connection with electric power systems and about various schemes for utilizing waste heat. In one instance the writer saw a 1,500-kilowatt steam-turbine plant where boilers were supplied entirely by waste gases from coke ovens. This plant was operated in multiple with a large transmission system, the amount of load on plant being regulated automatically by the supply of waste gases to the boilers.

The electrical equipment, particularly in the modern power houses in Great Britain, is very similar to that in this country. In Germany there seems to be some timidity about high-voltage generators, very few of which exceed 6,000 volts. A few of the latest turbo-alternators have been built for 10,000 volts and have also been equipped with smooth rotors instead of with revolving fields having definite poles. During the last few years the switch equipment in many large European power houses has been entirely reconstructed and oil switches installed instead of the former air-brake knife switches. On the Continent most of the oil switches have the three-conductors in a single oil vessel instead of in separate oil vessels and compartment. Nearly all oil switches are remote controlled and equipped with overload and reverse-current relays. The generator voltages in the stations visited ranged from 5,000 to 12,000 volts. The frequency in the power stations which supplied railway service exclusively or in large part was usually 25 cycles. In other power houses the frequency was usually either 40 or 50 cycles.

Transmission Systems.

The transmission systems observed were all underground and most of them were operated independently at the sub-station, i. e., two lines entering a sub-station were not tied together on the same bus-bar. This general scheme has become known as the so-called "radial system" and is recognized as representing a slight sacrifice in economy in order to secure in the present state of the art the best reliability of service in a transmission system supplying large sub-stations. The "interconnected system," in which incoming lines at sub-stations and also adjacent sub-stations are constantly tied together, was also used to a considerable extent. This system affords better economy in transmission but is also more largely at the mercy of automatic protective devices. The so-called "ring system," in which a single cable from the power station supplies a number of sub-stations in series and finally returns to the station after having formed a loop or ring, is employed at Newcastle. The cable between two adjacent sub-stations is equipped with overload relays at each end, which relays are connected in opposition or "balanced" by means of a two-conductor pressure wire paralleling the main high-tension cable. In case of a breakdown in the cable the "balanced" condition no longer obtains and the relays instantly disconnect the particular piece of cable at each end. The continuity of service to sub-stations is, however, not interrupted even though such services may be somewhat impaired. This ring system was developed and apparently is well adapted to the conditions at Newcastle, i. e., a large number of comparatively small sub-stations (1,000 kilowatt capacity and less). This transmission system as laid out covers a manufacturing and mining district about 30 miles long and 18 miles wide and is an extremely interesting development.

The principal power transmission systems of Paris, Berlin, Frankfort, Glasgow and one of those in London were operated sectionalized. In Berlin, where sectionalizing is carried perhaps to the extreme, the three large stations were operated entirely independent, each supplying its own group of sub-stations. Each sub-station in turn supplies its own independent network. The two largest generating stations are each operated in two or three sections. The opinion of most of the leading engineers was in favor of a reasonable amount of sectionalizing in very large high-tension alternating-current transmission systems.

Sub-station Equipment.

In sub-station equipment, except possibly such as is used for railway service, there is very great lack of standardization. Two of the large exclusively railway power systems in London as well as the metropolitan underground system in Paris and the tramways system in Glasgow used rotary converters very similar to those used in American practice. Many of the other systems employed a varied assortment of induction and synchronous motor-generator sets and some of them used a type of converting unit known as asynchronous motor generators. In Berlin, however, where all of these various types were found in service, the very latest installations consisted of a special type of rotary converter. These rotary converters differ from those commonly used in this country for lighting service by the absence of the independent regulating apparatus known as the induction regulator. The range in voltage, which with the rotaries in Berlin was much more than ordinary, was secured by means of an additional set of fields, thus increasing the length of the unit and in effect placing the regulator on the shaft instead of having same in the form of a separate piece of apparatus.

The amount of switching apparatus and the number of automatic protective devices and instruments was in most cases very considerable. In some instances, particularly in Berlin and Glasgow, the provisions for locating trouble on the low-voltage distribution system were complicated and extensive.

The character of sub-station buildings in most cases was very good and thoroughly in keeping with the requirements. Many of them allowed much more liberal room for apparatus than would be considered advisable with the very high real-estate values that often obtain under American conditions. In the Berlin system as well as in the Metropolitan railway of Paris each sub-station was equipped with one or more large storage batteries.

Underground Construction.

The so-called solid system of underground construction is very largely used in Great Britain. This consists of cable laid in troughs or a similar arrangement by means of which the cable is completely enclosed with some sort of asphaltum or similar compound. The cable cannot be removed except by digging a trench its entire length. The more recent large installations, however, employ the conduit or "draw-in" system, in which underground cables can be installed or removed at will after the conduit and manholes are once provided. This system is becoming quite popular in the larger cities. The choice as between the conduit and "solid" systems in these cities is now usually dependent upon the number of cables which it is expected ultimately to install. If the engineers believe that more than two or three cables are at all likely to be needed the conduit system is preferred. Many English engineers maintain that the "solid" system is the more lasting and less susceptible to electrolysis troubles, but this is still a more or less open question. On the Continent a so-called "buried" system is employed almost exclusively. It consists of laying lead-covered cable protected by armor and jute directly in the ground.

One of the reasons why the "solid" and "buried" systems are usually used in Europe, especially for the house-to-house distribution, is the absence of excavated space under sidewalks and the strip of gronnd which is usually found between sidewalks and building lines. This latter strip is usually paved with a very cheap rough mosaic pavement, under which the distributing mains can be buried. The service taps to such mains can then readily be made at a minimum cost and with the minimum of inconvenience to the public.

The necessity for a very high standard of electrical service, as previously stated, is not so urgent in Europe as in this country. On the other hand, the cost of repairs to the "solid" and "buried" underground distribution systems is usually much greater than where the conduit system is employed. As a result the distributing mains and low-tension feeders are fused comparatively light and many elaborate methods for keeping track of the insulation resistance are followed. This is expensive and necessarily results in frequent interruption of service often of several hours duration.

Conclusion.

The electric power systems in the larger cities of Europe are on the whole thus far not as extensive as the larger systems in this country. In all undertakings where the conditions of the electric power problem are similar the solution is usually also similar. Electric transportation on the whole is not so general as in this country, interurban electric railways being comparatively rare. The amount of electric lighting per capita is also not so great, particularly in the smaller cities. The development in incandescent lamps, while not so

1. Part of an address before the Electrical Section of the Western Society of Engineers, October 19, 1906. The author is electrical engineer for the Chicago Edison Company.

good in Great Britain, has reached a higher plane in Germany and Austria than in this country.

In electrical manufacturing and export trade a very large business is being developed. One of the very large electric manufacturing companies in Berlin employs 30,000 men and makes very heavy shipments, particularly to South America and South Africa. Another manufacturer who had many years experience in America has, in Berlin, within a very few years built up a business, largely export, which employs 5,000 hands. American manufacturers with their wonderful capacity for standardization and production in large quantities should have little to fear in the world's competition, but are by no means in a position to rest on their oars.

Holding Power of the Stombaugh Guy Anchor.

A number of tests were made recently by Prof. R. C. Carpenter of Cornell University to determine the holding power of Stombaugh guy anchors. These tests are reported as showing that the five-inch anchor held 12,000 pounds when bored into the ground five feet; the six-inch, 15,000 pounds; the eight-inch, 20,000 pounds; the 10-inch, 25,000 pounds, and the 12-inch, 30,000 pounds.

FIG. 1. TESTING STOMBAUGH GUY ANCHORS.

FIG. 2. ANCHOR READY FOR THE STRAIN.

FIG. 3. DOWNWARD PATH OF THE ANCHOR.

The accompanying pictures illustrate how these holding powers are possible. Fig. 1 shows the apparatus with which Professor Carpenter tested the Stombaugh guy anchor. Fig. 2 is a picture of a 12-inch anchor from which half of the clay into which it was screwed was carefully taken away. Close examination reveals the course of the helix or screw through the clay. It will be noted that the solid clay was not disturbed and the anchor left practically no trace of where it went in. Fig. 3 shows the same anchor and clay after the cuts of the helix were opened out with a putty knife, to show more clearly the downward path of the anchor.

The manufacturers, W. N. Matthews & Bro., 203 North Second Street, St. Louis, will send further information and a report of Professor Carpenter's tests on application.

Single-phase Generator at Belleville, Ill., Works Economy in Copper.

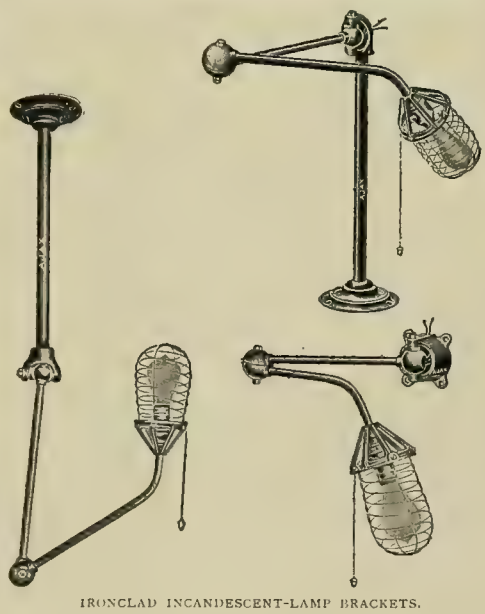
Belleville, Ill., having some 20,000 inhabitants, possesses a greater number of manufacturing industries of various kinds, especially foundries, than is usual for a town of its population. The Belleville Gas and Electric Company, which has been supplying both light and power for these factories for several years, for a long time maintained a 500-volt direct current service which, it was found, required considerable expenditures for feed-wire copper in order to extend and enlarge its service to take care of new factories scattered along the rights-of-way of several railroads passing through Belleville.

A means of overcoming this difficulty was presented in the alternative of supplying power from single-phase lighting circuits, or of installing a polyphase distributing system for power purposes. The latter plan involved expensive changes, so that the use of a single-phase system was adopted and an Allis-Chalmers Corliss engine directed connected to an Allis-Chalmers single-phase generator was the equipment selected to solve the difficulty. The generator is a 550-kilowatt 2,300-volt 60-cycle machine of standard Allis-Chalmers design, and the engine is one of the well-known Reynolds-Corliss type, 30 by 48 inches, also built by that company.

While a considerable portion of the present output is through a 500-volt direct-current generator, the 500-volt system is not being extended. All new business is taken on the single phase alternating-current circuits, and some business has even been changed from 500 volts direct current to single-phase alternating current, because of better voltage regulation on the alternating-current circuits. Out of a connected load of about 900 horsepower, 500 is in direct-current motors.

Ironclad Incandescent Brackets.

How necessary it is to guard incandescent lamps and fixtures against rough treatment is shown by the steady demand for wire lampguards. But these guards protect only the lamps, leaving unguarded the supporting brackets, although these are commonly made only of plain brass tubing. To meet this shortcoming the Ajax Line Material Company of Chicago is supplying a line of ironclad adjustable brackets originated in England but well suited also to American conditions. These comprise eight types, three of which are pictured herewith, adapted respectively for ceiling, wall, floor or bench use. They are all made of iron piping with substantial iron joints, at least one joint on each fixture being of the "ball and socket" type so as to give an unusual range of adjustment. Being fitted with so-called pull sockets, these fixtures allow the use of closely meshed iron shadeholders corresponding to the extra protection for which the designer has aimed. They are shipped with sockets, wired as shown in the cuts, and are neat enough in appearance to warrant their use in shipping rooms as well as factories.



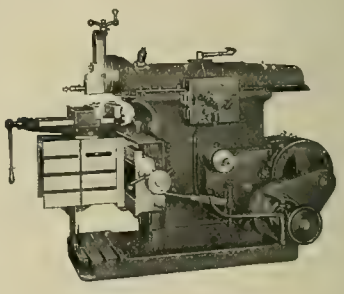
IRONCLAD INCANDESCENT-LAMP BRACKETS.

Reedsville, Wis., has voted for a municipal light plant to be operated in connection with the waterworks.

New Motor-driven Shaper.

The illustration herewith shows an interesting application of a General Electric continuous-current motor to a high-speed quick-stroke 24-inch shaper recently manufactured by Gould & Eberhardt of Newark, N. J., for the National Tube Company of Lorain, Ohio. As will be seen, the motor is mounted on the back of the main column of the shaper, thus making it integral with the tool, and at the same time keeping it well up with the floor, where it will be protected from dirt or sweepings. The compact cylindrical construction of the motor adapts it well to the machine so that a symmetrical unit results. Power is transmitted to the main shaft of the shaper through a Morse silent chain.

One of the particular features of interest in this electrically driven tool is found in the fact that the motor is not stopped and started each time that the tool itself is stopped or started. The motor may run continuously, and by means of the long curved lever shown at the right of the view a clutch is thrown in or out, as occasion requires, thus giving perfect control of the cutting head without the strain or shock involved in starting and stopping the motor instantaneously.



NEW MOTOR-DRIVEN SHAPER.

A desirable feature in connection with the clutch is the mechanical brake, which enables the cutting head to be brought to rest almost instantly during any portion of the stroke. The arrangement for governing the transverse feed of the table is ingenious and effective, as is also the means for supporting the table on the extended base when heavy work is being machined.

National Conference on Standard Electrical Rules.

The annual meeting of the National Conference on Standard Electrical Rules will be held at the Edison Auditorium, 44 West Twenty-seventh Street, New York city, on March 29th at 2 p. m., to act upon any business which may be brought before the meeting. The organization will also consider such amendments to the National Electrical Code as may have received action at the annual meeting of the electrical committee of the Underwriters' National Electric Association at its meeting on Wednesday and Thursday, March 27th and 28th.

It is desirable that all organizations and corpora-

tions having membership in the conference should be represented by a delegate; and all persons interested are invited to attend. C. J. H. Woodbury is secretary. His address is Room 57, 45 Milk Street, Boston.

Proposed Regulation of Public Utilities in New York.

The creation of two public-service commissions of five members each to replace the present State Board of Railroad Commissioners, the State Commission of Gas and Electricity, the New York city inspector of gas meters and the New York City Rapid Transit Commission, is the purpose of a bill introduced in both branches of the New York Legislature last week. The bill embodies the principal recommendations in Governor Hughes' message to the Legislature.

There would be two districts. The jurisdiction of the commission in the First District extends to all railroads, street railroads and common carriers operating exclusively within New York, Kings, Queens and Richmond counties; to street railroads any portion of which is within the district, except as to construction and local facilities and transportation outside the district; as to construction and local facilities and transportation of railroads within the district; to the manufacture, sale or distribution of gas and electricity within the district; and, in addition, the commission is vested with all powers hertofore conferred upon the Board of Rapid Transit.

All jurisdiction not given to the commission of the First District is vested in the commission of the Second District, including the regulation and control of all transportation on railroads, other than street railroads, from one district to another.

The bill prescribes the duties of transportation companies, pipe-line companies, and of gas and electric companies, and gives to the commissions power to regulate the operations of such companies. It provides that the franchise of a public-service corporation shall not be assigned, transferred or leased without the approval of the proper commission. It forbids a railroad or street-railway corporation to purchase or hold any of the capital stock of any other similar corporation, unless authorized by the commission, and a similar provision is made as to gas and electric corporations.

According to the promoters of the bill, the main features of the present Gas and Electricity Commission law are reproduced in this bill. The articles dealing with railroads, street railways and common carriers are new, and, in order to secure uniformity, have been made to conform to the interstate-commerce act, where there would be a similar duty imposed by each act. It will not be the duty of the commissions to operate any public-service corporation subject to their jurisdiction, but to see these corporations are so operated as to comply with the law.

Rateau Process for the Utilization of Exhaust Steam.

The first application in America of the Rateau process for the utilization of exhaust steam from intermittently running engines has been put in operation at the steel works of the International Harvester Company, South Chicago, Ill. The exhaust steam from a reversible blooming mill is utilized in a low-pressure Rateau turbine of 600 kilowatts capacity, direct-connected to two direct-current 250-volt generators. In view of regulating the intermittent exhaust of steam, the exhaust of the blooming mill is worked through one of the water-type Rateau steam regenerators, which has a capacity sufficient to take care of intermissions of several minutes' duration in the running of the main engine. The steam then feeds the low-pressure turbine and is condensed in a barometric condenser.

The pressures are atmospheric pressure absolute at the inlet of the turbine and 28 inches vacuum at the outlet. The quantity of steam available from the main engine is more than twice the amount needed by the turbine. In order to avoid back pressure on the engine a 24-inch relief valve exhausts direct to atmosphere when the pressure has a tendency to increase.

In case of a shutdown of the main engine for a long period of time an automatic reducing valve allows the steam from the boilers to be directed and utilized in the low-pressure turbine.

This process is said to show that in the exhaust of an average size reversible blooming mill there is enough available power to run from 1,000 to 1,500 kilowatts, the only expense being interest on the investment and condensing water.

Mr. A. Leonhauser, engineer of the International Harvester Works, in collaboration with Mr. C. H. Smoot of the Rateau company, designed the entire plant. The turbine and dynamos were manufactured by the Western Electric Company in the Hawthorne shops, under the drawings, specifications and supervision of the Rateau Turbine Company.

The barometric condenser and air pump were furnished by the Alberger Condenser Company of New York. The steam regenerator, designed by the Rateau Steam Regenerator Company, was built by John Mohr & Sons of Chicago. The piping was furnished by the Best Manufacturing Company of Pittsburg.

The whole plant was contracted for and put in operation by the Rateau Steam Regenerator Company of Chicago, which handles the exclusive rights in America for the steam regenerators.

Michigan Independent Telephone Association.

The tenth annual meeting of the Michigan Independent Telephone Association was held at Coldwater last week. Incomplete records of the companies of the state indicate 100,000 Independent telephones in service in Michigan. Over 140 members and guests were in attendance, including J. B. Hoge of Cleveland, Ohio, president of the International Independent Telephone Association, Frank L. Beam of Mt. Vernon, Ohio, president of the Ohio Independent Telephone Association, and Theodore Thorward, president of the Home Telephone Company of South Bend, Ind., each of whom made strong addresses. Mr. Hoge explained the remarkable development throughout the country and the unqualified success of the Independent companies. Mr. Beam stated that accurate statistics in Ohio, recently made, show over 290,000 Independent telephones in that state. Mr. Thorward said that the long-distance lines were being built into Chicago from South Bend, and that by fall connections would be made, thus securing to the Michigan companies service with Chicago.

Officers for the next year were elected as follows: President, E. B. Fisher, Grand Rapids; secretary, W. S. Vivian, Grand Rapids; treasurer, A. C. Hinebough, Burr Oak. Five delegates-at-large to the International telephone convention in Chicago next June were elected as follows: J. B. Ware, Grand Rapids; W. B. Woodbury, Detroit; A. C. Hinebough, Burr Oak; W. J. Melchers, Alma; C. E. Tarte, Grand Rapids; alternates, R. B. McPherson, Howell; C. R. King, Ann Arbor; H. A. Price, Bay City; W. A. Young, Benzonia; R. C. Smith, Homer. A legislative committee was appointed, consisting of W. B. Woodbury, Detroit; R. B. McPherson, Howell; R. D. Graham, Grand Rapids; Thomas Bromley, Hart; W. B. Melchers, Alma.

Telephone News from the Northwest.

A telephone tax bill is offered in the Minnesota Senate which places a gross-earnings tax of three per cent. on all lines running through the state, the tax being of a proportionate character. Of the tax, 75 per cent. is to be paid to the village or town where the exchange is located and 25 per cent. goes to the state. All the tax on toll-line service is to go to the state.

The South Dakota Senate has passed a bill to enable towns to construct telephone systems.

The North Dakota Independent Telephone Company has been granted a local franchise at Grafton, N. D.

The Legislature of Montana has passed a bill placing telegraph and telephone companies under the jurisdiction of a commission, which will undertake to fix rates.

The North Dakota Independent Telephone Company has been granted admission to Fargo, N. D. This will give the Independents connection with that city—something they have long sought.

The Minnesota Legislature has killed the proposed bill to make telephone and telegraph companies common carriers, and to make connections with rival companies.

F. D. Cleaver of Iowa Falls has been promoted to the position of manager of the Iowa Telephone Company at Des Moines.

The North Dunkerton Telephone Company has been incorporated at Waterloo, Iowa, by Charles Northrup and others with a capital of $5,000. R.

Indiana Telephone Items.

The Lewis Telephone Company of Lewis has incorporated to build an exchange and telephone system through portions of Vigo, Clay and Sullivan counties. The capital stock is $10,000, and the directors, C. C. Givens, W. W. Woodron, C. W. Boston and J. N. Woods.

The Farmland Telephone Company of Farmland has increased its capital stock to $12,000, to make necessary improvements. The company paid an eight per cent. dividend last year.

At a recent meeting of the Delaware-Madison County Telephone Company it was decided to build a new and modern exchange building in Anderson and rebuild the entire system.

The Western Union Telegraph Company has paid into the county treasuries of the state $61,000, the tax on a valuation of $3,337,323, amounting to $69 for each mile of wire that the company operates in the state. The payment is made under protest, as a suit is now pending to reduce the assessment to $37 a mile.

The Central Union Telephone Company has opened a new branch exchange on the south side in East Morris Street. The mechanical equipment is of the latest type and the switchboard has an ultimate capacity of 9,600 lines.

Stockholders of the Pike County Telephone Company, with principal exchange in Petersburg, have elected directors and officers, naming J. W. Coleman as president. During the last six years the company has put in 800 telephones in the county and has caused reduced rates.

Indiana telephone men are greatly interested in the Interstate Long-distance Telephone Company incorporated at Detroit last week with a capital of $15,000,000. It is organized for the purpose of building a long-distance telephone system throughout Michigan, connecting with the various Independent systems of Michigan, Ohio, Indiana and points east and west.

The Farmers' Telephone Company has incorporated to construct telephone exchanges and telephone systems in Monroe, Brown, Lawrence and Jackson counties. The principal office will be in Bloomington. Bids are now in order for material and equipment. William R. Smith, John A. Knight, Morton Payne and S. J. Woodburn are directors. S.

GENERAL TELEPHONE NEWS.

The McPherson (Kan.) Rural Telephone Company has been incorporated.

A new automatic telephone system will be installed at Rushville, Ind., to cost $27,000.

The Halford and Colby Mutual Telephone Company has been incorporated at Colby, Kan.

A new concern, to be known as the German Northwest Telephone Company, has been organized at Eustis, Neb.

The Barron County Telephone Company of Barron, Wis., has been incorporated with a capital stock of $25,000.

The White County Telephone Company of Carmi, Ill., has been authorized to increase its capital stock from $10,000 to $25,000.

The Farmers' New Era Telephone Company of Lake Geneva, Wis., has increased its capital stock from $50,000 to $100,000.

The Bradner (Ohio) Telephone Company has been incorporated with a capital stock of $20,000 by A. D. Fowler and others.

The Gillespie (Ill.) Telephone Company has been incorporated with a capital stock of $25,000. J. A. Stice and others are incorporators.

A new company, known as the Green Sulphur (W. Va.) Mutual Telephone Company, has been organized with a capital stock of $5,000 by G. W. Allen and others.

The Laporte City (Iowa) Farmers' Mutual Telephone Company has filed articles of incorporation; capital, $21,000. O. A. Wallace is president and A. A. Sloan, secretary.

The Pioneer Telephone Company of Enid, Okla., has completed its new telephone system, which has been under construction for over a year, and which has cost over $300,000.

Among recently incorporated telephone companies are the following-named: Yale Telephone Company, Yale, Okla.; Iowa Telephone Company, Iowa, La.; Hereford (Texas) Telephone Company; Great Bend Telephone Company, Hankinson, N. D.

At the annual meeting at Milwaukee on March 4th of the Wisconsin Telephone Company plans were outlined for the expenditure of $1,500,000, to be used in extending and improving the system in Wisconsin. The old directors were re-elected.

Dowagiac, Mich., is to have an Independent telephone system, to be operated by the Cass County Home Telephone Company. Automatic telephones, free service to seven exchanges, connections to Grand Rapids and Chicago and low rates are some of the promises made. Home people compose the board of directors. The capital stock is $150,000, one-third of which is pledged.

The eleventh annual meeting of the Iowa Independent Telephone Association will be held at the Garretson Hotel, Sioux City, Iowa, on March 19th, 20th and 21st. The programme will have features to interest all—investors, managers, the small fellow and his larger neighbor. The manufacturers are going to make fine exhibits. Charles C. Deering of Boone is secretary. The Sioux City Jobbers and Manufacturers' Association has arranged for a merchants' meeting in Sioux City the same week.

Mail advices from Skagway tell of a telegraphone system which is now being operated successfully in the Arctic regions. Skagway and White Horse are said to be connected by a telephone system installed by the operating department of the White Horse and Yukon Railroad. The system can also be used from any point along the line of railway. The telegraph wire is utilized by the long-distance telephone—the longest, if not the only one, in Southern Alaska. Every train on the system carries an instrument which can be attached to the telegraph wires and immediate communication obtained.

CORRESPONDENCE.

Continental Europe.

Paris, February 26.—The hydraulic station of the town of Kubel, Germany, has been enlarged. New machines and an extra hydraulic outfit have been added so as to provide for the increasing demands for current. At present the Kubel station has a capacity of 9,000 horsepower. A second penstock is now installed alongside the first one, and it lies parallel to the latter, running for some 1,000 feet length to the water chamber. The inside diameter of the new penstock is 1.6 meters. The expense connected with the increase of the plant is estimated at about $40,000. Sulzer Bros. of Winterthür, Switzerland, supplied the new turbines and the rest of the hydraulic outfit.

At Grasse, in the Maritime Alps region, there is some question of lighting the neighboring villages from the city power plant and of extending a certain number of lines throughout the country. The Municipal Council is considering whether the electric lighting thus carried out will be cheaper than gas lighting. The project which was under discussion by the Municipal Council of Saramon in relation to the erection of a new light and power plant for the town has now been adopted definitely. A concession for the new plant is granted to Engineer Lafargue for a period of 30 years. It is intended to erect an electric station for this purpose at the neighboring point of Boular. The establishments of Prechacq-les-Bains, a health resort of some importance, are taking measures to secure a large amount of current for the electric lighting of their large buildings and the premises. The concession has been awarded to the Compagnie Electrique de Dax, which is to erect a station in the vicinity. Some of the current from this plant will be used for Pontoux and other towns in the neighborhood, and a series of pole lines will be run from the station for this purpose. The same company has made a proposition to the municipality of Montfort for furnishing electric light in the town, and the affair no doubt will be concluded very shortly.

The Municipal Council of the town of Selloncourt is considering the demand made by one of the local lighting companies, the Société Electrique du Refrain, for a pole line to run from the company's power station to the town, taking in a number of localities on the way. In the city of Narbonne the question has come up in regard to the increase in the public lighting of the town, including the public buildings. For this a considerable number of new arc lamps is to be installed, also the incandescent lamps which will be needed for the various buildings. Electric motors are also to be installed. The duration of the present project is fixed for 30 years.

A practical test of the new image-transmitting apparatus invented by Dr. Korn of Munich was made not long since in Paris. One of the illustrated weekly journals, L'Illustration, made arrangements with the inventor to have the exclusive use of the apparatus in France and the option of installing stations in other countries of Europe. It is to have the apparatus built by Carpentier of Paris, and the work has already been commenced. Dr. Korn was called to Paris by the journal and made a public demonstration before a large audience. The sending and receiving apparatus were placed in the hall and were connected by a double wire which ran to Lyons and return, the two ends having been joined together at Lyons. This gave a total length of about 600 miles of actual line wire. In this case the photograph, consisting of a film wrapped around a glass cylinder, was reproduced on a sensitive film at the receiving cylinder and the test was quite conclusive. A photograph of President Fallieres was transmitted in this way without any difficulty and the results show that views of different events in a distant city can be sent over a wire and can be used for newspaper work. The problem may be said to be practically solved by Dr. Korn's apparatus. The journal in question intends to commence using it as soon as the new instruments can be constructed, or probably in a few months.

A. DE C.

Great Britain.

London, March 1.—An item of some interest was mentioned in Parliament the other day. It was that glassblowers in this country who make X-ray tubes are unable to produce them in sufficient number to meet the demand required for the military hospital. Consequently, owing to better quality and price, they are purchased from continental manufacturers.

The government has decided to appoint a committee to go into the whole question of the International wireless-telegraph convention at Berlin last year. Apparently it is desired to have an inquiry and report upon whether the British government should ratify the Berlin conclusions. Can the Marconi influence be at work?

The Swansea municipal telephone system is not yet sold, either to the postmaster-general or the National Telephone Company. The corporation will shortly hold a special meeting to consider the latest offer from the National Telephone Company, which is the whole capital expenditure upon the undertaking, leaving the corporation to retain the sinking fund, the company also bearing the cost of the litigation re intercommunication. The record of the National Telephone Company at Tunbridge Wells, however, is creating considerable opposition to the Swansea sale. At Tunbridge Wells, to compete with the municipal system, the company reduced its subscription rates considerably. When the municipal undertaking failed to make both ends meet and was absorbed by the company, up went the rates to about the original figure. The fear of the same thing happening in Swansea is very great, and there is talk of forming a local company, presumably with the object of maintaining the existing competition.

Speaking of the National Telephone Company, at the annual meeting a few days ago a trust fund was sanctioned to provide compensation for the officials who will not be absorbed by the state in 1911, and also for the directors. Under the agreement with the company, the Postoffice will not take over any official who is earning a salary of $3,500 or upward. The half year just closed constitutes a record for the company. The net income showed an increase of $580,000 over the previous half year.

During the year ended March, 1906, 183,512,421 passengers were carried on the southern tramways of the London County Council, being 141,845,555 on the electric lines, and 41,666,866 on the horse lines. This compares with a total of 100,228,954 passengers carried during the year 1899-1900, when the council first commenced to work the lines. The tramways committee in reporting these figures —those for 1907 are not yet out—states that the volume of traffic now to be dealt with and its continual increase does not seem to be quite recognized. It is clear that the railways are severely hit by the competition of the electric tramways, for the chairman of the Southeastern and Chatham Railway recently stated that the number of suburban passengers carried by the railway shows a decrease of 3,300,000 since the opening of the tramways.

As is the usual fate of deputations to cabinet ministers, the deputation of Scottish authorities which sought to move the postmaster-general into quickening the construction of underground telegraph lines to Scotland did not get much satisfaction. In fact, complete dissatisfaction is expressed at the result, and an appeal to Parliament is to be made.

There has just been completed a complete system of electric lighting at the Naval Ordnance depot at Devonport, and electric cranes are now to be installed. The plans and estimates for these have been approved by the Admiralty, the existing manual cranes being retained—they being of comparatively recent design—platforms and gearing being attached for the adaptation of the hoisting and traversing motors. Each crane is to be provided with two electric motors, one of 10 horsepower for hoisting purposes, and one of five horsepower for traversing.

The District Railway Company is now using harder rails when renewals are made, owing to the rapid deterioration of the original metals since electric traction was inaugurated.

G.

Dominion of Canada.

Ottawa, March 9.—N. W. Harris & Co. of New York have purchased $1,650,000 of five per cent. bonds of the Dominion Power and Transmission Company, the big merger company which has just been incorporated by the Dominion government.

Some American financial papers have made the assertion that the Bell Telephone Company of Canada is controlled by the American Telephone and Telegraph Company. This is stated to be incorrect, as the American concern owns less than 40 per cent. of the Bell stock.

The Rio de Janeiro Tramway, Light and Power Company, the Canadian concern, with headquarters in Montreal, has received a cable advice that the balance of the bond issue, amounting to $4,100,000, has been underwritten by a strong international syndicate composed of leading banking houses in London and on the Continent. This is regarded as satisfactory evidence of the confidence placed abroad in the future of the undertaking.

The directorate of the Dominion Power and Transmission Company, the new electric merger capitalized at $25,000,000, has been settled and the following directors and officers elected: President, Col. J. M. Gibson; vice-presidents, James Dixon and John Knox; general manager and secretary, W. C. Hawkins; treasurer, J. R. Moodie; J. W. Sutherland, S. O. Greening, all of Hamilton, Ont.; Andrew Cook of Chicago and Winthrop Coffin of Boston. Two places on the board have yet to be filled.

The fourth annual report of the Electrical Development Company of Ontario shows no statement of profit and loss made last year, the small amount received from the sale of power being thought insufficient to warrant such. The president, Sir Henry Pellatt, states, however, that next year he hopes to be able to report that the company is earning the whole of its fixed charges.

New enterprises continue to offer competition in Montreal. The Crescent Manufacturing Company has written the City Council asking for permission to supply electric power for the purposes of heating, lighting, etc., in a certain district of Montreal. This company has secured a charter to carry on business throughout the Dominion, with power to purchase, own, develop and operate waterpowers and to develop and generate electric power. The company is installing a first-class steam electric plant in Montreal to produce electric power for the purposes of its own business, and the large surplus of energy will be available to supply the needs of the immediate neighborhood.

W.

Winnipeg, Man., March 9.—The Rainy River International Telephone Company, Rainy River, Ont., has decided to install long-distance connections between Rainy River and Fort Francis, taking in the intervening towns. This will mean a stringing of some 55 miles of line. The system the company owns at Emo will also be put into working order.

B. S. Jenkins, superintendent of the Canadian Pacific Railway Telegraph Company, with headquarters at Winnipeg, says that the company will string a number of new copper wires throughout the Northwest this year. In all some 1,700 miles of wires will be strung.

The whole country for miles around Dunmore Junction, Alberta, is lighted by a natural gas well which has caught fire through the carelessness of the workmen employed at the boring. The well is already down 1,200 feet and it is said to be the strongest flow of gas ever discovered in Canada. Several towns and one city are now being lighted entirely by the natural product. The work of boring is still going on under difficulties in an endeavor to get at the oil beneath the gas area. Arrangements are now being made to light several adjacent towns. For miles around gas has been struck and the flow is so great and constant that a number of manufacturers have already located in the "gas belt" of the Canadian Northwest.

J. G. Dodds, who is in charge of the construction of the power plant at Kenora, Ont., states that work is nearing completion. The falls being utilized are capable of generating 30,000 horsepower and the cost of the work is $300,000, although the town raised $400,000 for the work. Last summer from 400 to 500 men were employed all the time and as soon as weather permits another large force will be put on.

If the stories afloat at Cornwall, Ont., are correct the Longue Sault Rapids are to be "harnessed" in the near future in a manner to rival Niagara. The recent change in the control of the Canadian St. Lawrence Company foreshadows a great development of electrical power at Speiks Island. There are great possibilities for this plant. On the American side, however, projects are going ahead more rapidly. It is said that representatives of unlimited capital in close touch with the Pittsburg Reduction Company, which owns the Massena power plant on the St. Lawrence, have made a first payment on the whole of Barnharts Island and a portion of the Longue Sault Island and are looking at the property at the foot of Speiks Island. So far nothing definite can be learned with regard to the intentions of the Americans, but it may be fairly concluded that they include more development of power, and rumor credits the company with the intention of damming the channel of the South Sault and possibly a part of the main Sault River as well. The amount of power now going to waste in these channels is very large.

R.

New England.

Boston, March 7.—The Texas Traction Company has filed a mortgage for $2,000,000, covering its prospective line, with the Old Colony Trust Company of this city, and the company's bonds, amounting to $1,000,000, will be issued. The company is building an interurban electric railway between Sherman and Dallas, Texas.

It is said that the National Wire Corporation of New Haven, Conn., will be reorganized. The company's property is now in charge of receivers.

The Massachusetts railroad commissioners have approved rights to do freight and express business for the Boston and Worcester and the Brockton and Plymouth street-railway companies. Both companies had obtained rights from every city and town through which their lines go. By the approval of the Brockton and Plymouth Company's rights, freight can be sent by electric railway from Plymouth, Mass., to Providence, R. I., via Brockton and Taunton. The Boston and Worcester company must obtain the necessary privileges in Boston and Worcester before it can inaugurate its freight service, as its cars enter those cities over the tracks of the Boston Elevated and the Worcester Consolidated companies, respectively.

The Susquehanna Railway, Light and Power Company has filed incorporation papers with the secretary of state of Connecticut. It has a capital of $20,000,000, but its certificate says that it will commence business on a capital of $1,000. The corporation's charter allows it to engage in almost any kind of business.

At their meeting this week the Boston aldermen adopted resolutions protesting against the New England Telephone and Telegraph Company's new

schedule of rates for the district within five miles of the Boston City Hall, declaring that the rates were unjust and inequitable.

Alderman Berwin has presented an order requesting the mayor to petition the Legislature for permission to build a subway from the Tremont Street end of the present subway, to Dudley Street in Roxbury, the same to replace the elevated structure.

The Framingham (Mass.) selectmen have granted a franchise for a double track 2⅝ miles long, to the Boston and Worcester Street Railway Company, provided the company build a boulevard 80 feet wide for one-half mile, and one 75 feet wide from the end of the wider section to the Southboro line. The work will cost $300,000, and the company has filed a bond for $50,000 as an earnest that it will do the work. The franchise must now be approved by the Massachusetts railroad commissioners.

The Somerville (Mass.) aldermen have at last confirmed Melvin F. Underwood's appointment as commissioner of electric wires and lights. Mayor Grimmons made the appointment a year ago, but the aldermen refused to confirm it, so the mayor acted as commissioner, under the city charter, Mr. Underwood performing the duties of the office. The aldermen confirmed the appointment last week.

The Massachusetts highway commissioners' hearing upon the petition for lower telephone rates in the Boston district was abruptly adjourned last Friday, in spite of protests from the petitioners and the representatives of the New England Telephone and Telegraph Company. The commissioners issued the following statement: "The Highway Commission has determined that the interests of the public demand an investigation of the affairs of the New England Telephone and Telegraph Company, with the purpose of determining whether the present rates are excessive. In the proposed investigation the commission will be glad to receive the aid and advice of a committee of business men selected by some responsible business organization of the city of Boston." B.

New York.

New York City, March 9.—Dr. Lee De Forest demonstrated his latest discovery on March 6th in a room on the top floor of the Hotel Normandie to a small audience of electricans and personal friends. Through an ordinary telephone those present listened to various operatic selections transmitted through space from the New York Electric Music Company at Telharmonic Hall. Dr. De Forest explained the process in detail, describing the method by which he has been enabled to adapt the telharmonic system to the ordinary wireless apparatus.

In addition to the process of wireless music Dr. De Forest took advantage of the opportunity to demonstrate his wireless telephone. The tones of the voice are transmitted by the same process as the music. The telephone system seemed to lack a little in volume and definition, making it necessary to pitch the voice a little higher and speak very distinctly. Nevertheless the demonstration was successful.

Judge Betts of Kingston has appointed Captain Arthur M. Murphy of Catskill receiver of the Catskill Electric Railway Company, of which W. H. Stewart of Harrisburg, Pa., is president.

A desire on the part of the Flatbush Gas Company to branch out as an electric-light company has been stopped by Commissioner Cozier of the department of water supply, gas and electricity, who has refused the company permission to erect poles on the Eastern Parkway for the purpose of installing an electric service. Mr. Cozier, being in doubt whether the company was not exceeding its franchise rights in making this application, sought the advice of Corporation Counsel Ellison, who decided that the privilege asked for should not be granted.

The Morris County Traction Company of South Orange, N. J., has filed a petition with the authorities of Milburn township asking permission to build a trolley road to Milburn Avenue from Maple Street to the Maplewood line. It is thought that the next thing on the programme will be a consolidation of the Morris County Company with the Public Service interests. If there is anything in the rumor that a deal between the two companies is to be negotiated it means the opening up of a new and hitherto inaccessible region to the Public Service. It is proposed to start the work as soon as the weather permits and the road is expected to be running this summer.

The State Railroad Commission has granted permission to the proposed West Shore Traction Company to construct a high-speed electric road, 20 miles long, from Tompkins Cove down the Hudson River to the New Jersey state line at Carterel, passing through 10 villages. It is reported that the West Shore Traction Company will extend its line from the state line 15 miles through the state of New Jersey to Jersey City, and will eventually enter New York city through the so-called McAdoo tunnel.

The New York Central Railroad Company has started proceedings in the Supreme Court to condemn two large tracts of land in Westchester County to carry on the work of changing the motive power from steam to electricity. One section to be condemned consists of several acres at the New York and Harlem Railroad station in the center of White Plains. The other parcel applied for consists of about 20 acres near the Ossining station of the road. As this encroaches on the property owned by the Northwestern Lighting Company the latter, through its attorneys, has interposed objections, and the issue will be tried out before Justice Mills of the Supreme Court. Another important work now being carried on by the company is the changing of the course of the Bronx River from White Plains to Mount Vernon so that it can widen its roadbed for four tracks. D. E. P.

Michigan.

Grand Rapids, March 9.—Several railroad bills are before the Michigan Legislature, and among them is a measure that provides for a commission of three men to have supervision over electric as well as steam roads. The electric-railway men are asking that the steam roads be compelled to deliver freight to the electric roads when it is so consigned, something which they have refused to do in the past, in some cases, and to accept freight from electric roads when loaded on standard cars.

General Manager Samuel Freshney of the Grand Rapids Board of Public Works believes that the city might well buy current from the Grand Rapids-Muskegon Power Company rather than to operate the city lighting plant by steam power. His report on the investigation made has been approved by the board. By having current delivered at the switchboard the cost of street lighting for the city would be reduced $6,000. The offer of the company is to accept $18.70 per lamp per year for a 10-hour and 15-minute day, on a three-year contract, using the city plant for the purpose, and that alone.

The city of Holland will vote in April on a proposition to bond for approximately $30,000 to double the capacity of the city lighting plant.

Whether to purchase additional lighting apparatus at a cost of $30,000 or to buy power of the Commonwealth Power Company is a problem that is agitating the city of Lansing.

The Shiawassee Light and Power Company is securing flowage rights that it may raise its dam and get a greater head of water, thus giving it power to compete more successfully with the Owosso and Corunna Electric Company in Shiawassee County.

Berrien Springs is to vote on a proposition to bond for $20,000 for waterworks and electric lights.

The Michigan United Railways will spend $25,000 in improving Lake View Park at Lansing, and will change its name to Oakwood Park.

Business men of Ithaca and St. Louis are preparing to build an electric road between the two cities. No attempt has yet been made to interest outside capital in the project. C. M. Brown is chairman of the Ithaca committee at work on the project.

Greenville's contract with the Greenville Gas and Electric Light, Power and Fuel Company for lighting the city streets will expire March 30th. The company offers to renew at a rate of $50 per annum a lamp on moonlight schedule till one o'clock, $65 on an every-night schedule till one o'clock, and $75 on an all-night schedule, on a 10-year contract. L. W. B.

Indiana.

Indianapolis, March 9.—F. C. Weisenheimer of Indianapolis, B. R. McBride of Columbus, N. E. Nelson of Lowell and Randolph Martin of Lafayette, engineers representing Purdue University, have disclosed by surveys that Flatrock River, near St. Paul, Ind., is capable of developing a large amount of electrical power. They have designed a 30-foot stone-concrete gravity dam by which 2,800 horsepower can be developed the year round, which could supply electric power not only for St. Paul but for Indianapolis, Greensburg and Shelbyville. The dam would make a lake of large proportions which could be converted into a popular pleasure resort. The estimated cost is $300,000.

Hinshaw & McKnight of Westfield have bought the Hill flouring mill and will repair the building and machinery and operate the plant. They propose to add an electric-light plant for the purpose of lighting the town, business houses and dwellings. The Town Board will be asked to grant a franchise.

The power-house building at Crawfordsville of the Indianapolis, Crawfordsville and Western Traction Company is completed and the work of placing machinery is progressing rapidly. It is promised that the overhead work of the line trolley and feeder line will be finished by March 15th and that the track will be ready for the through operation on June 1st—the date that was set for the opening of the line.

The city electric-light plant of Peru is greatly in need of improvements that will cost upward of $15,000. Instead of making this expenditure the City Council is considering a proposition of the Fort Wayne and Wabash Valley Traction Company to furnish electric current to run the city lighting plant at the rate of three cents per kilowatt delivered at the city switchboard. It is said the proposition is regarded with favor.

At a meeting of the Board of Town Trustees of Greenwood a 20-year contract was granted the Citizens' Water and Light Company for supplying water and light. The contract provides for 25 arc street lights and 40 water hydrants.

The Gamewell Fire Alarm Company and the Signalphone Company are competitive bidders for the contract to install a new fire-alarm system in Kokomo.

The Bluffton, Geneva and Celina Traction Company has filed articles of incorporation to build an electric railway from Bluffton, Ind., to Celina, Ohio. L. S. Justus, Samuel Bender, A. W. Brown and R. S. Cummings are directors.

The American Bridge Company and the American Steel Car Company have each secured sites in the city of Gary upon which to erect large subsidiary plants. Three electric interurban railroads have applied for franchises to run through Gary.

C. M. Pierce and associates of New York are proposing to construct a fast electric railway to run between Fort Wayne and Detroit. In case this line is built direct connection between Indianapolis and Detroit will be established.

At the recent annual meeting of the stockholders of the Indiana Union Traction Company and its allied interests, the old boards of directors for the three companies were re-elected. The officers for the Indiana Union Traction Company will be selected some time this month in the city of Philadelphia. Officers were elected for the Union Traction Company and the Muncie, Hartford City and Fort Wayne line. The report of the gross earnings for the year was $1,943,101.83; operating expenses, $995,266.25; fixed charges, taxes, interest and stock dividends, $832,322.75; surplus for the year, $115,502.83.

The Fort Wayne and Wabash Valley Traction Company has ordered plans for the construction in Lafayette of one of the largest and handsomest terminal stations in the state. The site selected is on the corner of Main and Seventh streets.

A. A. Anderson of Columbus has been appointed general manager of the Louisville and Indianapolis Traction Company in addition to being general manager of the Indianapolis, Columbus and Southern Traction Company.

Two petitions for franchises for electric railways have been presented to the City Council of Valparaiso—one by the Chicago, Lake Shore and South Bend Electric Company and the other by the Goshen, South Bend and Chicago Electric Road. Both companies ask for an exclusive franchise. The citizens insist that franchises be granted to both companies and that each be required to put up a cash guarantee that the road will be constructed within a reasonable time.

An order went into effect on a number of Indiana traction lines March 7th requiring a physical examination of all conductors and motormen for sight and hearing. There is no specific age limit, but good physical health is required. S. S.

Illinois.

Peoria, March 9.—A meeting was held here this week of the various electric companies and the city electrician as to compiling a new ordinance governing electrical inspections. Mr. Townsend of the Underwriters, the Peoria Gas and Electric Company, the electrical contractors and the city electrician were in attendance. A committee was selected to draw up a new ordinance. It will call for a better grade of work with a clause requiring conduit on all wiring jobs in the fire limits or the business section and the appointment of an inspector with no other duties to attend to.

The Pioneer Telephone Company of El Paso has been incorporated with a capital of $1,000. Incorporators are: William Eft, Lewis C. Kindon and Charles C. Brown.

The telegraphers of the Postal and Western Union of Springfield have formed a union.

The general repair and construction shops of the Illinois Traction Company will be located in Decatur. A 40-acre tract has been purchased and a general storehouse 120 by 160 feet, and a shop proper 200 by 300 feet will be built.

The American District Steam Company of Lockport, N. Y., has taken out a license from the secretary of state to do business in Illinois, location Chicago.

Ten of the new interurban cars have been completed by the American Car Company for the Illinois Traction Company. Six will be used on the Peoria-Bloomington line and four on the Decatur-Champaign branch.

It is reported that most of the right-of-way for the Roodhouse-Virden electric road has been secured.

The Mississippi Valley Electric Company will build the electric line from Nauvoo to Fort Madison, Iowa. A line will also be run south from Nauvoo and a branch to Carthage and also one to Hamilton, where it will connect with the Keokuk-Hamilton road. A party of surveyors started this week to survey the line.

The Wabash steam road has cut the rate be-

tween St. Louis and Decatur from $6.34 to $4.50 for the round trip. The interurban rate between Springfield and St. Louis is $3.05 for the round trip, or just 10 cents more than the regular one-way rate on the Chicago and Alton and Illinois Central. Since the interurban has been running it has been taking the business away from the steam roads, hence the cut.

The Property Owners' Association of South Washington Street has received word from the Warehouse and Railroad Commission that the state board has no jurisdiction in the matter of compelling an interchange of freight between steam and electric roads. Both the Terminal and the Peoria Railway Company are asking for franchises on that street. The Peoria Railway Company and the Terminal offer to put in side tracks and switch cars to the business houses adjacent. V. N.

Northwestern States.

Minneapolis, March 9.—An agreement has been practically reached between the City Council of Winona, Minn., and the La Crosse and Winona Traction Company regarding a franchise for the latter.

Montezuma, Iowa, will vote on March 25th on an electric-light franchise for W. R. Lewis.

The Menominee (Mich.) Electric Manufacturing Company has bought the plant of the Davis Electric Company at St. Louis and will move the same to Menominee.

A. M. Hurst and associates have applied for an electric-light franchise at Maquoketa, Iowa. The proposition will be submitted to a vote on March 25th.

The Sleepy Eye (Minn.) Milling Company has made a proposition to furnish electric light for the city, as the municipal plant is about worn out.

The council of Mankato, Minn., is considering a franchise to be granted to W. L. Hixon and H. E. Hance for a street-railway system.

A municipal electric-light plant will be established at Tecumseh, Neb., and bonds for $12,750 have been voted. R.

Pacific Slope.

San Francisco, March 7.—The United Railroads of San Francisco is improving its sub-station equipment by installations of five additional rotary converters, which are now being delivered by the Westinghouse Electric and Manufacturing Company. Four 1,500-kilowatt rotaries and one 750-kilowatt complete with the necessary transformers and station equipments are included in the order.

The United Railroads management asserts that the recent award of the board composed of three arbitrators in the question of wages and hours favored its employes. The union men who operate its cars and who struck for $3 pay and an eight-hour day are not satisfied and say they will insist upon eight hours when the agreement expires next May. All platform men are to receive 31 cents an hour during the first year of service; 32 cents during the second year, and 33 cents during subsequent years, this amounting to a general increase of about 21 per cent. Platform men will be required to work 10 hours a day as at present. Station shopmen will receive a minimum of $3.50 a day. Station operators who formerly received from $80 to $90 a month will receive from $96 to $108. Linemen foremen will receive $4.50 a day and journeymen $4. Carbarn and track foremen will receive $110 a month; journeymen to be raised from $2.50 and $2.80 a day to $85 and $100 a month. Laborers are to receive $2.25 a day during the first month and $2.50 thereafter. In general the eight-hour day will apply to all employes with the exception of platform men. The award is to date from September 26, 1906, to May 1, 1907. The California Street and Geary Street Railroad lines are also to abide by this decision.

The Westinghouse Electric and Manufacturing Company has contracted to supply three 125-250-volt three-wire direct-current generators for the isolated electric-lighting plant to be installed in the new Alaska Commercial Building on California Street. Babcock & Wilcox will supply three water-tube boilers and the Tracy Engineering Company three automatic high-speed engines to be direct connected.

The new $1,000,000 Hotel Claremont which has been erected in the foothills on the western edge of Berkeley, Cal., covering an area of 210 by 600 feet, will have an independent light and power plant. Two 200-horsepower boilers will furnish steam to compound engines direct connected to direct-current generators. The Westinghouse Electric and Manufacturing Company has taken the contract for the generators. The power plant will also operate elevators, ammonia condensers for ice machines, a combined vacuum and compressed-air sweeping plant, etc. There will be a large laundry equipped with the most improved laundry machinery.

F. M. Greenwood, who obtained a franchise a year ago from Alameda, Cal., to build and operate an electric railway through that city in connection with a ferry service to San Francisco, has organized a company for that purpose under the name of the San Francisco, Alameda and Eastern Railway Company. The company has a capital of $2,000,000.

The Davies Bros. Electric Company of Tacoma, Wash., has been dissolved, as it is to be absorbed by a new corporation which has just been incorporated under the laws of the state of Washington with a paid-up capital of $150,000. This transaction means the establishment in Tacoma by the new corporation of one of the largest electrical fixture manufacturing plants on the Pacific Coast. Marcus C. Davies is president of the corporation.

It is feared that unless the controversy in which Electrical Workers' Union No. 6 and the Building Trades Council are involved is not ended soon there will be a tie-up of the building industry in San Francisco. There are about 1,000 electric wiremen in this city, of which about 700 belong to local No. 6, which has been on strike since the beginning of the year. Buildings that are not wired cannot be lathed or plastered. Consequently many lathers and plasterers may be thrown out of work until a settlement is made. Recently a rival inside wiremen's union was organized and affiliated with the Building Trades Council, which body had previously suspended the charter of local No. 6 because its members failed to give the electrical contractors the 90 days' notice which their agreement required before striking. The District Council of Carpenters at a recent meeting denounced the action of No. 6 and pledged its support to the Building Trades Council in any action it may take. It also warned all affiliated unions not to aid the striking electrical workers on penalty of expulsion. A.

PERSONAL.

A. S. Hoopes, manager of the Iowa Telephone Company at Davenport, Iowa, died suddenly a few days ago.

Christ Amundson has been appointed superintendent of the Tri-state Telephone Company at Austin, Minn.

James S. Beaudrot, engineer, with the Savannah (Ga.) Electric Company, died suddenly from heart disease while at his work, on February 26th.

J. N. Babcock of Topeka, Kan., has been elected president of the Wawasee-Ligonier-Topeka-La Grange Electric Railway. Building operations will soon be commenced.

John E. Miles, for years employed by the New England Telephone and Telegraph Company at Haverhill, Mass., proposes to enter the electrical business at Sturgeon Bay, Wis.

Elmer White, formerly with the D. E. Berry Electrical Company of Owensboro, Ky., has been appointed manager of the Thompson Electrical Company of Evansville, Ind.

F. L. Morse, assistant to the president of the Utah Light and Railway Company at Salt Lake City, has resigned his position there and will leave for New York city, where he has business interests.

James Bowdish, for years trainmaster at Pasco, Wash., for the Northern Pacific Railway Company, has been appointed superintendent of the Cœur d'Alene division of the Spokane and Inland Empire system.

Robert Edwin Jenkins, former president of the Metropolitan West Side Elevated Railway of Chicago, died on March 5th in Hahnemann Hospital, Chicago, after a prolonged illness. He was 61 years old and lived in Chicago 41 years.

Charles S. Butts, construction engineer for the McKinley syndicate, has resigned his position to accept an offer tendered him by the Columbia Construction Company of Milwaukee, Wis. Mr. Butts will have entire charge of the interurban-railway construction work of the company.

C. W. White, who for some time past has been employed by the Postal Telegraph-cable Company as electrician at Texarkana, Tex., has been appointed electrician at Hillsboro, Tex., taking the place of T. Oliver, who will fill Mr. White's place at Texarkana.

Lord Kelvin has, at the invitation of the Institution of Electrical Engineers, allowed himself to be nominated for the presidency of the Institution for the coming session. This will make the third time that Lord Kelvin has occupied the presidential chair of the British Institution.

Mr. D. McNicol, manager at Salt Lake City, Utah, of the Postal Telegraph-Cable Company, recently gave a lecture on "Radio-telegraphy" at the Salt Lake City Y. M. C. A. under the auspices of the telegraphy and electricity classes. Many interesting experiments were performed, including the lighting of an electric lamp by wireless transmission.

William A. Brooks, one of the founders of the Haverhill Electric Company, died in Haverhill, Mass., on March 2d. He was born in Bar Mills, Maine, but had lived in Haverhill since he was 18 years old. He was in the dry-goods business for a number of years. He had served in both branches of the city government and two terms in the Massachusetts Legislature. He was vice-president of the Essex National Bank, a director of the Haverhill Savings Bank, and trustee of Hall Hospital and Linwood Cemetery.

C. D. Shreve, former manager of the electric-light plant at Louisiana, Mo., died recently at Sulphur, I. T. Mr. Shreve was a Civil War veteran.

Joseph S. Wells, for many years identified with street-railway interests in Salt Lake City, Utah, has been appointed general manager of the Utah Light and Railway Company in that city, operated by Harriman associates. The company proposes to expend a large sum of money this year in the improvement of the transit and lighting system of Salt Lake City.

J. M. Robb, secretary and treasurer of the Peoria Gas and Electric Company of Peoria, Ill., will leave that company the last of this month to become manager of the Chattanooga Gas Light Company at Chattanooga, Tenn. Mr. Robb has been with the Peoria company since its formation and has had wide experience in both the gas and electric branches of the business.

W. T. McCaskey, formerly special agent for the Allis-Chalmers Company, has been appointed general manager of the Indianapolis, Newcastle and Toledo Electric Railway Company, and has entered upon his new duties. He has been connected with electric traction work since its inception in this country, and is said to be especially well informed on all matters connected with the business. Work on this line has been carried on successfully all winter. The electric machinery for the new power house is now arriving, and will be installed rapidly.

Thomas Richardson, who has had wide experience in power-plant design and was connected with Westinghouse, Church, Kerr & Co., is now head of the drafting department of W. S. Barstow & Co. of New York. Associated with him and in charge of steel structural designing is Harold S. Richmond, who graduated from the Norwich University of Vermont and took a post-graduate course at the Thayer School of Civil Engineering of Dartmouth College. Mr. Richmond has been connected with the Boston and Maine Railroad, Westinghouse, Church, Kerr & Co. and other concerns.

Prof. John K. Rees, Rutherford professor of astronomy (emeritus) in Columbia University, died on March 9th in his fifty-sixth year. He was graduated from Columbia College in 1872, and subsequently received the degrees of A. M., E. M., and Ph. D., and was the first to be awarded a fellowship in science. For five years he held the professorship of astronomy at Washington University, St. Louis, and for 21 years he occupied a like position at Columbia. He served as president of the New York Academy of Sciences, as vice-president of the American Mathematical Society, as secretary of the section of mathematics and astronomy at the 1879 meeting of the American Association for the Advancement of Science, and as general secretary of the same association at the 1880 meeting. To him was due principally the adoption of the present system of standard time now in use throughout the world, and first put in operation by the railway systems of the United States. The other great object of the Metrological Society, the introduction of the metric system of weights and measures was also greatly furthered by his efforts.

J. R. Lovejoy has been appointed general manager of the sales department of the General Electric Company. Mr. Lovejoy has long been known to the electrical fraternity and this title is a formal recognition of the responsibilities with which he has practically been charged for the last two or three years. Mr. Lovejoy was born at Columbus, Ohio, in 1863. After a post-graduate course at the Ohio State University, from which he received the degree of B. Sc., he entered the employment of the Thomson-Houston Electric Company at Lynn, Mass., in August, 1886. Here he gained his practical experience and graduated from what was then known as the "expert course" to take up engineering work in the Boston office of the company. Later his time was devoted to executive duties at headquarters, and when the Thomson-Houston Company was merged into the General Electric Company in 1892 he became general manager of the supply department. In 1900 he was made also manager of the railway and lighting departments of the General Electric Company. He is an officer and a director in several subsidiary companies. Mr. Lovejoy is a director and a member of the excutive committee of the Schenectady Trust Company and was one of the organizers of that concern. He is also a member of the American Institute of Electrical Engineers, the Franklin Institute, and the American Society for the Advancement of Science, as well as several organizations pertaining to electrical science. In addition to his diversified duties Mr. Lovejoy finds time to take an active part in promoting the welfare of the Mohawk Golf Club of Schenectady, of which he is president. He is also a member of the Mohawk Club of Schenectady and the University Club of New York. For many years Mr. Lovejoy has been interested in the subject of archæology so far as it is related to imple-

ments of the stone age, particularly Indian arrowheads, of which he has made a noted collection. Mr. Lovejoy's home and principal office are still situated, as for several years past, at Schenectady.

ELECTRIC LIGHTING.

The American Electric Company, St. Joseph, Mo., sustained a loss by fire recently.

Orofino, Idaho, has granted a franchise to J. O. Adams for an electric-light system.

The Hartford (Conn.) City Lighting Company proposes to expend $8,000 in improving the plant.

The Granite City (Ill.) Light and Fuel Company has accepted plans for a $20,000 addition to its plant.

The Western Light and Power Company of Cisco, Texas, has been incorporated with a capital stock of $50,000.

The Atmore Lighting and Ice Company of Atmore, Ala., has been incorporated with a capital stock of $15,000.

The town of Social Circle, Ga., has issued $15,000 in bonds for the erection of an electric-light and power plant.

The plant of the Mt. Vernon (Ohio) Electric Light and Railway Company was partly destroyed by fire a few days ago.

W. H. Wolff of Dalhart, Texas, has purchased the plant of the Del Rio (Texas) Electric Light Company and will remove it.

A. E. Kelsey has sold the electric-light plant at Clio, Mich., to J. H. O'Rourke of Romeo, who has secured a 10-year franchise.

The Mt. Vernon (Ind.) Electric Light Company will receive bids for the erection and equipment of an electric-light plant in that city.

An ordinance is before the council authorizing an issue of $300,000 in bonds for establishing a municipal lighting plant at Atlanta, Ga.

The Craig Water and Light Company of Texico, N. M., has been capitalized at $25,000. D. F. Craig of Independence, Mo., is one of the incorporators.

Bids for lighting the city of Natchez, Miss., for a term of 10 years will be received up to May 1, 1907. George T. Eisele, city clerk, can give particulars.

The electric-light plant at Jacksboro, Texas, owned by Hensley Bros., was recently destroyed by fire. The loss is estimated at $10,000, with no insurance.

The Arctic Ice and Fuel Company of Austin, Texas, has been incorporated with a capital stock of $25,000, and will manufacture and sell electric light and ice.

J. H. Young, Perry Building, Philadelphia, Pa., has been engaged to prepare plans for a municipal electric-light and waterworks systems to cost $125,000 for the city of Haddonfield, N. J.

The Steamboat Springs (Colo.) Electric Company will largely increase its plant. The company intends to install new machinery capable of supplying all the power necessary for the entire district.

It is said that an electric-light plant will be established at Saltillo, Mex., to run in opposition to the plant now in operation there. Northern capitalists are said to be interested in the new enterprise.

The United Gas Company, which purchased the Wichita (Kan.) Gas, Electric Light and Power Company, will buy new machinery to be installed in the electric-light plant at a cost of $75,000 to $100,000.

The electric-light plant in the town of Palisade, Colo., has been sold to B. O. Smith of Milwaukee, Wis., the consideration being $20,000. It is said that a similar sum will be expended in enlarging the plant.

The stockholders of the Edison Electric Illuminating Company of Boston have voted to increase the capital stock from $11,494,100 to $12,643,600 and the number of shares from 114,941 to 126,436. The proceeds will be used in developing business.

The city of Monmouth, Ill., is now lighted by electricity. The boiler room of the plant contains three boilers, each capable of supplying steam to a 265-horsepower engine. The three alternating-current units in the engine room have a capacity, respectively, of 200, 100 and 50 kilowatts. J. W. Lanphere is chief electrician.

By employing gas engines to generate power it is estimated that the total cost of the proposed municipal lighting plant at Milwaukee, Wis., will be about $380,000, the annual operating expenses being figured at $33,000. These figures have been submitted to the board of public works. It is stated that by using gas engines the saving of coal would be at least $30,000 a year. The estimated cost of the plant was based on the generation of 4,500 horsepower from three 1,200-kilowatt direct-connected gas-engine units, a maximum capacity of 3,000 arc lights being considered. Manufacturers of steam plants have not as yet submitted figures to the board.

It is reported that the Lake Charles (La.) Ice, Light and Waterworks Company is considering the installation of a 1,000-kilowatt turbine, an alternating-current generator and other equipment. J. A. Landry is manager of the company.

Bids will be received until April 4th for furnishing and installing electric-lighting fixtures in the following buildings at Fort Sam Houston, Tex.: Postoffice exchange, gymnasium, hospital, officers' club building, stables and shops. L. J. Fleming, construction quartermaster, can give particulars.

The Litchfield (Ill.) Gas and Electric Company is preparing plans for the installation of a boiler of 200 to 250-horsepower capacity, a 100-horsepower engine, a 150-kilowatt alternating-current two-phase generator, series alternating-current lighting system and 80 enclosed arc lamps of 2,000 candlepower, with regulators and transformers. D. Davis is manager of the company.

The Beaver River Light and Power Company, whose principal place of business is to be in Beaver Falls, Lewis County, N. Y., has been chartered by the state department to carry on operations in the villages of Lowville, Beaver Falls, Croghan and Castorland and the towns of New Bremen and Denmark. The capital stock is placed at $40,000.

A number of Texas capitalists and bankers have organized a chain of electric-light companies in North Texas. It is believed that these concerns have some indirect connection with the proposed Dallas and Sherman Interurban Electric Railway Company, and among those chiefly interested are O. Goodwin, J. F. Strickland, M. B. Templeton, R. B. Stitcher and J. D. Caldwell. The following is the list of separate corporations: Bonham Electric and Gas Company, Hillsboro Electric and Gas Company, Dublin Electric and Gas Company, Cleburne Electric and Gas Company, Waxahachie Electric and Gas Company, Sherman Electric and Gas Company. The capital stock of these concerns ranges from $10,000 to $200,000.

ELECTRIC RAILWAYS.

The Lafayette (Ind.) Traction Company is preparing to build a $25,000 terminal station.

The city of Sioux Falls, S. D., has granted a franchise to F. M. Mills and others for a street-railway system.

The Metropolitan Elevated Railway of Chicago has petitioned for a franchise to extend its line to Cicero—a suburb.

The Lexington (Ky.) Railway Company proposes to reconstruct its lines. About $200,000 will be spent in improvements.

The Bellaire Southwestern Traction Company of Cleveland, Ohio, has increased its capital stock from $10,000 to $500,000.

The St. Elmo, Springfield and Northern Railway Company proposes to construct a road from St. Elmo, Ill., to Springfield.

The Sparta-Melrose Electric Railway and Power Company of Sparta, Wis., has been incorporated with a capital stock of $300,000.

An electric railway will be built from Clarksville, Ark., to the Spadia coal fields, a distance of eight miles. It is estimated to cost $250,000.

The Davenport (Iowa), Burlington Interurban Railway Company has been incorporated with a capital stock of $250,000 by G. W. Hepwell and others.

The Terre Haute Indianapolis and Eastern Traction Company has been incorporated with a capital stock of $100,000. Robert I. Todd and W. F. Milholland are among the directors.

The Henderson Traction Company of Louisville, Ky., has been formed with a capital stock of $150,000. Samuel McDonald of Louisville and Walter Schmidt of Cincinnati are interested in the company.

The Alton (Ill.), Peoria and Jacksonville Railway Company has been incorporated to build a road from Alton, through Jacksonville to Peoria. The company has petitioned to increase its capital stock from $300,000 to $800,000.

Final arrangements have been made for the locating of the principal repairs and construction shops of the Illinois Traction system at Decatur, Ill. The plans for buildings and improvements on the property provide for the expenditure of $100,000 during the coming season.

The Illinois Traction Company will build an addition to its power house at Danville, Ill., and will install a 3,000-horsepower generator which will be more than twice the size of the largest generator now in service there. It will be used to furnish power for the sub-stations on the interurban lines. A 25-ton traveling crane will also be installed in the addition.

The employes of the Louisville (Ky.) street-railway company went out on a strike on March 10th. The company for a time abandoned all attempts to maintain service within the city limits, and as a result many suburbanites were obliged to remain in the city for a considerable time.

The company which promoted the Toledo and Chicago interurban railway is also interesting itself in a new company, known as the Kendallville and Goshen Traction Company, which will be under the same directorate, and proposes to construct a line from Kendallville, Ind., to Goshen, with branch lines adjoining Rome City and Albion.

Representative David H. G. Kuser has introduced a bill in the Pennsylvania Legislature making it imperative for electric-railway companies operating suburban railways to equip cars with toilet rooms under a penalty of $100 for every day that a car or cars are operated without such facilities. The companies are given six months from the passage of the act in which to comply with its provisions.

The recent decision of Judge Scott of the Illinois Supreme Court, practically declaring that the Joliet (Ill.) electric line must have a separate franchise in order to permit it to enter the city of Aurora, is likely to affect the entrance of the Belvidere line into Elgin, according to local authorities, who say the cases are exactly similar, so far as the question before the Supreme Court of the state is concerned.

The Market Street elevated electric railway in Philadelphia has been completed and the first trains were run a few days ago. Work on the road was begun in October, 1904. The power for the trains is supplied from the new power house on Beach Street, which was recently equipped with several powerful Westinghouse dynamos. The electro-pneumatic block-signal system has been installed over the line and repeated tests have shown it to be in good working order. Each car on the line is equipped with two 125-horsepower motors of the box type and with 25 16-candlepower incandescent lamps.

The Havana (Cuba) Electric Railway Company was recently reorganized in New York city following a meeting of the stockholders in Jersey City. The new directors are Warren Bicknell of Cleveland, David T. Davis, Robert Mather of the Rock Island Railway interests, Walter G. Oakman of the Guarantee Trust Company, James Rattray and Samuel San Miguel, Henry Runken, Carlos Zaldo and Frank Steinhart. The reorganization was accomplished largely through the instrumentality of Mr. Steinhart, United States consul general at Havana, who represented some $8,000,000 of the total $12,000,000 capitalization.

POWER TRANSMISSION.

The Pacific Power Company, a corporation recently formed at Anderson, Cal., proposes to erect a plant capable of generating 15,000 horsepower on Battle Creek.

At a meeting of the Washington Water Power Company held recently at Spokane, Wash., it was decided to increase the capital stock from $5,000,000 to $10,000,000. Improvements and extensions will be made.

Cedar River is to be dammed a short distance above Rochester, Iowa, for furnishing power for the new electric interurban road between Iowa City, Tipton and Davenport, the final survey of which is about completed.

The Missouri Lead and Zinc Company has begun the installation of an addition to its electrical power house in Joplin, Mo., enlarging the capacity to 1,200 kilowatts. A steel and concrete structure is to be erected beside the present frame structure.

J. B. Lucas, manager of the Spring River Power Company of Baxter Springs, Kan., is making a survey on Spring River for the building of a waterpower plant. It is proposed to install a hydro-electric plant for the purpose of furnishing electricity for light and power to the mines at Baxter Springs.

Articles of incorporation of the Cherokee Power Company of Afton, I. T., have been filed. The company, which is capitalized at $1,100,000, proposes to build a power plant on the Grand River southeast of Afton about 12 miles. The site chosen for the plant is about 20 miles from Vinita. Joseph Schneider of Joplin is president of the company.

Two years' work on the great dam and power plant of the Helena Power and Transmission Company on the Missouri River, near Helena, Mont., was completed a few days ago when the machinery was started. Electricity is now being supplied to Butte and Anaconda at the smelters and mines for lighting and transportation purposes. The new dam is 650 feet long and 75 feet high and is made almost entirely of steel. The gates of the wall were closed a few weeks ago, since which time

the back waters of the dam have formed a lake more than a mile long. The plant has a capacity of 15,000 horsepower.

The Colorado-Nevada Electric Power Company of Los Angeles, Cal., has been incorporated, with a capital stock of $10,000,000. The company will manufacture and transmit electricity for the use of railroads, quarries, municipalities and consumers in general. The directors are: Rea E. Maynard of Los Angeles, F. G. Baum of Berkeley, F. V. Keesling, C. R. Lewis and O. K. Grau.

Moderate gains in gross and net earnings have recently been recorded by the Hudson River Electric Power Company for the fiscal year ended January 31, 1907. Gross earnings for the twelve months aggregate $917,684, compared with $754,642 in the previous year. The company was incorporated in New York state three years ago. It supplies power to Albany, Troy, Schenectady and many other points in that part of the state. It has a contract with the New York Central Railroad Company through the Utica and Mohawk Valley Railway Company to furnish the latter with 5,000 to 20,000 horsepower, which will be increased as additional power is required. The company has an authorized capital of $5,000,000.

Negotiations, it is said, are in progress in Denver, Colo., looking to the consolidation of the Central Colorado Power Company, capitalized at $22,000,000, and the Northern Colorado Power Company, capitalized at $10,000,000. The plans are being carried forward by Myron T. Herrick, former governor of Ohio; Thomas F. Walsh, Simon Guggenheim and others interested in the two companies. Should a consolidation be effected the big company will be capitalized at $50,000,000 and will supply electric light and power to almost three-fourths of the state of Colorado. The Central Colorado Power Company, which was organized last November, will immediately place $9,000,000 in Colorado for the purpose of carrying out some of its plans. Power stations will be constructed in Gore Canyon, Glenwood Springs and on the Gunnison River.

PUBLICATIONS.

The Lane & Bodley Company, Cincinnati, Ohio, has issued bulletin No. 101, which deals with the four-valve shaft governor engine. A table is given which shows the speed and power developed by various sized engines of the type described.

Some facts about the Crouse-Hinds harpoon guy anchor and a couple of pictures showing interesting installations are contained in a flyer published by the Crouse-Hinds Company of New York. This anchor is efficient in service and easy to install. It can be driven in any kind of wet, dry or frozen soil.

A well-illustrated circular from the Charles J. Jager Company of Boston is devoted to the Jager marine type of direct-connected electric generating sets for gas, gasoline or alcohol, in sizes from three to 60 horsepower. The circular is on a timely subject and contans valuable information on residence, marine and isolated-plant lighting, water supply, battery charging and various power installations.

The Allis-Chalmers new type K direct-current motor has been especially designed to meet the mechanical and electrical requirements occasioned by the growing demand for direct-current motors that can be applied to the individual drive of machinery of various kinds. A little flyer, No. 4002, has just been issued by the company and gives a thorough description of construction of this machine, also noting the various applications to which it is adapted.

SOCIETIES AND SCHOOLS.

The next meeting of the Chicago Jovian Club, composed of members of the Rejuvenated Sons of Jove, will be held on March 18th at the assembly room of the Chicago Edison Company, 139 Adams Street, beginning at 8:30 p. m. A. D. Blocker of 139 Adams Street is secretary of the club.

The trustees and faculty of Thomas S. Clarkson Memorial School of Technology are preparing for the eleventh anniversary of the granting of the charter by the University of the State of New York. Commemorative exercises will be held on the eve of Charter Day in the chapel hall of the school at eight o'clock on March 18th. The address will be delivered by Frederick Remsen Hutton, professor of mechanical engineering, Columbia University, and president American Society of Mechanical Engineers.

The Oklahoma Electric Light, Railway and Gas Association will hold its first convention in Oklahoma City on April 22d and 23d. Charles W. Ford of Oklahoma City is secretary of the association.

The next meeting of the Iowa Electrical Association will be held in Clinton, Iowa, at the Lafayette Inn, on April 18th and 19th. President A. W. Zahm says that a very good programme has been prepared. The forthcoming meeting bids fair to be one of the most largely attended and successful meetings that the association has ever had. Prof. L. B. Spinney of Ames, Iowa, is secretary.

F. L. Gilman of the Western Electric Company, New York, G. A. Moyer, with the General Electric Company, and H. M. Hale, with the New York Rapid Transit Commission, were speakers at the Harvard Engineering Society's ninth annual dinner at the Harvard Union, Cambridge, Mass., March 2d. They are all graduates of Harvard—Mr. Gilman in 1895, Mr. Moyer in 1899, and Mr. Hale in 1904.

Thirty-three members of the Massachusetts Institute of Technology class of 1905, held their winter reunion and dinner at the Hotel Bellevue, Boston, recently. These 33 men are receiving salaries aggregating $3,276 a month, an average of nearly $100 each. One is receiving $200 a month and six are receiving $125 a month or more. H. A. Wentworth was toastmaster and G. B. Perkins gave an address on the Boston Club of the class.

Formal dedication of the new Engineering Societies' Building, in New York city, will be marked by appropriate ceremonies, extending through four days—April 16th to 19th, inclusive. All the details of the programme have not been completed, but a preliminary outline has been made. The formal dedication exercises will be held on the afternoon of April 16th. In the evening a general reception will be held. Founder's Day, April 17th, will be devoted in part to addresses by representatives of the founder societies and institutions, greetings from sister societies and institutions, presentation of medals, etc. Professional sessions of the founder societies will be held on the third day, April 18th. On April 19th the afternoon will be devoted to sessions of engineering societies, and in the evening there will be an informal smoker for all societies.

MISCELLANEOUS.

Electricity will be used to run a cotton mill to be constructed by W. I. Gray at Woodruff, S. C. A hydro-electric plant will be erected there.

The Lexington (Ky.) Railway Company recently lost its best patron in the person of Mrs. Susan T. Allen, a wealthy woman, who died at Lexington at the age of 80 years. Mrs. Allen was a believer in frequent street-railway rides as a cure for rheumatism. During the last 15 years, it is said, she spent four hours each day riding about the city, and it is estimated that during those years she traveled 75,000 miles.

The first carload of Oregon cobalt ore has been shipped to Thomas A. Edison's eastern laboratory from the Standard Consolidated Mine in the Martzburg District, Grant County, Ore. It is announced that arrangements have been made to ship two cars of this ore a month to the Edison workshops, where the cobalt will be used in the manufacture of storage batteries. A 100-ton mill will be operated at the mine on ore that carries gold, cobalt and copper.

The Central Railway of Georgia will substitute electricity for steam in its shops at Savannah. Every lathe and individual machine will be equipped with a motor so that the cost of operation will be reduced to a minimum. The plant will be able to develop something like 2,000 horsepower, and when completed, which will be in the course of a few months, it will be capable of not only furnishing all the power needed for driving the machinery of the several plants of the company at Savannah, but may also be used to furnish lighting power for the company in its offices, yards, etc. It is estimated that the expenditures will amount to $150,000.

TRADE NEWS.

The Davis Electric Company of St. Louis, Mo., has sold its plant in that city to the Menominee (Mich.) Electric Manufacturing Company. The plant and machinery will be moved to Menominee in April.

The John O. Stivers Electric Company of Denver, Colo., has been incorporated with a capital stock of $100,000.

The Davies Electric Corporation of Tacoma, Wash., has been incorporated for $150,000 by M. C. Davies and others.

The Craig Electric Company of Pittsburg, Pa., has been incorporated for $10,000. The directors are G. L. Craig, Allegheny; R. N. Young and M. H. Murphy of Pittsburg.

C. B. Smith, engineer in charge of the work in connection with the construction of the $3,500,000 power plant to be built by the city of Winnipeg, Man., Canada, at Lac du Bois, has received instruction to call for tenders on April 1st for all the necessary work and machinery. It is expected the majority of the tenders will be open for at least six weeks in order that European firms may bid.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until three o'clock p. m. April 4th, for the installation of a conduit and wiring system in the enlargement of the courthouse, post-office, etc., at Macon, Ga., in accordance with drawings and specifications, copies of which may be had at the above office, or at the office of the superintendent of construction, Macon.

A Schenectady dispatch to the New York Times, dated March 10th, says: "The General Electric Company has purchased 700 acres of land at Erie, Pa., and will build a large plant at that place. The site extends from the Lake Shore Railroad to the lake front. It is the intention of the company to use 400 acres for the erection of comfortable homes for its employes. Employment will be given to between 4,000 and 5,000 men. The new plant will not interfere in any way with those already established, having been made necessary by the increase in the company's business."

The Detroit Times of March 2d says that capitalists interested in the Home Telephone Company of Detroit, Mich., and the newly formed Interstate Long-distance Telephone Company of Michigan have taken large holdings in the Dean Electric Company of Elyria, Ohio, a large manufacturer of telephones and telephone supplies. To quote from the Times: "The purchase of the Dean plant places the Independent telephone interests in direct touch with an inexhaustible supply of material needed in construction work and a modern manufacturing plant, presided over by one of the most able telephone construction engineers in the world."

Importations of manufacturers' materials continue to increase. In the seven months ended with January, 1907, raw materials for use in manufactures were imported to the value of $262,000,000, against $223,000,000 in the same months of last year, while manufactures for further use in manufacturing imported amounted to $158,000,000, against $123,000,000 in the corresponding period of last year. More than one-half of the importations at the present time is for use in manufacturing, crude materials forming 32.3 per cent. of the total imports, and manufactures for further use in manufacturing, 19.5 per cent.

BUSINESS.

The Buckeye Electric Company of Cleveland says that where you have need for a larger unit than an ordinary incandescent lamp, and don't want to go to the expense of purchasing an arc lamp or other special high-priced devices, the Gem units are just the thing. The company has a special descriptive pamphlet entitled "Gem H. E. Bulletin." The Gem Focul lamp is a lamp built on the same principles, but in shape it is spherical. It has a round bulb and comes in 40 or 80 candlepower. The "Gem Focul Bulletin" is free for the asking.

The Hartford Steam Boiler Inspection and Insurance Company at the close of business on October 6, 1906, rounded out and completed a record extending over a period of 40 years. The Hartford was the first company to organize in America for the sole purpose of safeguarding and making practicable the general use of steam for power purposes; and for the scientific construction, installation and maintenance of steam power plants; and today, after a lapse of 40 years, it is probably the only company which makes a specialty of and does exclusively a steam-boiler inspection and insurance business.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 5, 1907.

845,740. Commutator Brush for Dynamo-electric Machines. Robert N. Baylis, Englewood, N. J. Application filed April 10, 1905.

The brush has a hole extending into it, a flexible conductor of braided wire having a continuous tubular end arranged to be inserted within the hole, and a pin-like expander or spreader arranged to be inserted into the tubular portion to expand the same and force it into intimate and uniform contact against the wall of the hole and entirely around the expander.

845,754. Lamp Socket. Charles A. Chase, Chicago, Ill. Application filed December 29, 1906.

A supporting body has a perforation, in combination with a lamp receptacle, comprising a back section of insulating material lying wholly on one side of the supporting body and against it.

845,765. Automatic Mail and Parcel-delivery Apparatus. Zadoc P. Dederick, Sherman, Texas. Application filed December 6, 1906.

An electric motor is located centrally within the car, which is provided with deeply grooved wheels, a sprocket pinion being secured to the motor shaft. The car travels on overhead wires, suitable brackets being provided for the support of the wires and secured to pipe posts firmly embedded in the ground.

845,796. Multiplex Telephony. Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa. Application filed March 3, 1904.

In a telephone system there are a metallic circuit, a differential or neutral coil having its windings included therein, an auxiliary coil possessing considerable self-inductance connected to the first or neutral coil, and means for arbitrarily determining the coefficient of self-induction of the auxiliary coil at will.

845,831. Motor Controller. Thomas S. Watson, Milwaukee, Wis. Application filed July 12, 1906.

Combined with an electric motor are an automatic controller therefor for intermittently changing the direction of operation of the same, and a starting box for the motor operative independently of the reversing controller.

845,836. Electric Igniter. John D. Wilmot, Denver, Colo. Application filed August 29, 1906.

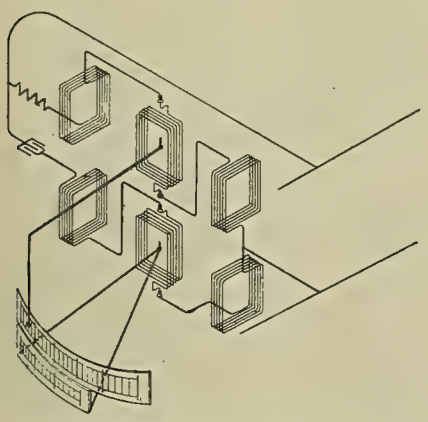
In the igniter described is a pair of crossed hand levers of non-conducting material pivotally connected intermediate their ends and formed at their short ends with opposite jaws upon which are coacting electrical contacts. Electric-circuit conductors are electrically connected to the contacts, the conductors being arranged upon the exterior of one of the levers.

845,848. Electrical Switch. Ernest W. Brackett, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed March 31, 1904.

A telephone hook-switch is described.

845,856. Method of and Apparatus for Braking Vehicles. George H. Condict, Plainfield, N. J. Application filed May 9, 1906.

The inventor describes the method of braking a vehicle driven by an electric motor, which consists in using the motor as a braking generator driven by the momentum of the vehicle, and maintaining in the motor during the braking operation a commutating field independent of the main field. The motor has a main field, a commutating field independent of the main field, and energizing coils for the fields, and a controller adapted to close the armature circuit of the motor through the energizing coils.



NO. 845 922.—FREQUENCY AND VOLT INDICATOR.

845,858. Combined Sounder and Resonator. Stewart F. Cox, Sallisaw, I. T. Application filed April 10, 1906.

The device comprises a resonator box provided with a partition, a bracket mounted upon the partition, a screw connected with the bracket and extending through the partition for the purpose of forming a limiting stop, an armature lever for striking the screw, and an electromagnet for actuating the armature lever.

845,875. Instrument for Surveying Bore Holes. Percy E. Lewis, Johannesburg, Transvaal, assignor of one-fourth to Luther Cyril Franck, Johannesburg, Transvaal. Application filed June 21, 1905.

In the instrument described are combined with the compass box and magnetic needle, a vertical ring encircling the box, and means operated by gaseous-fluid pressure for fixing the magnetic needle and compass box in the positions they assume at the point to be surveyed. An electromagnet actuates the valve which controls the admission of the fluid to the instrument. An electric cable is employed to pass a current of electricity through the electromagnet.

845,890. Electrically Driven Step-by-step Machine. Arthur F. Poole, Wheeling, W. Va. Application filed October 22, 1902.

The machine comprises an electromagnet, a neutral armature arranged to be actuated thereby, and a polarized armature within the field of force of the electromagnet.

845,894. Thermostat. Henry E. Reeve, New York, N. Y., assignor to the Automatic Fire Alarm Company, New York, N. Y. Application filed February 2, 1906.

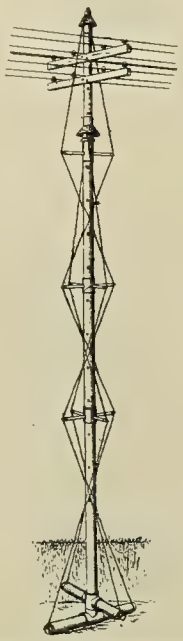
The device comprises a casing, an insulating disk centered and supported by the bottom of the casing, an automatic circuit-closing mechanism supported above the disk, terminal plates, electrical means of connection between the plates and the circuit-closing device, and insulating material for sealing in the terminal plates to prevent the entrance of moisture.

845,896. Speed-varying Mechanism. Gustaf T. Rennerfelt, Scranton, Pa., assignor to Walter H. Foster, New York, N. Y. Application filed June 8, 1905.

Combined are an electric motor, a number of primary gear ratios, a spindle, a direct-drive connection from the primary gearing to the spindle, and a magnetically controlled reduction gearing.

845,900. Trolley Wheel and Harp. Edward S. Roland, Cleveland, Ohio. Application filed October 19, 1905.

A trolley wheel has a central current-conducting member, separate side members between which the central member is mounted, separate bushings for the side members terminating at the central member, a current-conducting shaft having separate bearing rings within the bushings, and a harp adapted to support the shaft and wheel.



NO. 846,001.—METAL-TRUSS TELEGRAPH POLE.

845,904. Weft-replenishing Loom. Harry W. Smith, North Grafton, Mass., assignor to the Draper Company, Hopedale, Mass. Application filed September 12, 1901.

The device comprises two continually exposed metallic bodies covered by the feeder and the wall of the shuttle, one of the bodies being magnetic and the other magnetized.

845,922. Frequency and Volt Indicator. Joshua F. Begole, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed August 31, 1906.

In a frequency and voltmeter are combined with a pair of movable coils a pair of indicating devices co-operating to indicate frequency, one of the indicating devices being controlled by each coil, a stationary indicating device co-operating with one of the first-named indicating devices to indicate voltage, and means in series with one of the coils for varying the current with the frequency. (See cut.)

845,956. Frequency Indicator. Alexander S. Langsdorf, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed September 6, 1906.

In a frequency meter are combined with a pair of independently movable coils a pair of indicating devices co-operating to indicate the frequency, one of the devices being controlled by each coil, and means in series with one of the coils for varying the current with the frequency.

845,974. Outlet-box, Electric Conductor. Raymond S. Parsons, East Hampton, N. Y. Application filed November 12, 1906.

The box includes a casing provided with a number of openings, tubular wire-receiving members formed integral with the casing and extending inwardly from the latter at the openings, and means piercing the walls of the members and engaging the wires for locking the same against accidental displacement.

845,991. Alarm Signal. Robert J. Zorge, Chicago, Ill., assignor to the Zorge Safety Railway Equipment Company, Chicago, Ill. Application filed February 28, 1906.

Combined with a rotary torpedo carrier equipped with a ratchet wheel, are a striker equipped with a pawl, a magnet controlling the pawl, a main circuit controlling the magnet, an auxiliary magnet controlling the pawl, and an auxiliary circuit controlled by the first-named magnet.

845,995. Electrical Measuring Instrument. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed November 28, 1905.

Means are employed to pass an electric current through two spirals secured to a shaft mounted in the frame of the instrument.

845,996. Shunt for Electrical Measuring Instruments. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed December 9, 1905.

In the shunt described are a pair of overlapping shunt terminals composed of masses of conducting material, and a conducting plate of high-resistance material lying between and insulated from the overlapping portions of the terminals, and connected to the terminals.

845,997. Electrical Resistance. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed June 1, 1906.

An electrical resistance device comprises two massive terminals composed of blocks of metal of high specific conductivity located in close proximity, and a conductor of high specific resistance having its ends embedded into the blocks of metal respectively, to leave a short free length of metal between the terminals.

846,001. Metal Truss Telegraph Pole. Louis Blessing, Jackson, Mich. Application filed December 30, 1905.

This unusual pole is made of hollow metal pipe, with re-enforcing truss wires as shown. (See cut.)

846,068. Acousticon. Kelley M. Turner, New York, and Norton W. Johnston, Chappaqua, N. Y., assignors to the General Acoustic Company, a corporation of New York. Application filed August 25, 1905.

In a telephonic transmitting apparatus are a base or box adapted to contain an electric battery, a prismatic structure erected upon and supported by the base or box, the structure having an equilateral triangular form with three symmetrical faces, a transmitter inset into each of the faces, and electrical connections including the battery and the transmitters adapted to be connected to a suitable receiver.

846,081. Receiver. Louis W. Austin, Washington, D. C., assignor to the National Electric Signaling Company, Pittsburg, Pa. Application filed October 27, 1905.

In a system of signaling by electromagnetic waves, the receiver consists of a thermo couple having as its elements tellurium and silicon.

846,084. Electrical Measuring Instrument. Adelbert O. Benecke, Newark, N. J., assignor to the American Instrument Company, Newark, N. J. Application filed December 13, 1906.

In an electrical measuring instrument having a case and hinged cover, are combined means for first compelling the direction of the current through a high resistance and means rendered operative by opening the cover for thereafter changing the resistance by predetermined gradations to produce successively wider needle deflections of the instrument.

846,114. Electrical Winding. Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa. Application filed March 3, 1904. Renewed January 30, 1907.

A coil for electric transmission systems employing differential connections, has two windings upon a core, each winding being subdivided and the subdivisions of the opposite windings alternated in connection.

846,120. Electrical Switch. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed March 31, 1904. Renewed January 30, 1907.

In a telephone hook-switch, combined with a base and contacts mounted thereon, are an operating lever pivoted to the base and controlling the contacts, and an actuating lever slipped into engagement with the operating lever and readily removable therefrom.

846,144. Pole-distribution Rack for Telephone Systems. William Robinson, Muskegon, Mich., assignor to the W. G. Nagel Electric Company, Toledo, Ohio. Application filed May 3, 1906.

A wire-distribution bracket comprises spaced securing parts and means for connecting the same.

846,158. Socket Bushing or Fitting for Electrical Purposes. William B. Stewart, Philadelphia, Pa. Application filed August 9, 1906.

The device has a socket with a screw-threaded neck thereon and a bushing or fitting adapted to be screwed into the socket and tightened therein and formed of sections, each provided with a single partly oblong recess therethrough, the recesses, when the sections are together, forming a completely oblong recess adapted to receive a number of wires or conductors and clamp the same side by side against each other.

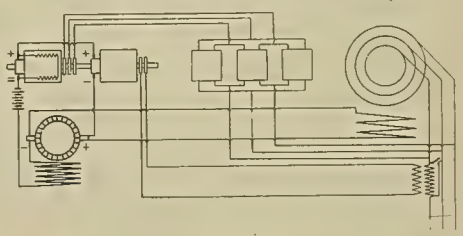
846,185. Electrical Indicating Device. Charles Crandall, Newport, R. I. Application filed June 2, 1906.

In a signal system there are a main-current wire extending the entire length of the road or section, a main battery, insulated rail sections placed in staggered relation to each other, a relay, one terminal of the main battery being connected with the coil of the relay, the other terminal of the battery being connected to the main-circuit wire and to one section of the rail sections.

846,205. Trolley Harp. Charles Hibbard and Warren Hibbard, Sandy Hill, N. Y., assignors to the Glens Falls Improved Trolley Fork Company, Glens Falls, N. Y. Application filed February 28, 1906.

Details are described.

846,214. Voltage Regulator for Alternating-current Generators. Frederick R. Keller, Lancaster, Pa. Application filed October 22, 1906.



NO. 846,214.—VOLTAGE REGULATOR FOR ALTERNATING-CURRENT GENERATORS.

Combined with an alternating-current generator and its exciter are two rotaries having their alternating-current ends supplied from the generator, the direct-current ends of the rotaries being connected in series with the field winding of the exciter, the rotor of one of the two rotaries being driven from the rotor of the other rotary. (See cut.)

846,223. Means for Maintaining Constant the Voltage of an Electric Circuit. Thomas Marshall, Chicago, Ill. Application filed January 10, 1907.

In a system for maintaining a constant voltage in an electric circuit are combined a variable-voltage circuit, a generator having a field connected across the variable-voltage circuit, a constant-voltage circuit connected with the generator and the variable-voltage circuit, and an unvarying field opposing or neutralizing the first field.

846,227. Electric Motor. David Mendelson, Brooklyn, N. Y. Application filed January 25, 1907.

The motor comprises a vibrating armature, a fixed electromagnet, a circuit-closing switch operated by the oscillations of the armature and means for holding the circuit-closing switch closed when the motor is at rest to enable it to be self-starting.

846,276. Electric Signal Control. Mathew Abt, New York, N. Y. Application filed March 26, 1906.

Combined are a number of contacts normally closed, electric lamps mounted upon different floors and connected with the contacts respectively, mechanism controllable by movements of a revoluble member for opening the contacts successively, so as to darken the lamps in a predetermined relative order corresponding to that of the successive floors, and mechanism for opening a number of lamp circuits while the elevator is traveling in a particular direction.

846,286. Game Device. Howard D. Darlington, Norwood, Ohio. Application filed March 28, 1906.

A game device has contact points at the counting sections on the game-board. There is a source of electrical supply in circuit with the contact points and an alarm device in the circuit.

846,296. Speedometer. Adalbert Fleischmann, Frankfort-on-the-Main, Germany, assignor to the firm of Volt-Ampére-Gesellschaft, Fleischmann & Co., Frankfort-on-the-Main, Germany. Application filed May 11, 1906.

The instrument comprises a stationary, permanent magnet, a rotary plate adjacent to the magnet, one or more armature pieces on the plate, a non-magnetic metal disk interposed between the magnet and the armature, the latter projecting beyond the disk, so as to be entirely enclosed by the magnetic lines of force, a spring having a tendency to turn the element in the opposite direction to the action of the eddy currents induced by the rotation of the armature, and an indicator for indicating the deflection of the disk from its normal position.

846,326. Railway-gate-operating Mechanism. Milton H. Loudon, Kansas City, Mo. Application filed July 3, 1905.

In combination with a pivoted gate mounted on a pivot shaft are an electric motor, power-transmitting means between the motor and the gate, the power-transmitting means including friction gear to permit running of the motor after the gate has been moved from one position to the other.

846,327. Calling Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Application filed June 13, 1904.

Including with a contact-closing device are a battery and a normally open connection between the battery and the contact-closing device, a receiver hook arranged to operate the contact-closing device during its descending movement, and a key arranged to close the connection between the battery and the contact-closing device when the hook is in an elevated position.

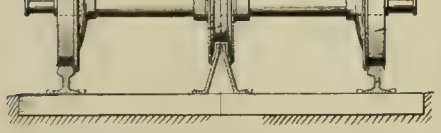
846,328. Registering Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Application filed October 20, 1904.

Combined with the local stations and the electrically operated switching mechanisms of an automatic telephone exchange are a registering device at each local station, and means by which the registering device of a calling station is operated by a response being received from a called station.

846,336. Automatic Fire-signal System. Robert L. McElroy, John E. Shepherd and James G. Nolen, Chicago, Ill., assignors to the Automatic Fire Protection Company, a corporation of Maine. Application filed December 12, 1903. Renewed July 23, 1906.

In the signal system described, in combination with circuits to be supervised comprising two wires, are signal-transmitting means for indicating a break in either wire, other signal-transmitting means for indicating a break in both wires, signal-responsive devices, and suitable circuit connections between the signal-responsive devices and the break-indicating means.

846,339. Safety Third Rail for Railway Tracks. John McRaven, Little Rock, Ark. Application filed February 27, 1906.



NO. 846,339.—THIRD-RAIL CONTACT DEVICE.

An A-shaped third rail is placed between the usual track rails of a railway track, and a grooved wheel is loosely mounted upon the car axle, the grooved wheel extending downwardly over the top of the A-shaped rail. (See cut.)

846,340. Electric Switch Mechanism. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 4, 1902.

A main circuit has terminals comprising parts of the core of a solenoid, the solenoid around the terminals being attached to the main circuit and being in series with a pilot circuit, the latter circuit having a higher resistance coil provided with a shunt. A switch opens and closes the shunt circuit. (See cut.)

846,354. Curling Iron. George F. Shields, Kern, Cal. Application filed August 19, 1905.

Details of an electric curling iron are described.

846,359. Display Rack. Frank P. Sparmaker and John L. Henry, Philadelphia, Pa., Sparmaker being assignor to Henry. Application filed October 26, 1905.

Incandescent electric lamps are placed upon a mirror frame, and electrical conductors are arranged within pipes and leading to and from the lamps. There are means for alternately breaking and making the circuit of the lamps upon the frame.

846,365. Automatic Trolley Retriever. Robert J. Walker, Anderson, Ind. Application filed January 13, 1906.

A device for retrieving the trolley pole of an electric car is described.

846,368. Telephone Signaling Device. Klas Weman, Buffalo, N. Y. Application filed January 23, 1906.

Combined are electromagnets, a yoke arranged thereover, a bridge depending from the yoke, an adjusting screw passing through the yoke and being adapted to raise and lower the bridge, an armature pivotally retained in the bridge, and means for preventing displacement of the armature consisting of a curved spring held against lateral and rotatory movement.

846,378. Wire-retrieving Attachment for Trolley Wheels. William C. Althen, Columbus, Ohio, assignor of one-half to others. Application filed April 2, 1906.

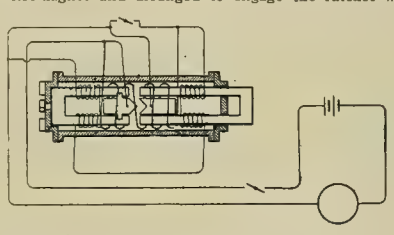
A yoke having a V-shaped wire-guiding portion is pivotally mounted upon the rear side of the trolley pole.

846,381. Telephone Exchange. Clarence A. Anderson, Salina, Kan., assignor of one-half to John Anderson, Salina, Kan. Application filed January 3, 1905.

In a party-line exchange are combined with a battery by means of which the party line is operated so as to establish telephonic connections between stations, a line-drop for indicating calls on the line, and means by which an operation of the drop will disconnect the battery from the line.

846,382. Switching Mechanism. Clarence A. Anderson, Salina, Kan., assignor of one-half to John Anderson, Salina, Kan. Application filed January 29, 1906.

The mechanism comprises a permanent magnet in the form of an inverted U, an electromagnet having its upper end supported by a pivot, the pivot being connected to and supported by the central part of the permanent magnet and the electromagnet having its lower end adjacent to and between the poles of the permanent magnet, springs for normally holding the lower end of the electromagnet midway between the poles of the permanent magnet, a bracket secured to the lower end of the permanent magnet, a ratchet wheel supported on the bracket, and a pawl secured to the lower end of the electromagnet and arranged to engage the ratchet wheel.



NO. 846,340.—ELECTRIC SWITCH MECHANISM.

846,394. Telephone System. Charles G. Burke and Edward J. Burke, Brooklyn, N. Y., assignors of one-half to John Q. A. Whittemore, Boston, Mass. Application filed October 14, 1905.

The system described comprises an annunciator, switches for controlling the annunciator, means for causing the annunciator to be actuated in one way when one of two connected subscribers desires to be disconnected, and to be actuated in another way when the other connected subscriber desires to be disconnected.

846,400. Clamp for Ground-wire Electrical Connections. Warren R. Cox, Cleveland, Ohio, assignor to George R. Blackburn, Cleveland, Ohio. Application filed February 19, 1906.

The clamp has one end bent to a V shape with a flat portion between the sides of the bend and a screw through the flat portion with a wire-engaging nut in it. One end of the clamp has a series of holes, the other end having a catch adapted to engage in one or another of the holes.

846,404. Electric Fuse. Louis W. Downes, Providence, R. I. Application filed December 8, 1903.

The fuse comprises a fuse link, a shell, a cap closing an open end thereof and having an opening therethrough, a plate secured to the cap and having an opening therethrough in alinement with the opening in the cap and a flange on the plate around the opening therein, a terminal electrically connected with the fuse link and projecting through openings in and beyond the cap and flanged plate to constitute a fuse terminal, the flange fitting closely about the terminal and rigidly connecting it with the cap.

846,413. Telephone System. Isidor Kitsee, Philadelphia, Pa. Application filed April 8, 1904.

In combination with a telephonic circuit centering in an exchange are a source of current for the circuit, a repeater for the circuit, the repeater provided with two armatures, a second circuit, and a source of current for the second circuit, the second circuit normally open, but adapted to be closed through the energizing of the core of the repeater, an annunciator for the second circuit, adapted to be made active through the closing of the circuit.

846,414. Receiving Device for Electric Transmission. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed April 10, 1905.

In combination with means to receive electric impulses are a receiving device operatively connected with a source of alternating or interrupted current in a manner so as to nullify the effect of the impulses, a source of direct current, means to nullify the effect of the direct source on the receiver, and means to disturb the nullifying effect in accordance with the incoming impulses.

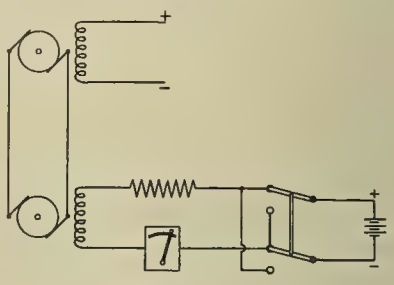
846,415. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed February 26, 1906.

In a telegraphic transmitting device ar two localized circuits, one of the localized circuits adapted to be opened and closed through the key-switch and the second of the localized circuits adapted to be opened and closed through the key lever.

846,416. Telegraphic Receiving Device. Isidor Kitsee, Philadelphia, Pa. Application filed September 6, 1906.

In combination with a receiving device are two conductors related to the movable part of the receiving device, liquid contacts and a local circuit for each of the conductors, a translating device common to both of the local circuits, the device being adapted to be operated through the movement of one or the other of the conductors.

846,422. Dynamo-electric Machine. Ernst Oelschläger, Charlottenburg, Germany, assignor to Siemens-Schuckert Werke, Gesellschaft mit Beschränkter Haftung, Berlin, Germany. Application filed December 10, 1904.



NO. 846,422.—DYNAMO-ELECTRIC MACHINE.

In a motor starter, combined with a motor having a generator in series with it, are a fixed resistance of small inductance in series with the generator field, means for supplying current to the field, and means for causing the tension of the current to be sufficiently in excess of the tension for which the generator field is wound to compensate for the loss of tension in the fixed resistance. (See cut.)

846,427. Alternating-current Machine with Commutators and with Compensating Windings. Rudolf Richter, Charlottenburg, Germany, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Application filed August 28, 1906.

The machine described comprises an armature winding, a compensation winding connected in series thereto, a field-magnet winding connected to the compensation winding, means connected electrically directly with the compensation winding adapted to produce a difference of potential between one part of the compensation winding and another part of the same whereby an auxiliary field is produced.

846,439. Motor. Herbert S. Mills, Chicago, Ill. Original application filed February 27, 1905. Divided and this application filed November 4, 1905.

Combined with a spring motor are an electric winding motor having a circuit and circuit-controlling means operated by the power of the spring motor.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 11, 1907:

422,910. System of Arc and Incandescent Electric Lighting. H. P. Brown, Chicago, Ill.
422,911. Electromotor. H. R. Butterfield, Waterville, Me.
422,925. Zinc Electrode for Galvanic Batteries. G. D'Infreville, New York, N. Y.
422,956. Electric Valve Controller. E. R. Malmborg, St. Louis, Mo.
422,968. Electrically Controlled Elevator. W. J. Paine, Boston, Mass.
422,975. Coupling Electric Motors. E. W. Rice, Jr., Lynn, Mass.
422,981. Automatic Electrical Annunciator. B. F. Shafer, New York, N. Y.
422,999. Field Magnet for Dynamos. E. Thomson and A. L. Rohrer, Lynn, Mass.
423,004. Overhead Electric System. W. Vogler, Somerville, Mass.
423,005. Trolley-wire Supporting Apparatus. W. Vogler, Somerville, Mass.
423,014. Casing for Electric or Other Apparatus. L. S. Woodbury, Calumet, Mich.
423,026. Armature. R. L. Cohen, Camden, N. J.
423,029. Regulation of Alternate-current Generators. S. C. C. Currie, Philadelphia, Pa.
423,134. Laying Electric Conductors. T. J. Cope, Philadelphia, Pa.
423,210. Electric Meter for Alternating Currents. O. T. Blathy, Budapest, Austria-Hungary.
423,223. Electric Heating Apparatus. M. W. Dewey, Syracuse, N. Y.
423,229. Telegraphic Repeater. S. S. Emery, Newton Center, Mass.
423,245. Electric Shaft Controller. A. W. Hart, Boston, Mass.
423,324. Secondary Battery. William A. Johnson and J. N. Smith, Toronto, Ontario, Canada.
423,335. Dry Galvanic Battery. L. Moorthamers, Brussels, Belgium.
423,361. Coin-operated Electric Apparatus. J. S. Wallace, Belfast, Ireland.
423,391. Trolley for Overhead Electric Railways. F. B. Rae, Detroit, Mich.
423,400. Electric Motor Car. D. C. Voss, Medford, Mass.

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Electricity for the Butcher, the Baker and the Brewer.

By Dr. Alfred Gradenwitz.

The advances recently made by the German brewing trade are mainly due to the improved methods adopted by it in the course of the last few years. When comparing the simple means at the disposal of brewers in the not remote past with the technical improvements of an up-to-date brewery, the influence exerted by the adoption of mechanical operation on the efficiency of working methods, and accordingly on the output, will be readily appreciated.

Manual work has been replaced everywhere by mechanical operation, and wherever heavy gearings were formerly moved by animal power this work is now dealt with with extreme ease by rapidly rotating motors. Moreover, the capacity of power production has been increased and the quality of the product improved by the more accurate mechanical work, while the extensive subdivision of work and saving of manual labor render the whole service more economical.

Since the adoption of electricity in the brewery trade methods have been further simplified, while the economical and productive arrangement of the service has been developed to a considerable extent. The ease and cheapness with which any existing steam-engine plant in most breweries can be adapted to the generation of electric current facilitated the adoption of electricity in the beginning for lighting, and subsequently for power purposes.

Owing to their admirable adaptability to the most varied requirements, electric motors were found extremely convenient for operating the working machines used in breweries. These machines are preferentially arranged for individual operation, thus doing away with practically any transmission belts and ropes (which take away light and air), as well as with transmission pits and the danger inherent thereto, while the working machines, independently of the drive, can be installed as is convenient. The consumption of power and oil and the wear and tear of the continually running transmission belts in connection with machines used only at intervals are done away with, electric motors using only as much power as required for the duty in question.

Figs. 2 and 3 represent some typical instances of electric operation in connection with brewing machinery from photographs courteously supplied by the Siemens-Schuckert Works of Berlin. The possibilities of electric motors in breweries may be said to be so many as to require far more space than is within the compass of a short article like this.

Some especially interesting uses should, however, be mentioned, such, for instance, as the barrel-tightening machine represented in Fig. 3. It may be said that the construction of many machines could not have been possible before the adoption of electricity. Pumps, centrifugal machines, fans blowers, shaking machines, etc., are operated by electric motors with most advantageous results.

In those works which, like baker's, confectioner's or butcher's shops, are engaged in the manufacture of food products, the beneficial effects of the use of electric motors are bound to make themselves felt to the same extent as in large workshops. The ease and simplicity of motor operation, its economical working and low requirements in regard to space and superintendence greatly contribute to increasing the output and efficiency of the works.

In bakeries the electric motor is mainly used for the driving of kneading machines. The work which previously was done laboriously by workmen's hands is now performed in a far shorter time by mechanical contrivances, thus saving much energy while obtaining a far better and more uniform product than in the case of hand operation.

Fig. 5 shows a kneading machine driven by an electric motor. The details of the arrangement will be readily understood. Rough-grinding mills (one is shown in Fig. 1) and cleaning machines as frequently used in bakeries are likewise advantageously operated by electric motors.

In butcher shops many machines, such as sausage-filling, chopping and mixing machines, are operated by the motors. As in the case of bakeries, the heavy work is here performed by mechanical devices, the accurate agreement between the consumption of energy and the output greatly improving the efficiency of the process.

A special advantage in connection with the above trades is the fact that electric motors do not require fuels, as ill-smelling oils or substances like petroleum, etc. They accordingly can be installed anywhere without any danger for the good quality of the product.

Figs. 4 and 6 represent some electric drives of working machines installed in butchers' shops, demonstrating the advantage of installing the motors, according to actual room conditions, either on the floor or on brackets.

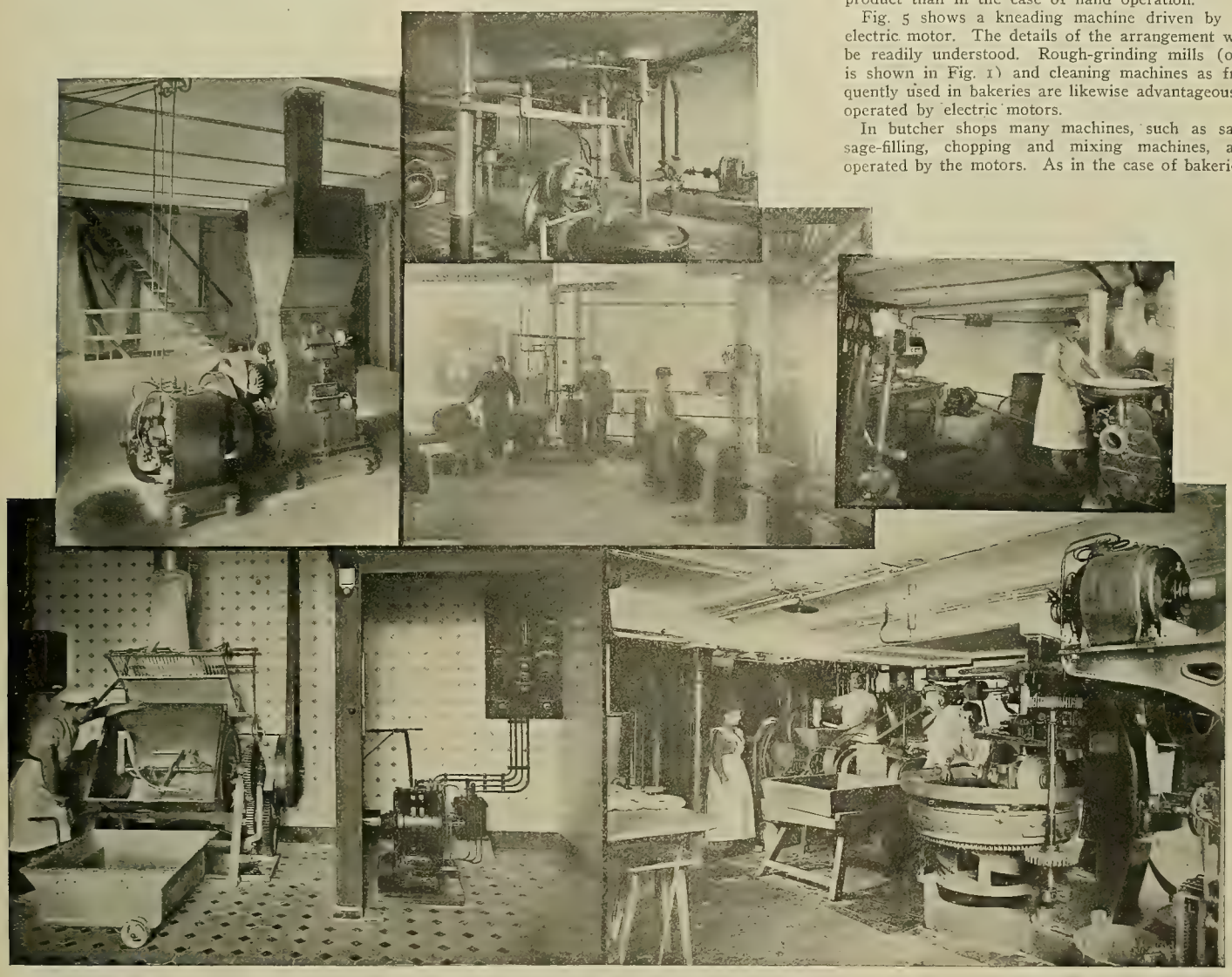


Fig. 1. Rough-grinding Mill Motor-driven. Fig. 2. Electrically Operated Brewing Machine. Fig. 4. Electrically Driven Butcher's Machine.
Fig. 5. Kneading Machine Electrically Driven. Fig 3. Electric Power for Tightening Beer Kegs. Fig. 6. Electrical Operation of Butcher-shop Machinery.
ELECTRICITY FOR THE BUTCHER, THE BAKER AND THE BREWER.

The Colorado Springs (Colo.) Electric Company has opened a school for the education of the people on the subject of electric lighting. The school will teach the cost of lighting, the way a plant is run and other facts about lighting. Householders are to be invited to ask questions and to make any investigations they wish.

Remedies for Electrolytic Corrosion from Escaping Current in Providence, R. I.

The official report of Mr. A. A. Knudson of New York, the expert on electrolysis, who recently made a thorough examination of the electrical conditions prevailing in the city of Providence, R. I., is very full and complete and contains a large amount of valuable information.

The overhead-trolley railway system of this part of Rhode Island is fed by a large power house in the city of Providence which sends out a current to all the various lines in town besides feeding sub-stations in other cities and towns. The power is supposed to return to its station by the track rail and auxiliary feeders. However, the rail return is never so complete that some current does not leave it and pass through the soil into underground water mains or other buried metallic structures. Just here is where the difficulty occurs.

FIG. 1 WATER METER IN PROVIDENCE DAMAGED BY ELECTROLYTIC CORROSION.

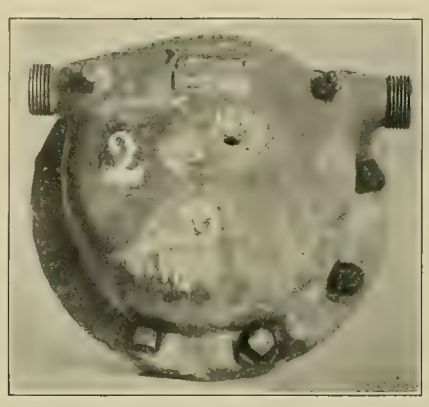


FIG. 2. WATER METER IN PROVIDENCE DAMAGED BY ELECTROLYTIC CORROSION.

FIG. 3 LEAD WATER PIPE IN PROVIDENCE DAMAGED BY ELECTROLYTIC CORROSION.

As a result of the jarring from the electric cars and other causes the bonding frequently becomes loosened, in which case serious trouble results. Passing along the mains the current may jump from one pipe to another, causing corrosion and leaks.

The tests were first made at several points on the east side of the Providence River. The examination revealed the fact that whereas in the past much damage had been caused to pipes by electrolysis, the present conditions were now practically normal, owing to a system of negative copper returns having been installed by the railway company.

Several water meters (see Figs. 1 and 2) and service pipes in different parts of the town had been damaged by electrolysis, caused by currents straying from the railroad track and passing to the ground through wet soil upon which the meters or pipes rested.

The method of remedy presented by Mr. Knudson is interesting. When all the data had been procured in the shape of tests and measurements they were submitted to the railway company, whose manager and superintendent at once took the matter up.

There were two large negative feeders on the poles, and from these two new tap connections were run down the poles to the tracks in the street. This had the effect of cutting down the potential difference, which was from 0.1 to 0.[illegible] volt between the meters and ground, about 50 per cent., with a similar result between the meters (or water pipes) to gas pipes, which were as high as from one to three volts.

It being apparent that nothing further could be done by the railway company in the way of further protection, it was recommended that a china plate be placed under the meters that rested upon wet soil. Of course porcelain or china is an excellent insulator, and the low cost being considered as well, it was thought that this was the best arrangement that could be suggested for the purpose.

Tests at a number of manholes and other places showed that the copper conductor by which all dead coverings of wires or cables were connected with the power-house negative for the purposes of protecting them from destruction by electrolysis was one of the direct causes of electrolysis upon the mains and service pipes, in that such connection makes the lead cable-sheath a part of the railway track return, so that any near-by pipes which are positively charged offer a convenient point for delivery for any current which may be flowing through them.

This phase of electrolytic action is illustrated by Fig. 3, which is a photographic reproduction of a piece of lead service pipe, 27 feet long, destroyed by electrolysis caused by its being near a telephone conduit. The greatest harm, however, is usually done by the large water mains and gas pipes. Conferring with the railway company on this point the suggestion was made that the water main in the street be bonded to the same negative conductor as the cable sheaths were.

It was decided to ascertain what further amount of current would be invited upon the main if such bond were made. Tests were made with the following results: The flow of current upon the eight-inch main was found to be under normal conditions 4.5 amperes. When the main was connected through an ammeter to the negative conductor a flow of 150 amperes was found, which flow under peak loads would easily reach 200 amperes. Under these circumstances the idea of bonding was promptly abandoned.

Further tap connections are to be made by the railroad company from the negative to the cable sheaths at more remote points with a view of relieving the congested district where damage is being caused. Mr. Knudson also gives a number of other valuable suggestions looking to an appreciable betterment of the prevailing conditions in other parts of the city.

The Connecticut railroad commissioners have rendered an important decision regarding street-railway companies' responsibility for damage caused by electrolysis. The Consolidated Railway Company recently asked the commissioners' approval for some new construction in Norwich, Conn., whereupon the city officials requested the imposition of a condition that the company should reimburse the city for any injury to the city's water pipes caused by electrolysis. The commissioners decided that street-railway companies are responsible for such damage, the amount thereof to be determined by the courts. The result of the first case under this ruling will be interesting.

Central-station Activity in Los Angeles.

Electric light and power are in demand in Southern California. The Edison Electric Company of Los Angeles, Cal., has plans for the development of additional power for Los Angeles and surrounding territory. Its Kern River plant is nearing completion, and when it is in operation the company will have, approximately, 55,000 horsepower. Even this large amount will not be sufficient, it is said, because of the increased volume of business.

At a meeting of the stockholders of the company it was decided to add $1,200,000 to the capital stock, making the entire amount $11,200,000. This increase is necessary because of the volume of work which is being undertaken. The Kern River plant has been enlarged and the waterpower capacity increased 200 per cent. and the steam power 125 per cent.

Manager A. L. Selig says that the prospects for a steady improvement in business are very bright. The earnings of the company last year increased about $460,000, while the expenses increased $200,000. The electric-lighting business increased 27 per cent., the power business 45 per cent. and the fuel business 49 per cent. The company proposes to place on the market 12,000 shares of common stock at $75 a share. It is the intention of the board of directors to make the first payment of dividends on the capital stock on August 15, 1907. This will amount to about $1.25 per share. The preferred stock of the company is $4,000,000.

The Latest Hydro-electric Power House at Niagara Falls.

By Orrin E. Dunlap.

The Niagara Falls Hydraulic Power and Manufacturing Company is hurrying its No. 3 power station to completion. This new power house is located at the water's edge in the Niagara Gorge, a short distance downstream from the company's No. 2 station, so familiar to engineers who have visited Niagara Falls. The power house has a length of 500 feet, a width of 95 feet and it will be 40 feet high. It is built of concrete, with steel frame, and along the river front there will be a walk of ample dimensions. The building was designed by engineers of the company. An electric elevator will be operated from the south end of the station to the cliff top. Previous to the erection of the new station the company cleared off the debris slope of the river bank, and broke away the ragged portion of the cliff, leaving the power-house site and the high bank clean and beautiful. The clearing of the site was a great task, and was accomplished last year.

In this new station the Niagara Falls Hydraulic Power and Manufacturing Company will install 13 units of 10,000 horsepower each, and two exciter units of 1,000 horsepower each. The first of the giant turbines is being installed by the I. P. Morris Company of Philadelphia. These turbines will make 300 revolutions per minute. Five of the units will be devoted to the service of the Aluminum Company of America, formerly the Pittsburgh Reduction Company, which company will get 37,000 horsepower, making it possible always to have one of the 10,000-horsepower units in reserve.

A penstock will be provided for each turbine. The operating shafts will be horizontal and at right angles to the length of the power house, the station to be divided by a central wall, the turbines to be installed on one side and the generators on the other side. These units will be the largest operated on a horizontal shaft on the New York side of the river, and the largest machines ever installed by the Niagara Falls Hydraulic Power and Manufacturing Company. The Niagara Falls Power Company operates 10,000-horsepower units in its No. 2 station, but they are of the vertical-shaft type. The switchboard in the new station of the Niagara Falls Hydraulic Power and Manufacturing Company will be on a gallery parallel to the river and overlooking the entire station.

The minimum head of water used will be 200 feet.

It will be recalled that the original permit granted by Secretary Taft to the Niagara Falls Hydraulic Power and Manufacturing Company was for 4,000 cubic second-feet of water, but that later he granted an additional permit for 2,500 cubic second-feet. The first permit was for water to operate its original development, and the later permit made possible the construction and operation of this new power station.

Under the original conditions of the development of this company, the water of its surface canal emptied into a basin located 300 feet back from the edge of the high bank, and for the operation of its

No. 2 station connecting canals carried the water to a forebay along the edge of the bank to the rear of the No. 2 works of the Aluminum Company of America. In order to provide water for the operation of the turbines in this No. 3 station a canal extension has been made off from the north end of the basin. This extension is 200 feet long, from 50 to 70 feet wide, and will have a depth of water varying from 20 to 25 feet.

At the end of this new canal section a new forebay has been built along the edge of the bank. It is 500 feet long, 70 feet wide at the inlet, and 20 feet wide at the extreme north end, while it will have a depth of 25 feet of water. This work required a great deal of rock excavation. Running along the edge of the cliff, a concrete retaining wall has been built the entire length of the forebay. It is 30 feet high, 25 feet wide at the bottom, tapering to an average of 15 feet at the top. A concrete wall has also been built at the rear of the forebay, the thickness being from two to three feet, the bottom of the forebay having a concrete covering of similar thickness. The walls of the canal leading from the canal basin to the new forebay are also of concrete.

Every part of the new work impresses one as being remarkably substantial. At a distance of every 53 feet in the retaining wall of the forebay along the cliff there is a three-tooth expansion joint. The sides of the teeth or lugs batter one inch to the foot and are coated with asphalt and coal-tar preparation to make them waterproof. The object of this joint is to prevent the concrete mass cracking, by cracking it at predetermined points. It is thus evident that the wall can shrink and still be watertight.

In the retaining wall intakes for 15 penstocks have been placed, 13 of them to have a diameter of nine feet, and two a diameter of five feet, the larger ones being to supply the turbines in the main station, and the smaller ones for the exciter turbines. These penstocks are being built directly in the concrete retaining wall, with large bell mouths on the water side. Then come the nine-foot valves, and then the penstocks proper. The vent pipe at the top of the penstock is built directly into the concrete wall at the top, a ladder affording access to the rear of the valves when the water is out of the penstock. The valves of each penstock will be operated by an individual motor and mechanism directly from the power house. Each will have a 20-horsepower specially designed motor, and will be under control of the operators in the power house, the valves closing when required in about 30 seconds. These valves and mechanism were supplied by the Coffin Valve Company of Boston, Mass., while the penstocks are made and being installed by the Pennsylvania Steel Works of Newcastle, Pa., one penstock being nearly completed. The penstocks are erected in 30-foot sections. They have flexible flanges riveted to them to prevent water seeping through along the penstock from the forebay. These flanges are in the forebay wall. In case of injury to the main shut-off valves, the wall is designed so that two steel gates can be slipped in front of any of the bell mouths, and the main valve removed for adjustment or repairs.

The connecting canal from the old basin to the new forebay is so designed that the water has a uniform retardation from 4½ feet per second to two feet per second, thus bringing the velocity of the water down before entering the bell mouths. Should it become necessary at any time to remove the water from the forebay, inlet gates of a massive character have been provided. They are three in number, each 16 feet wide and 30 feet high or deep. They are operated by heavy gearing, driven by electric motors, and have been put in for safety, their location being between the basin and the forebay. A gate house with steel frame and expanded-metal covering has been erected over them.

The entrance to the forebay is protected by a stationary steel boom, its purpose being to deflect ice and floating debris over the ice-run gates built into the side of the waterway, and so designed as to lower and allow water to flow over the top, carrying off the ice, etc. These gates will be operated by motive power, and can be set instantly to any requirements of ice disposal and at the same time cause as little waste of water as is possible with the service performed. The gates are three in number, 12 feet deep and 16 feet wide. They are the largest of this kind of gate ever made, and were furnished by the McClintic-Marshall Construction Company of Pittsburg, Pa. The inlet gates were made by the Buffalo Structural Steel Company.

At the bottom of the ice-run gates an "O G" dam has been located. It is made of solid concrete, reinforced with steel and sheeted with steel plates on the outside, on top of which the ice strikes in falling over the gates. It is thus deflected into the ice run proper, which will carry it over the high bank and to the river below without the formation of spray, and the consequent building of ice mountains, which have been found to be objectionable and dangerous to the No. 2 station. At the north end of the forebay there is a lower gate, eight feet wide and 10 feet deep, for the disposal of grass or debris that comes from the racks, and for slushing any ice or material that may get into the forebay. Small cars will be operated on a track laid on top of the retaining wall. The gate house will have cranes running its full length.

In order to make the handling of the heavy pieces of machinery easy between the cars on which they reach the lands of the Niagara Falls Hydraulic Power and Manufacturing Company and the power house in the gorge nearly 200 feet below the top of the cliff, a steel crane runway has been built. It is 200 feet long and consists of two pair of cantilever trusses, on which is operated a traveling hoist capable of lifting 50 tons. It was built by the Buffalo Structural Steel Company, and overhangs the edge of the bank 40 feet.

STEEL CRANE TO BE USED IN INSTALLING MACHINERY IN NEW NIAGARA FALLS POWER HOUSE; ALSO VIEW OF FOREBAY.

Turbine No. 2 has been shipped, and the present hope is to have five of the big power producers in place in the station by May 1st, which is the date mutually agreed upon by the Niagara Falls Hydraulic Power and Manufacturing Company and the Aluminum Company of America as a suitable time to commence the delivery of the first of the 37,000 horsepower the latter company is to receive. In preparation for this power, the Aluminum Company of America is erecting a mammoth plant north of the forebay site. This plant will be known as No. 3 works of the Aluminum Company of America, and it will be the largest of its Niagara plants. One part of it will have a rolling mill, a new feature of the aluminum manufacture at Niagara, as in the past this work has been done in New Kensington, Pa. The steel work of the new aluminum works is now being erected, and it is apparent that it is to be a very high and large building.

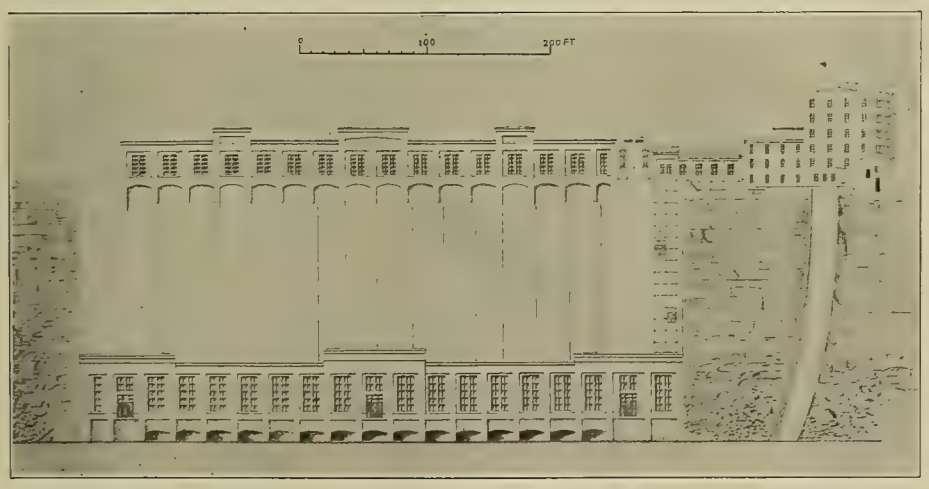
In addition to this, however, the Aluminum Company of America has leased the old Niagara Wood Pulp Company's site on the canal basin, and will there erect a temporary plant in which it will manufacture aluminum, having secured the 3,500 horsepower that formerly went to the Acker Process Company. This No. 4 works will be between the two big flour mills on the lands of the Niagara Falls Hydraulic Power and Manufacturing Company.

Last year the Niagara Falls Hydraulic Power and Manufacturing Company practically completed the widening of its waterway, so that it has ample water at its command. Some rock excavation still remains to be done. The work of constructing bridges over the canal at Third, Fourth and Erie streets will shortly be resumed and the work go forward with vigor under the influence of spring weather.

On Tuesday of last week Secretary Taft held a conference in New York city with E. L. L. Olmsted, Frank Millett and Charles McKim, the landscape architects, who will have charge of planning the improvement of the scenic beauty of the Niagara Gorge in the vicinity of the Falls and below the upper steel arch bridge. Niagara awaits the plans with much interest.

Chief Engineer John L. Harper is in charge of all the work of the Niagara Falls Hydraulic Power and Manufacturing Company.

It might properly be added that the penstocks extending from the power station to the forebay will be built into the concrete retaining wall or facing of the cliff, making an appearance of gigantic pilasters, an arched effect to be created as shown in the power-house elevation given herewith. This will give a handsome effect and make the scenic view from the Canadian side quite imposing. In every particular the Niagara Falls Hydraulic Power and Manufacturing Company makes an effort to have its power stations present a pleasing appearance.

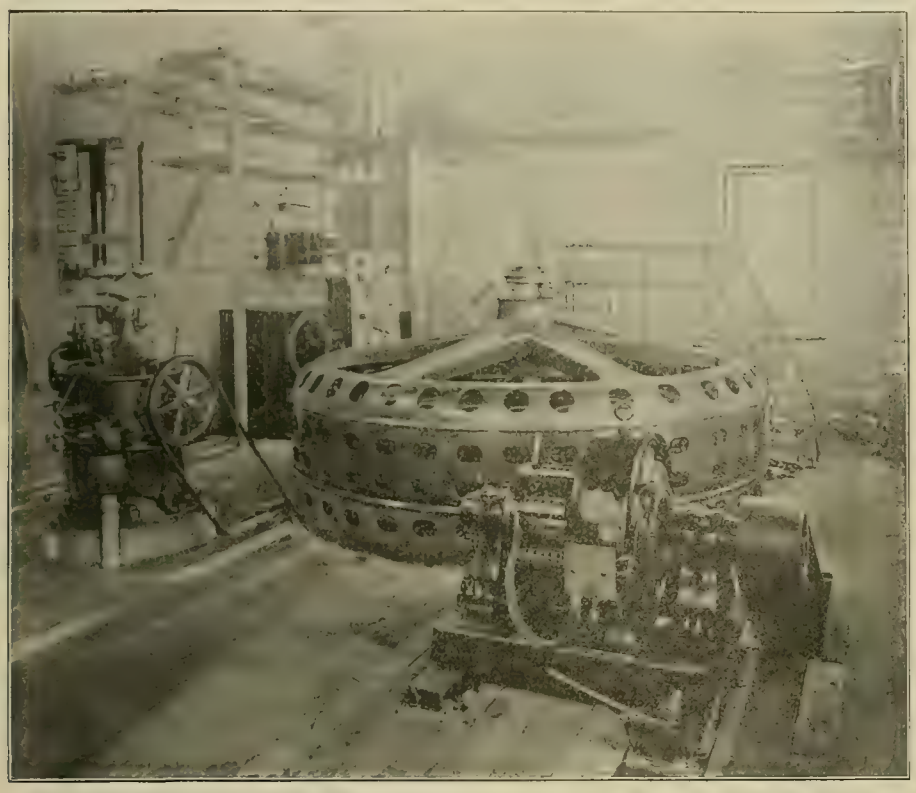


ELEVATION OF POWER HOUSE NO. 3 (NOW BUILDING) OF NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

Municipal Hydro-electric Plant at Nelson, B. C.

Nelson is a city of 6,000 inhabitants in British Columbia which has a municipal electric-light and power plant operated by waterpower. Power is obtained from the Kootenay River. Just across the river is the large hydro-electric plant of the West Kootenay Power and Light Company, which until recently supplied the current to light Nelson, also utilizing the hydraulic power of the river.

The new hydro-electric plant at Nelson consists of a vertical unit, both the turbine, waterwheel and the generator being of Allis-Chalmers manufacture. The former, of standard design, is from the Scranton (Pa.) shops of the manufacturing company, and the generator, especially designed for direct vertical connection to hydraulic turbines, was built at the electrical works of the company in Cincinnati.



MUNICIPAL HYDRO-ELECTRIC PLANT AT NELSON, B. C.

A recent test of this unit at Nelson in the presence of city officials resulted favorably. The turbine-generator unit has a normal capacity of 750 kilowatts, but during the test run this output was increased to 1,340 kilowatts for a period of over 45 minutes' continuous running without undue increase in temperature of bearings. The usual tests were made as to the heating of the coils and bearings. According to the guarantees, the armature and field coils did not rise in temperature above 35° Centigrade.

The Big Gas Engines in San Francisco.

Under date of March 14th the San Francisco correspondent of the Western Electrician writes as follows:

The Pacific Gas and Electric Company, which had to shut down its 5,000-kilowatt generating set at the Potrero power station in San Francisco on account of repairing the breakage of the engine, has since been running its three new direct-connected gas engines at Martin Station, more or less, during the hours of peak load, in order to supply the deficiency in capacity of its electric power plants in the city.

It is announced that, although it was found necessary to reduce the initial pressure of the gas from 150 pounds, for which the engines were designed, to 75 pounds, for reasons of safety, more than 3,000 kilowatts has been developed by each of the 4,000-kilowatt gas-engine generating sets. The gas manufactured at the Martin plant, six miles south of San Francisco, by the Lowe crude-oil water-gas process, is said to carry 50 per cent. of hydrogen, causing fears of possible back firing, etc. Hence it was decided to reduce the pressure and lessen the compression effect in the big cylinders.

The management has been proceeding very cautiously in operating the gas engines on test runs for several months past. The engines were started up and run at very slow speeds, but serious heating of journals, rod-brasses, etc., occurred, and it was a long time before the speed could safely be increased sufficiently to generate 3,000 kilowatts. It is now expected that the engines will soon come up nearly to their rated capacity of 5,400 horsepower each.

The Municipal Lighting and Power Plant of South Norwalk, Conn.

By G. P. Hutchins.

Municipal ownership is of so comparatively recent origin that its success or permanency as a feature of political economy cannot as yet fairly be judged. It is the custom of its opponents to point out the numerous examples of failure as proof positive of the impracticability of this institution as a permanent agency for controlling industries and undertakings of a public-service nature. On the other hand radically inclined publicists and economists cry forth every instance of successful operation as certain evidence that municipal control is the only solution of transportation and other public-service problems.

I submit that in fairness an institution of this kind should be given ample opportunity of development and full trial before final judgment is given as to its merits and efficiency. I believe that in the early years of any such experiment more failures than successes are to be expected.

Great innovations, going to the very life of the people and involving the complex relations of human nature, cannot be subjected to the prompt, rigid and scientifically accurate tests applicable to new developments in electricity or applied mechanics. Each case deserves presentation of all conditions and factors making for defeat or victory, so that thinking men may judge whether the outcome was due to causes of merely local operation or to inherent defects in underlying principle. This has not been the case in numerous reports of municipal-ownership failures occurring in England and Scotland, as well as of sporadic cases in the United States. It is here proposed to avoid this philosophic error in describing the essential features of a case of successful operation under municipal control.

Historic Development and Growth.

Sixteen years ago the city of South Norwalk, Conn., was supplied with electric light and power by a private concern. Operating without competition, this corporation lighted the streets with unreliable arc lamps of 800 nominal candlepower for periods and at prices arbitrarily fixed to suit its convenience, regardless of repeated public protest and demands for longer and better service.

All remonstrances proving vain, the potent Spirit of '76 asserted itself in this New England community. After a series of public meetings, the citizens voted an appropriation of $22,500 for the establishment of a municipal plant. This was in 1892. A committee of three was appointed by the City Council to direct the new construction. Albert E. Winchester, then a consulting engineer in New York, was selected to design and supervise the work. In course of time he identified himself with the enterprise, making it his life work. That the South Norwalk plant is a model of administrative and technical efficiency is due in a large measure to the devotion of this engineer, who gave up a position of brilliant promise, professional eminence and financial success in order to work out a practical success for the principles of public control, which appealed to him.

In one sense it is to be regretted that the purely economico-scientific value of Norwalk's success is weakened as an argument in favor of municipal ownership by the overshadowing effect of unusual devotion and capacity of one individual. How much of the success was due to the system cannot be determined. It will furnish opponents in argument this ready weapon: "Where a capable individual infuses his personality into the principle of public ownership, that very force of personal incentive is furnished, which is the mainspring of success in private control. Cases where real capability is willing to renounce its personal advancement for the sake of principle are rare. It is neither wisdom nor policy to justify general adoption of an institution dependent upon such abnegation for its success."

On land purchased by the committee at South Norwalk, a 100-horsepower plant began supplying current to 86 open arc series lamps on city-owned pole lines on Friday, October 13, 1892. The fire-alarm system was transferred from the fire department to be incorporated with the electric works—a departure in public service which has proved singularly advantageous.

After several years of public lighting the results were so encouraging that on petition to the council a committee was appointed to report on the advisability of enlarging the plant for the purpose of extending the service to commercial lighting. Mr. Winchester, then one of the electric-light commissioners, was selected to conduct the investigation. After two years' exhaustive research, covering electric-light plants in all parts of the United States, a favorable committee report led to an appropriation of $20,000 for commercial addition in October, 1897. All the work was designed and supervised by Commissioner Winchester.

Commercial-lighting supply began on August 1, 1898. The following October the most important and distinctive feature of this system of control was instituted when, with the council's sanction, all the private and street-lighting systems were put on a stoutly commercial basis, charges being established for all output of the plant so as to enable it to pay its expenses from its own income, just as under private ownership.

Whoever originated this measure certainly had rare political foresight and knowledge of human nature. By supplying a means for ready comparison of post and service with commercial and other municipal plants, he put this organization on its mettle; what is more, he actually advanced it with individuality. Huge trusts long ago saw the value of a similar system. They made each separate plant continue its individual organization and system of accounts, dealing with other establishments of the trust as separate entries. Most of the advantages of emulation, personal pride and individual responsibility are thus retained.

In the history of municipal ownership South Norwalk will shine as the pioneer in operating a municipal electric plant from an independent business standard, entirely divorced from politics.

Business increased so rapidly that on May 15, 1900, $17,500 additional was appropriated for enlargement, followed by $20,000 in 1903. In the course of these extensions and renovations all of the original equipment of dynamos, engine and lamps was retired, after 11 years of very satisfactory service. In 1901 the electric power system of a local company was purchased by the commissioners, very materially extended and connected with the city's generators. The city was now operating a complete public service and commercial service on light and power, having practically driven out all competition by natural growth and survival of the fittest.

All this did not occur without opposition on the part of the private companies we saw in complete control in 1891. Numerous suits and applications for injunction, offers to purchase or lease the city's plant, and local adverse propaganda were resorted to, but to no avail. Although the opposition company has control of the street-railway system and supplies the city with gas, it actually has but one per cent. of the customers for electric lighting and power.

So satisfactory was the municipal service and so rapid the growth of electric demand, that by the end of 1904 the commissioners were confronted with the fact that another enlargement would have to be made in time to meet the fall load of 1905. The plant had practically outgrown its space limitations. An increase of boilers, which was necessary if the increased output was to be attained by adding steam units, would necessitate removal of the whole generating plant to the city's property at the water front, in order to secure direct boat delivery of coal and convenient condensing facilities. In view of the great trouble and expense,

such movement had to be avoided if any suitable alternative could be found.

After an exhaustive investigation of all existing types of gas, gasoline and fuel-oil engines, it was decided that the installation of an American Diesel engine, 225-horsepower fuel-oil engine directly connected to a 160-kilowatt Fort Wayne generator would furnish the required increase of power at increased economy without need of moving the plant. The council having indorsed the commissioners' report advocating the proposed enlargement at a cost of $22,000, a city meeting appropriated the estimated amount on June 12, 1905.

All material for increasing and extending the distribution system was purchased by the commissioners direct, and the work entailed was performed by the regular operating staff with temporary help. Just four months after the enlargement was authorized, the new engine and generator were started under trial load, which illustrates the businesslike spirit of this organization as well as one of the advantages of the Diesel engine.

The flexibility of the South Norwalk municipal works system was shown at this time by its opening a steam-heating system for heating the passenger coaches of waiting trains of the New York, New Haven and Hartford Railroad Company. Though this forms but a small source of revenue, by making a market for surplus steam, it is important as indicating on the part of the plant management a degree of initiative and readiness to avail itself of every commercial opportunity, wholly at variance with the reluctance to extend and the "hide-bound" supineness so frequently complained of as incident to municipal control.

The same appreciation of technical advances and readiness to discard antiquated equipment or methods may be traced throughout the career of this plant. They prompted the weeding out of the whole original outfit in 1903, and especially in the radical departure from steam to fuel-oil power generation in 1905.

The plant is the result of a natural and healthy growth. After 1898 the numerous expensive enlargements were paid for, not out of bond issues or loans, but with notes signed by the commissioners and indorsed by the city treasurer. These notes have been redeemed, and will be entirely redeemed from the profits of the plant, which also carry the entire interest load of debts contracted for the plant's erection and progressive enlargement. For instance, the annual statement of January 1, 1906, reported a total debt of $85,400.01; that of January 1, 1907, a debt of $74,694.51, showing a reduction of $10,705.50, all out of the business of the works. In addition to this, $3,445.81 was paid for interest.

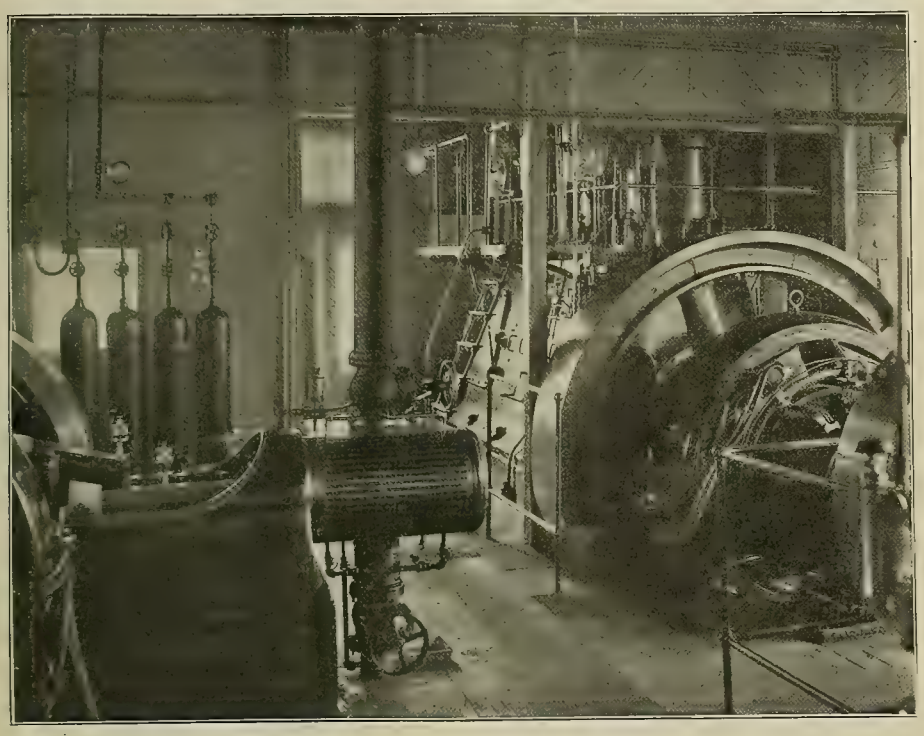
Since October, 1905, no material additions have been made to the plant, so that this article will give a reasonably accurate description of existing equipment in this rapidly extending station. The demand has again grown so far beyond the plant's capacity that enlargement in the immediate future becomes imperative. It is a high testimonial to the worth of Diesel engines that additional installations of such units are contemplated as the means of increasing the output.

Plant and Equipment.

Considering the fragmentary growth of this plant, it is singular that it presents the appearance of a unitary conception embodied in one comprehensive design. The main building, of brick, 1½ stories high, 109 feet long and 48 feet wide, contains in the fireroom four return fire tubular boilers, each of 125 nominal horsepower, a feed-water heater, injector and the ordinary boiler-room appliances, excepting that the unusually complete arrangements for weighing coal indicate an appreciation of systematic and accurate data collection.

All of the steam engines are of the Watertown high-speed type, each direct-connected to 250-volt direct-current multipolar generators. Of these, two are 60-kilowatt Siemens & Halske machines, two 60-kilowatt Eddy, and one is a 165-kilowatt Fort Wayne dynamo. The Diesel engine, shown at the right in the picture, is direct-connected to a 160-kilowatt Fort Wayne generator, which carries the main part of the load. So economical has this engine proven itself that it is run practically all the time and is credited with an average of two-thirds the entire monthly output of the plant.

A Norwalk air compressor belted to a 25-horsepower General Electric 250-volt motor is used to compress to about 800 pounds per square inch, the air used for injecting the sprayed fuel oil into the Diesel cylinders. A cylindrical fuel-oil storage tank containing 3,350 gallons is placed underground, close to the plant. From the storage tank it is pumped into an accurately gauged distributing tank, which enables positive check to be made on all oil consumed. At the present price of 3¾ cents a gallon, the fuel cost of the Diesel engine-generator kilowatt-hour is 3½ mills. The following data will be of interest, as showing the efficiency and economy of the South Norwalk electric works:



A CORNER OF SOUTH NORWALK LIGHTING PLANT, SHOWING FUEL-OIL-ENGINE UNIT.

Average income per kilowatt-hour	$0.04479
Average cost per kilowatt-hour, including interest, depreciation and operating expenses	$0.02764
Average profit per kilowatt-hour	0.01715
Gallons of fuel oil consumed last year	59,163
Pounds coal consumed last year	2,500,810
Average cost of coal per kilowatt-hour	$0.02250
Average cost of fuel oil per kilowatt-hour	$0.00359
Average lbs. coal per kilowatt-hour	8 lbs.
Average Watt-hours per gal. fuel oil	9916
Average Watt-hours per lb. coal	114

The streets are lighted by direct-current series enclosed arc lamps of 1,400 nominal candlepower on two circuits having 13 miles of wire and a total possible capacity of 130 lamps, spaced at an average distance of 500 feet apart. These lamps were lighted 357 nights during the last year, each lamp averaging 3,287 hours of service at a cost of $0.0182 per lamp per hour.

The economy achieved by the Diesel engine is shown by the comparison of 246 watts supplied per hour for one cent in 1906 with 191 watts produced in 1905, although this record would appear even more favorable had not the Diesel engine been used for 2½ months during that year.

The commercial lighting and power services are continuous for 24 hours a day, except during daylight on Sundays. There are 460 consumers of lighting and 60 for power. Lamps equivalent to approximately 10,000 16 candlepower are connected and motors aggregating 598 horsepower in capacity, the kilowatt rating of generators being 565. Last year 872,372 kilowatt-hours were generated, 586,872 by fuel oil and 285,510 by coal. The average income per kilowatt-hour was 4.479 cents, at a cost of 2.764 cents. The average cost by fuel oil was 2.25 cents, as compared to 3.59 cents by coal, a difference of 1.32 cents in favor of the former.

It is true, however, that these figures do not actually apply to the whole showing, because the cost of coal per kilowatt-hour is disproportionately high, because steam was used as an auxiliary and to carry peak loads only. The commissioners estimate that the cost of street lights last year was $6,540, which is $1,526 less than they would have cost if paid for at the rate of $74 per lamp-year charged Norwalk by a private company. At the average rate of $83.71 obtaining in Connecticut the total saving for the city since starting of the plant has been $21,478.09. Benefits to private consumers may be judged from the comparison of base rates of 10 cents per kilowatt-hour, with 10 per cent. rebate for cash charged by the municipal plant and 16 cents, with 10 per cent. rebate charged by the private lighting company.

In every way this plant has been a source of profit and credit to the community. Directly and indirectly it supplies power to factories furnishing employment supporting 2,000 people. New industries are continually being attracted to South Norwalk because of the extremely low rate charged for power and light. It is almost impossible to find a vacant house at any reasonable price within corporate limits, and new buildings are going up in all parts.

Particularly interesting is the fact that no breath of "graft" suspicions has ever been connected with these works. The operating staff consists of A. E. Winchester, general superintendent, city electrical engineer and chief of the Fire Department, one clerk, two engineers, two foremen, a meterman, line foreman, and one lineman and trimmer. They are entirely controlled by the three electrical commissioners, appointed for three years by the council, which is elected annually. By stimulation and common consent it is arranged that the Electric Commission and that in charge of the waterworks shall always be divided between the two principal political parties. Thus the electric commissioners are always Democratic by two to one, and the waterworks commission is Republican in the same ratio. This provision seems of little practical value or importance. As long as the city's affairs are properly managed it will continue in force, but as soon as incompetency or dishonesty manifests itself, this "gentlemen's agreement" will be disregarded, as it has no sanction in law.

In fact, I fail to discover any inherently efficient safeguards of municipal ownership as a system in the experience of South Norwalk. It is unquestionably a success, but given the same conditions of a highly intelligent community in a very prosperous manufacturing section, having dedicated to it the entire energy, ambition and skill of a competent engineer, it is difficult to see it could be anything but a success, owing to the exceptionally advantageous conditions.

What might have been the result had there not been a Winchester available and willing to identify himself with this work cannot be properly judged. Much credit is due to the capable and persistent efforts of the electric commissioners, but the success is mainly a monument to one man's singleness of purpose. Natural recognition of the importance and value of this work has been given Mr. Winchester by his appointment by the Civic Federation as a member of the commission sent to England to investigate and report on municipally owned undertakings.

Death of A. D. Newton.

Many electrical men will be grieved to hear of the death of Mr. Arthur D. Newton, who was very well known in the electrical industry and had many friends. Mr. Newton had been in poor health for some time, but was getting better and had started south, from Boston, for a rest. Suddenly, however, there came a change for the worse while he was in Washington, D. C., and he died in that city on March 12th. Mr. Newton was for years the president and manager of the Eddy Electric Manufacturing Company of Windsor, Conn., but at the time of his death was manager of the electrical department of the Boston office of the H. W. Johns-Manville Company. Mr. Newton leaves a widow and one child.

New Process for Treating Tantalum.

A new process of producing pure ductile tantalum consists in heating in a vacuum above its melting point tantalum containing or combined with hydrogen. Care is taken during the heating process that the vacuum is not reduced by the separate gases, all of which are promptly drawn off by the air-pump. It is said that by heating a mixture of tantalum chloride vapor and hydrogen, tantalum containing hydrogen can be obtained. At a comparatively low temperature a brittle metallic body is separated from this mixture. The necessity of heating the tantalum in a vacuum is due to the fact that under other circumstances the tantalum would take up foreign matter from the surrounding atmosphere.

If the proposed budget of the city of Chicago for 1907 is adopted, $1,982,523 will be appropriated for the Department of Electricity.

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DATES AHEAD.

Underwriters' National Electric Association (general annual meeting of the Electrical Committee), 32 Nassau Street, New York city, March 27th and 28th.

Central Electric Railway Association (regular meeting), Algonquin Hotel, Dayton, Ohio, March 28th.

Ohio Independent Telephone Association (annual convention), Columbus, Ohio, March 28th.

Iowa Electrical Association (annual meeting), Lafayette Inn, Clinton, Iowa, April 18th and 19th.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

RAILROAD presidents, financiers and magnates of various degrees exhibit considerable unrest at the present time, largely due to the tendency of the national administration to hold the railroads to a strict accountability for their acts. They talk of great lessening in purchases of equipment, cutting down the labor bill and other sweeping reductions. Among other things they seem to be giving more attention to the probable economy of electric operation. Possibly, therefore, from this troubling of the waters may result a distinct acceleration of the slow process of "electrifying" American railroads.

MEMBERS of the American Institute of Electrical Engineers should take pains to vote on the proposed new constitution now submitted to their attention. Much hard, earnest work has been expended on this draft of a constitution by the law committee and the board of directors, and as a mere act of courtesy, if nothing more, members should take the trouble to vote "for" or "against" it. Our own opinion tends toward the belief that the best interests of the Institute will be served by the adoption of the new constitution. However, each member of the society should examine the document and decide for himself. Whether his decision be favorable or no, he owes it to himself as well as the society to send in his vote.

WHEN TIMES are good, a large number of patents are issued by the United States Patent Office. In dull times the number is less, and during periods of marked industrial depression the output of patents is notably decreased. The number of patents issued is thus a very fair barometer of the prosperity of the country, when some allowance is made for the natural increase to be expected with the growth in population. Judging by this standard the country continues to enjoy an era of unsurpassed "good times," for the number of patents issued from week to week is very large. The Western Electrician publishes in every issue a list of the new electrical patents, with a very brief description of each invention, and the space required by this department seems to be steadily increasing, although an effort is made to compass the descriptive matter in as small a space as possible. Sometimes, perhaps, the descriptions are too concise to give an adequate idea of the inventor's method or apparatus as shown by the various combinations in the claims allowed by the government. This flood of electrical patents indicates also the extent to which electricity is employed in the arts, but in addition it is unimpeachable testimony to the general prosperity of the country. Viewed in either aspect, the situation is a gratifying one.

GARBAGE or street-refuse disposal by burning may be a very good way of caring for the waste products (except ashes and absolutely non-inflammable material) of cities. But electrical engineers have long held that it is a very poor way to raise steam under the boilers of an electric-light plant. In England several combined "dust destructors" and electric-light plants have been built by municipal authorities, the idea being to kill two birds with one stone by disposing of the refuse and making electric light at the same time, with great economy and to the delight of all concerned. But the amiable delusion seems now to have faded, for the London Times Engineering Supplement reports that the "dust destructor" has lost a good deal of the respect formerly paid to it by members of municipal electric-lighting committees. On the whole the anticipated benefits have proved illusory. It has even been found that dust-destructor generating stations have, on occasion, actually consumed more coal than would have been required if the rubbish furnace had never been made part of the plant, and other objections have revealed themselves. "There is, therefore, nothing surprising," says our London contemporary, "in the paragraph in the report of the Bermondsey district auditor, in which he declares that the work carried on at the dust destructor attached to the power station is costing the borough £3,000 more than other methods of disposal, and he attaches great weight to the electrical engineer's opinion that the alliance with the dust destructor makes the costs of electrical production higher than they need be. Certainly there has been no advantage yet disclosed in the accounts, and the charge of 2¼d. per unit (kilowatt-hour) for public lighting as against the London Electric Supply Corporation's offer of 1½d. affords no prima-facie case in support of the claims of the dust destructor's admirers."

Some American advocates of this fad will perhaps take notice.

THE WESTERN ELECTRICIAN does not favor municipal ownership of industrial enterprises. Given ideal private ownership and ideal public ownership, and it believes the former is to be preferred, for it fosters that spirit of initiative, of inventiveness, of self-reliance, which has so much to do in making a people great. But of course neither form of ownership will ever be ideal. And between imperfect private ownership and imperfect public ownership, the former is still to be preferred, for here there is the added advantage that methods of restraint and control in the interest of the community as opposed to individual selfishness can be more easily and exactly applied to the private owner. With the recent lesson of the London County Council in mind it is hardly necessary to argue this point. Private ownership, then, with honest, reasonable but strict municipal control, seems to be the best solution of this vexing problem.

But because this journal is opposed to municipal ownership it does not follow that instances where this method is apparently successful are to be ignored in its columns. Conceivably, also, as there is nothing morally wrong in municipal ownership, its employment as an expedient might be justified by those who admit its fallacy as a principle of political economy. And it is the fact that in but too many instances private ownership has only itself to blame where municipal ownership has been set up.

It is therefore with the idea of giving the other side a fair hearing that we print in this issue and at some length the article by Mr. G. P. Hutchins on the apparently successful municipal electric-light and power plant in South Norwalk, Conn. But we do not imagine that this example will, after all, occasion much disquietude to advocates of private ownership, for the reason, among others, that it appears to have been conducted through a long series of years by a man both honest and capable, who gave up a private career for it and bestowed upon it all the private initiative which he possessed. In other words, if we read Mr. Hutchins' article correctly, Mr. Winchester practically sacrificed his own prospects as an engineer in private practice to devote himself to the operation of a municipal electric-light plant in a place having less than 7,000 inhabitants at the time of the last United States census.

This circumstance is so exceptional as to be extraordinary. It can hardly be cited as a precedent for municipal success elsewhere. If, for instance, a rich man should establish a fine plant, present it to his native town and endow it liberally, so that people came to see it as a model, that would be no argument for municipal ownership. But, from Mr. Hutchins' account, Mr. Winchester gave the South Norwalk plant more than money; he lavished himself upon it, as other men do on their private interests. The age of martyrs has not passed, perhaps, but we fancy that martyrs to the cause of public ownership will always be few in number and need not be reckoned with in a practical consideration of the subject.

Moreover, the plant contains some new machinery and some that is old and out of date. Taken as a whole, it is reasonable to suppose that the aggregation is not particularly efficient. The older machinery may have lived its life and amply paid for itself, but it still stands as a part of the plant. It would be interesting to know whether sufficient depreciation has been allowed to permit this antiquated equipment being written off. Indeed, an explanation of what is considered a fair allowance for depreciation on all classes of apparatus in this particular plant would be valuable in considering the history of the enterprise.

But why be captious? The story of the South Norwalk plant is an interesting one, and although the author himself is doubtful whether the experience in that small town is to be taken as a precedent for other communities, the account should have due weight in considering the voluminous record of municipal-ownership experiments.

Variable-speed Alternating-current Motor.

An invention by Dr. Charles P. Steinmetz of Schenectady, N. Y., on which a United States patent, No. 843,774, was granted on February 12th, relates to alternating-current dynamo-electric machines. The object is to provide an efficient variable-speed alternating-current motor. The ordinary induction motor, says the inventor, is essentially a constant-speed machine, and its speed can be varied only at the expense of efficiency.

The principal feature of the new invention consists in supplying to the secondary member of an alternating-current motor a low-frequency current

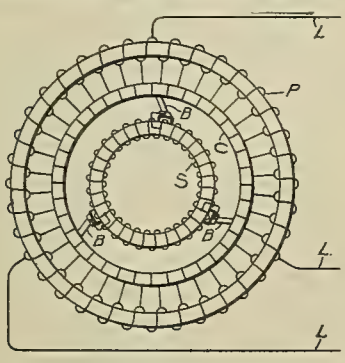


FIG. 1. DIAGRAMMATIC DRAWING OF STEINMETZ VARIABLE-SPEED ALTERNATING CURRENT MOTOR.

derived from the primary member. This is accomplished by providing a commutator for the primary instead of for the secondary member and brushes bearing on the commutator fixed relatively to the secondary instead of to the primary member. This arrangement supplies to the secondary member a current of a frequency corresponding to the slip of the secondary member. For a current of this low frequency the self-induction of the secondary winding is comparatively small, and consequently the power factor of the motor is high.

Fig. 1 of the accompanying drawings shows diagrammatically an alternating-current dynamo-electric machine arranged in accordance with the invention, and Fig. 2 shows a modification of the device. In Fig. 1 (P) represents the primary member of an alternating-current motor connected to a source of three-phase current, indicated by the leads (L) (L) (L). For the sake of simplicity the primary winding is shown as a Gramme ring; but in practice any well-known form of construction, such as a distributed drum winding, may be

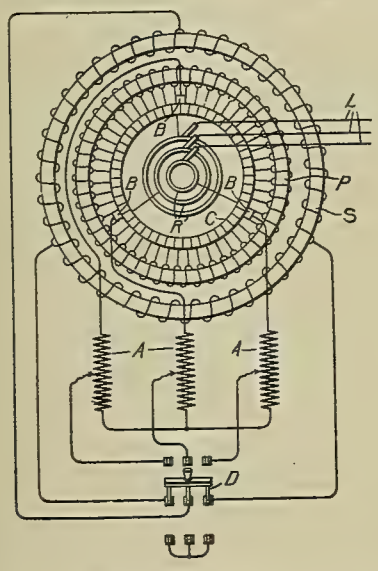


FIG. 2. ARRANGEMENT FOR ROTATABLE PRIMARY WINDING AND STATIONARY BRUSHES.

employed. The same remarks apply to the secondary winding (S), which is also shown diagrammatically as a Gramme ring. The primary winding (P) is provided with a commutator (C), while the secondary winding is provided with brushes (B) (B) (B) bearing on the commutator (C) and connected to fixed points on the secondary winding.

If it be assumed that the primary winding and its commutator are stationary, while the secondary winding (S) and the brushes (B) revolve and three-phase currents are supplied to the primary winding through the leads (L), three-phase currents will be supplied to the secondary windings (S) through the brushes (B), but the latter currents will have a frequency corresponding to the difference in speed of the rotation of the primary magnetic field and of the secondary member—that is, if the secondary member were stationary the currents supplied to the secondary member would be of the same frequency as the primary currents. At synchronism the currents through the secondary member would be of zero frequency and at intermediate speeds of a frequency corresponding to the slip of the secondary member. At speeds near synchronism this frequency is very low, and consequently the secondary winding acts almost as a non-inductive circuit for these currents. As a result the power factor of such a motor is much higher than when the secondary winding is provided with a commutator and full-frequency current supplied through commutating brushes.

In order to avoid the stationary commutator and revolving brushes (shown in Fig. 1), the arrangement shown in Fig. 2 is preferred. In this arrangement the primary winding (P) is made rotatable and is provided both with a commutator (C) and with collector rings (R), by means of which current is supplied from the source through the leads (L). Stationary brushes (B) bear on the commutator and lead off the low-frequency current for the secondary winding. In order to vary the motor speed, current-controlling means are inserted between the brushes (B) and the secondary winding (S). These devices are indicated at (A) and may consist of inductive devices, such as auto-transformers, or of variable resistances, or both. As the voltage impressed on the secondary winding is decreased the condition of the secondary winding approaches more closely a short-circuit and the motor approaches synchronous speed. By means of switch (D) the secondary winding may be disconnected from the brushes (B) (B) and short-circuited upon itself when synchronism is reached, if it is desired to operate the motor at synchronous speed. When the switch (D) is thrown to its lower position, the brushes (B) (B) may be raised from the commutator, if desired.

While the invention is described with particular reference to an alternating-current motor, in most of its aspects it is equally applicable to self-exciting alternating-current generators as well, or, in other words, it is broadly applicable to any dynamo-electric machine in which it is desired to supply low-frequency currents to one of the members of the machine.

Central-station Attitude Toward High-efficiency Lamps.

Indicating the attitude of one progressive central station toward the new high-efficiency lamps, the following, from the house organ of the Edison Electric Illuminating Company of Boston, will be read with interest by managers:

"As already announced, in accordance with its wish to enable all its customers to employ the electric light with the utmost of satisfaction and economy, and because 'a pleased customer makes ten,' the company has arranged to supply new and highly efficient lamps upon the favorable and equitable terms stated below.

"The Gem lamp is adapted for use anywhere within the territory supplied by the company. It gives 25 per cent. more light than the ordinary 16-candlepower lamp. When used with a distributing prismatic reflector shade it gives approximately 30 candlepower of effective light at useful angles below the lamp. When used with a concentrating shade it gives about 60 candlepower of useful downward light, concentrated within narrower limits than with the first shade. The price of the lamp and shade is 55 cents, or the lamp alone will be given in exchange for an old Edison lamp and five cents. It is intended that when a larger supply of these lamps is available the lamp itself will be furnished or exchanged free.

"The tantalum lamp, with its filament, or burner, made of the rare metal tantalum, is adapted for use on the direct current only; that is, in Boston, north of Northampton Street. This lamp also gives more light than the regular 16-candlepower light, and with the prismatic reflector shade gives either 35 candlepower or 67 candlepower of downward light, as choice is made of either a distributing or a concentrating shade. This lamp is an expensive one to manufacture; but it will be furnished by the company to its customers for 30 cents, excess charge, or in combination with the shade and holder for 80 cents, excess charge.

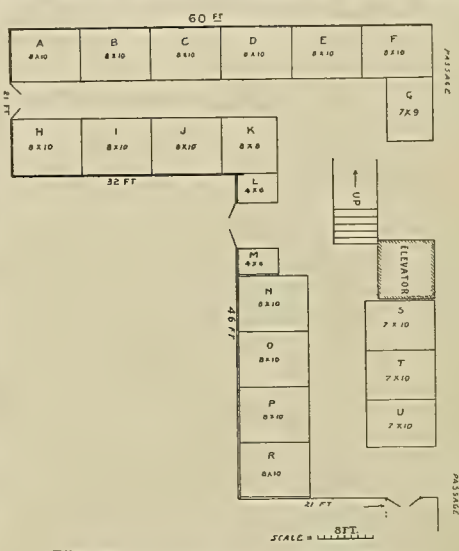
"As either of these lamps consumes only the same amount of current as the ordinary 16-candlepower lamp, it will be perceived that its employment will give more light for the same expenditure, or fewer lamps may be used and the same amount of illumination obtained as before for much less money cost."

The Iowa Conventions of Next Month.

The convention of the Iowa Electrical Association will be held in Clinton, Iowa, April 18th and 19th, and of the Iowa Street and Interurban Railway Association on April 19th and 20th. Headquarters for both associations will be at the new Lafayette Inn. The rates at the hotel will be from $2.50 to $3.50 a day for each person, American plan. Two or more persons will be required to occupy one room.

Space for exhibits, as indicated by the accompanying diagram, also current for light and a limited amount of power, will be provided in the basement of the Lafayette Inn, free of charge. The only expense to exhibitors will be that of providing materials and labor for erecting and dismantling booths and the moving of their goods. Current furnished will be single-phase 60-cycle 110 and 220-volt alternating, and 600-volt direct current.

Arrangements have been made with the Western Passenger Association for a rate of 1⅓ single-trip fare on the certificate plan, from any part of the state of Iowa and from Chicago, St. Louis and Minneapolis, based on a single-trip rate of three



EXHIBITION SPACES FOR IOWA CONVENTIONS.

cents a mile. Badges of all delegates will be accepted for transportation on the Clinton Street Railway, Iowa and Illinois Railway and the Tri-City Railway.

The local committee, consisting of P. P. Crafts, R. M. Howard and Thomas Crawford, desires to be advised by April 15th as to the space reservation and amount of current required by exhibitors.

Harriman on the Chicago Subways.

The Chicago Daily Tribune on March 14th printed an apparently authorized interview by its New York correspondent with Mr. E. H. Harriman. The Harriman interests are largely interested in the Chicago freight tunnels, about which Mr. Harriman is quoted as saying:

"Those tunnels ought to do well if there were co-operation on the part of the business people of Chicago. But, so far as I can understand, it is hard work to get the merchants to have their places connected up. I don't think the people quite understand how beneficial those tunnels could be made.

"If we were given the privilege of carrying light, heat and power, as well as telephone wires, we could do a great deal toward abolishing smoke. Chicago ought to be one of the brightest and cleanest cities in the country. If we were given the right to do what I suggest it would result in removing a great many of the small smoke-making furnaces."

Another man connected with the Harriman "crowd" said the Harriman people did not know much about electricity. He left the inference that there was not a deep interest in the matter at this time. The fact that the Chicago Edison Company has proceeded with the sale of its five per cent. notes to raise money for improvements is taken in some quarters to indicate that there is no immediate prospect of the resumption of negotiations for taking over the Chicago Edison properties by the Harriman interests.

Next Meeting of National Electric Light Association.

The thirtieth annual convention of the National Electric Light Association will be held in Washington, D. C., on Tuesday, Wednesday, Thursday and Friday, June 4, 5, 6 and 7, 1907. The headquarters will be in the New Willard Hotel, the entire tenth floor of which will be devoted to the exhibits of the associate members and the general meetings of the convention.

The Application of the Storage Battery to Lighting, Power and Railway Service.[1]

In this paper, which was illustrated by diagrams, batteries for lighting, power and railway service were divided in two general classes under the headings (A) batteries for railway and power service and (B) batteries for lighting service. These headings were again subdivided and the functions of the batteries given under these latter subdivisions. The divisions and subdivisions were as follows:

(A) Railway and Power

1. *Power-house or Sub-station Batteries*—
   Current regulation.
   Peak work.
   Current regulation and peak work.
   Emergency reserve.
2. *Line Batteries*—
   Current regulation.
   Peak work.
   Current regulation and peak work.
   Improving the line voltage, effecting copper saving or offsetting a rotary sub-station.
   Emergency reserve.

(B) Lighting.

1. *Central or Sub-station Batteries*—
   Peak work.
   Emergency reserve.
   Voltage regulation.
   Equalizing.
2. *Line Batteries (Battery Sub-station)*—
   Peak work.
   Emergency reserve.
   Voltage regulation
   Improving the line voltage, effecting copper saving or offsetting a rotary sub-station.
   Equalizing.

The paper was divided in two parts, the first treating of the means of controlling the charge and discharge of the batteries and the second treating of the results accomplished by the batteries in performing the functions as outlined above.

In the first part the characteristics of a storage cell were shown, and it was explained that in order to maintain a predetermined rate of charge or discharge on any particular storage cell the electromotive force of the source of supply or demand must throughout the charge or discharge of the cell be increased or decreased so as to conform to the curve of charge or discharge at that particular rate.

The first part was subdivided into automatic regulation and hand regulation of batteries, the former being necessary where batteries are required for current regulation—that is to say, to relieve the power house or sub-station of sudden fluctuations continuing for only a short period. It was shown how this automatic regulation is accomplished by means of boosters—the regulating shunt booster for power house and sub-station work, the constant-current booster for certain classes of power work where the generators are required to supply a lighting load and a fluctuating power load, and the compound booster for operation in conjunction with line batteries. The automatic regulation of charge and discharge of line batteries, floating without boosters, was also discussed; in this case the regulation is accomplished by means of the drop in the line between the power house and the battery.

The carbon regulator was then explained. This regulator is used for automatically varying the strength of the booster fields and also for changing the direction of current flow in these fields. By the method of hand regulation it was shown how this was accomplished by means of a rheostat control of the booster fields in cases where boosters were installed in railway and power work. In lighting service where the batteries are not required to respond to rapid load fluctuations but are required to discharge continuously for comparatively long periods of time, hand regulation is accomplished by means of end cells, additional cells being cut in series in the battery as the discharge continues, no booster being used for discharge regulation.

The second part of the paper dealt with the advantages resulting from the use of batteries in railway, light and power service. In the case of batteries in a railway power house, the batteries by relieving the station of fluctuations allow the engines in service to operate at a steady and economical load. It was shown that by performing this service the battery would increase the capacity of the station and materially improve the load factor of the units in operation. In small railway stations particularly the fluctuations are so great that they necessitate the operation of more units than would be required if the generating apparatus only had to supply the average load. Since with a battery the generating apparatus is only required to supply the average load, the battery caring for all fluctuations above and below the average, the station can be operated with fewer generating units, thereby eliminating the constant losses of the machines that can be shut down.

In interurban service where batteries are installed in the sub-station, not only the power plant but the rotaries, static transformers, high-tension transmission lines, alternators, engines and boilers are relieved of the load fluctuation with a consequent improvement of the load factor on the system. In small waterpower plants the regulating feature of the battery is important as by removing the load fluctuations the maximum output may be obtained from the waterpower. Line batteries doing fluctuating work not only afford relief to the power house but frequently save more than their cost in feed wire, or where the average load of a line is comparatively small the battery will often offset a rotary sub-station. As line batteries of this type require no regular attendant by offsetting the sub-station a material saving in labor is effected. The value of the line battery as against additional copper lies in the fact that the copper with the battery has only to carry the average current, while without it sufficient copper must be installed to transmit the maximum current with a drop in voltage which will not be prohibitive to good operating conditions.

In larger railway work, such as surface and elevated roads in large cities where a pronounced peak occurs during the rush hours in the morning and evening, batteries besides regulating the load fluctuations are required to discharge continuously during the peaks, thus relieving the power plant at this time. In a number of cases by installing the peak batteries on the line instead of at the power house they not only relieve the power house but also the feeder system of load during the peak. A case was cited of a road in Chicago where a large line battery was installed of this type which effected a copper saving equal to the cost of the battery. These peak batteries are particularly valuable in cases where the operating company is buying waterpower. Since waterpower rates are based, broadly speaking, on a maximum demand basis, by reducing the peaks the rate for the waterpower can be reduced to an amount that will more than cover interest and maintenance on a storage battery.

In lighting work, such as Edison service, in the larger cities, practically the same arguments for storage batteries for peak work hold as in railway work. The emergency values of the batteries, however, are greater in this service than in railway work, as they are always available for sudden unforeseen demands for power, such as occur on dark days when the batteries may care for the rapidly increasing load until additional generating apparatus can be placed in service. In cases of breakdowns in any part of the Edison system they are also of great value. The battery sub-stations, which are more or less analogous to the line battery on railway work, are usually located at distributing centers; by discharging during the peak they not only afford relief to the power house but reduce the supply of power sent over the mains during the peak. In this connection the battery is also available as a means of regulating the voltage at the centers of distribution.

Discussion.

Mr. P. Junkersfeld doubted that the elevated-railroad people of Chicago realized the value of the storage battery frequently termed the "watch-dog of electric service." The storage battery, he said, possessed a great number of advantages. In lighting work in large cities, where it is used for emergency service, many of the companies believed in having the battery fully charged all the time. The speaker thought that there was a great field for it in large manufacturing establishments, not only for direct-current but for alternating-current work as well. Another important application of the use of storage batteries, Mr. Junkersfeld believed, was in connection with switching operations in large railroad yards. In this connection, however, it would have certain limitations governed by the amount of work to be done.

Mr. Waring thought that the use of batteries for industrial purposes as referred to by Mr. Junkersfeld would be governed entirely by the work to be performed and by the charging facilities. There was one point which he (Mr. Waring) did not cover in his paper, and that was the application of the battery to alternating-current work. So far the use of the storage battery in this connection was in its infancy, although his (Mr. Waring's) company had in the last two years made a number of sales of batteries for alternating-current work. The speaker referred to the installation of a battery in the phase-changing station of the alternating-current plant of the Spokane and Inland Empire electric-railway system in the state of Washington.

Prof. C. E. Freeman of Armour Institute wished to know what difficulties, if any, had been met with in making the adjustments (shown in a rough diagram exhibited by Mr. Waring) to meet the variations in line. Mr. Waring stated that as far as carbon regulation was concerned, he had not heard of any serious difficulties. In only one instance that he knew of had any trouble occurred.

In answer to a question asked as to the best method of temporarily repairing a cell in which there is a small hole through which the electrolyte leaks out, H. M. Beck stated taht he knew of no other method than that of simply putting a patch of lead on the hole.

G. H. Atkin referred to the general lack of knowledge of the buying public respecting the functions of storage batteries. He said that, speaking as a salesman, the lack of such knowledge was one of the hardest things he was obliged to contend with.

Questioned as to the average life under normal conditions of the plates of a battery, Mr. Beck stated it could scarcely be said that there were any normal conditions. The hardest worked batteries, he said, were used in peak railway service. In such batteries two and three peaks a day occurred winter and summer. Under the hardest work it would usually be a difficult matter to use up the positive plates of a battery in less than four years, while the negatives would last longer than that.

In answer to a question asked by D. W. Roper as to the difference in the methods of discharging batteries, Mr. Junkersfeld stated that it was the practice in England to discharge the batteries through boosters. The speaker thought that in England the standard of electrical service was not as high as in America. He thought that the usual American method of discharging a battery through the end-cell switch was more reliable than the English method of booster discharge.

Referring to the action of lightning on a battery, Mr. Beck stated that lightning as a rule would strike the booster before the generators.

Among others who took part in the discussion were C. A. S. Howlett and Mr. Taussig. A unanimous vote of thanks was tendered Mr. Waring for the presentation of his paper.

1. Abstract of a paper by J. M. S. Waring, read before the Electrical Section of the Western Society of Engineers, Chicago, March 15, 1907. The author is district engineer for the Electric Storage Battery Company at Chicago.

The Lighting of Large Office Spaces.

Some 30 members of the Chicago section of the Illuminating Engineering Society attended the regular meeting on the evening of March 14th. The papers presented at the New York meeting of March 8th, and printed in abstract in last week's issue of the Western Electrician, were discussed. The meeting was held in a La Salle Street restaurant, after those present had dined together. George C. Keech, the chairman of the Chicago section, presided and introduced as the first speaker Mr. V. R. Lansingh of New York, the secretary of the national society.

Mr. Lansingh told of the duty of the national organization, which simply directs the work of the various sections, which are all of equal rank, including the one in New York. He mentioned that the headquarters of the national society are now in the new Engineering Societies' Building in New York city. He also made the interesting statement that a new section would probably be organized in Cleveland before long, and that it was quite possible that another new section would be formed in St. Louis.

Mr. S. H. Moore of the People's Gas Light and Coke Company read the two gas papers which were presented at the New York meeting. These were the one entitled "Lighting of the Offices of the Consolidated Gas Company, New York," by William J. Clark, and the paper of Charles M. Cohn, which described the lighting by gas of the new office building recently erected by the Consolidated Gas Company in Baltimore.

Mr. Lansingh opened the discussion. He criticized the distribution of light in the Irving Place office of the Consolidated Gas Company of New York as shown in Mr. Clark's paper. Turning to Mr. Cohn's paper, he objected to the statement that "the efficiency of the mantle burners made the matter of light absorption by suitable shades a matter of little importance." He said that in the building described by Mr. Cohn the distribution of light was evidently neglected; the lighting might be satisfactory, but it was quite evident it was not economical. The speaker took occasion to point out that the inverted gas burner is very efficient. Whereas with the upright burner 55 per cent. of the light is thrown above the horizontal, with the inverted burner 65 per cent. is below the horizontal. This is with clear glass. Concluding, Mr. Lansingh said that the Baltimore company, in the case of the new building described by Mr. Cohn, had violated some of the principles of good illumination, particularly in the matter of diffusion and economy.

Mr. Moore was called on as a gas man to discuss the papers, but he laughingly remarked that, as there were only two gas men present, the remainder being electrical men, he thought the subject of gas lighting could hardly be adequately represented. In future meetings he hoped that a larger proportion of gas men would be present. However, without having seen the Baltimore office, he was inclined to agree with Mr. Lansingh that the lighting might be improved.

Mr. Lansingh added that if the gas manufacturers would provide chimneys for mantle gas burners of thin, fine glass and also colored, it would be possible to obtain fine decorative effects with lighting of this description.

Secretary J. R. Cravath read the paper by Edward A. Norman entitled "Comparison of Methods of Office Illumination," giving the results of tests of different methods of illumination at the Harlem district office of the New York Edison Company and at the drafting room of the same company at 55 Duane Street. Mr. Lansingh pointed out that cove lighting (or lighting from a source concealed in a cove near the ceiling) tends to deteriorate, owing to the dust settling on

the lamps and also in the cove. He recommended that a sheet of clear glass be placed over the opening of the cove. Another objection to this form of lighting is that it is difficult to get at the lamps in the cove. The speaker also pointed out that the indirect or cove lighting in this case is very trying on the eyes and that it is hard to judge distances in a room so lighted. There is no opportunity for the eye to rest itself by a dim corner or shadow, and the continuous, even light is extremely tiring in the long run. However, the Harlem office room is a very beautiful one, being designed for show purposes. It has a high advertising value by attracting attention from the outside.

Mr. W. D'A. Ryan of Lynn, Mass., said that cove lighting is most expensive and should not be attempted where the illumination of a room is the single end aimed at. In the Harlem office a spectacular effect is obtained, and this is what was desired. Turning to drafting-room lighting, Mr. Ryan said that it was not necessary to put two to 2½ watts per square foot in the drafting room to secure first-class illumination. In the Duane Street drafting room, where the watts per square foot are much greater, the conditions are peculiar, and it is undoubtedly true that more light is provided in this room than is needed, or, indeed, than is indicated by good engineering practice.

Returning to the subject of cove lighting, Mr. Ryan remarked that with the total diffused light one can judge neither form nor distance. The light is similar to that on a foggy day outdoors. Then again, from the point of economy, indirect lighting cannot be afforded, even if it has its advantages, which it has not. Semi-concealed lighting is far better. Here the sources of light are partially concealed, and there are faint but not deep shadows.

Speaking of the various tables of results given in the papers, Mr. Ryan declared that in illuminating engineering it is difficult to make straight-away comparisons, owing to great variations in conditions, one condition of prime importance being consideration of the horizontal plane where most light is needed.

Mr. E. W. Lloyd of the Chicago Edison Company gave some interesting figures in relation to the lighting of a drafting room in New York city by the Moore tube. The total length of this tube is 138 feet, and the area lighted is 2,078 square feet. The height of the ceiling is 16 feet five inches. The height of the tube from the floor is 10 feet. The total wattage consumed is between 3,000 and 3,300, giving about 1.45 to 1.6 watts per square foot, according to the rarefaction of the tube. Tests show that the watt consumption and the power factor of the tube depend on the color of the light, which is itself dependent on the rarefaction of the tube. For white lighting a test gave the following results: Watts, 2,600; volts, 190; apparent amperes, 33. In this case the power factor is about 41½ per cent. With red light these were the results: Watts, 3,250; volts, 210; amperes, 27.5. In this case the power factor was about 56 per cent. It is remarked that the low power factor is a drawback to this kind of lighting. Another inconvenience is found in the fact that, although the frequency is 60 cycles, some shadows are formed when an object is moved with rapidity. The light given by the Moore tube as installed in this drafting room is not quite sufficient when the men do detailed work, and they are obliged to use the ordinary incandescent lamp in addition. However, the color of the light is very good and soft. It is pleasing to the eye. The illumination provided is quite sufficient for general use and is very diffused. The tube is in the shape of a parallelogram, and is suspended six feet five inches below the ceiling.

Mr. Keech mentioned the case of a drafting room in South Chicago lighted by Cooper Hewitt mercury-vapor lamps. Here the 5,000 square feet to be illuminated is lighted with a total consumption of 7,700 watts. The illumination is very satisfactory. The lamps are placed near the windows to give the same effect, as near as may be, of daylight.

Referring to arc lamps for interior illumination, Mr. Ryan said that the tendency is to use fewer arcs for this purpose and to employ more amperes at the arc. The only salvation of the arc for this form of lighting, he said, is to push up its efficiency and to diffuse the light.

Mr. Lansingh laid stress on the necessity of economy in installing lighting systems. He said the lighting industry suffers because installation and service are unduly expensive. He told of the lighting of the dining room of his own house. This room is 17 feet square and yet is lighted well by one 16-candlepower lamp, although it is usually thought that three or four such lamps are needed. The dining table is round and 50 inches in diameter. A round art-glass dome is suspended two feet above the table. It contains a cluster of incandescent electric lamps connected to two switches. There is a center lamp with the tip downward surrounded by four radiating lamps. The outside lamps are on a separate circuit and are only used when the table is lengthened. Ordinarily, the one center lamp is sufficient. The fixture is equipped with a prismatic reflector, and from one lamp the illumination is diffused uniformly over the whole area of the table. The dome is low enough to protect the eyes of those seated at the table from the direct light. The general lighting of the room is mainly obtained from the reflection from the white tablecloth.

Alfred Johnson of Mandel Bros. agreed with the preceding speakers that concealed lighting is not satisfactory. However, the source of lighting should be partly concealed, so that it should not be trying to the eye. In his experience, 10-foot centers and diffusers have proved the best in lighting office rooms. He does not believe in desk lights, owing to the reflection of the light from the white paper or ledger page on the desk. Walls should be tinted straw-color rather than white.

Mr. Lloyd remarked that there was but little illuminating engineering in Chicago. Perhaps Marshall Field's new store represented the first attempt to get down to a scientific basis in lighting interiors. Much money has been wasted in illumination, and there is a great opportunity for education and investigation on this subject. Mr. Johnson indorsed this by saying, "We are all in the same boat; we don't know much about it."

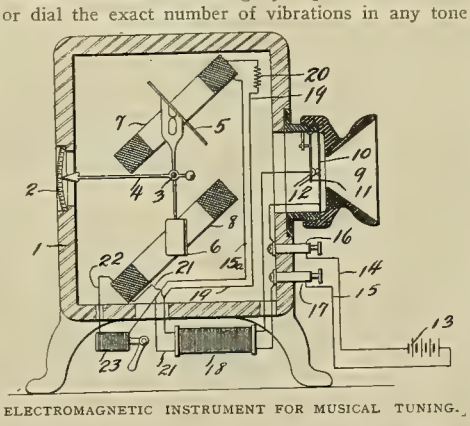
Mr. J. R. Cravath and others also took part in the discussion. Among the listeners was C. R. Gilman of Milwaukee, who is interested in car lighting for the Chicago, Milwaukee and St. Paul Railroad.

Before the meeting adjourned a brief report was presented on the subject of by-laws for the Chicago section by a committee consisting of William E. Keily, George H. Lukes and Prof. Philip B. Woodworth. The committee reported that, after examining Article IX. of the new constitution relating to sections, it was considered that, for the present at any rate, by-laws are not needed by the Chicago section, as the constitution makes sufficient provision for the management of the section. The report was adopted, and an adjournment was then taken

Electromagnetic Tuning Apparatus.

Lewis R. Wheeler of Tacoma, Wash., has recently been granted a United States patent (No. 844,838) on an electromagnetic device for use particularly in tuning musical instruments and for general use in indicating the pitch or frequency of vibration of sounds.

The invention, which is of unusual interest, embodies means for indicating by a pointer and scale or dial the exact number of vibrations in any tone



ELECTROMAGNETIC INSTRUMENT FOR MUSICAL TUNING.

or sound ranging between the number of vibrations distinguishing mere noise and the number of vibrations distinguishing music—that is, between about 20 vibrations per second minimum and in general practice 4,100 vibrations per second maximum.

The device primarily aims to provide an apparatus which will generate a current of electricity having a frequency or number of alternations per second proportional to the frequency of vibrations of a given vibrating string, column of air or other sonorous body. There is provided a scale calibrated chromatically in order that the indicator will disclose the exact pitch of any musical sound, so that in practical use any one familiar with the nature and use of the instrument can readily tune the most difficult instrument without experience or knowledge of music.

The accompanying cut illustrates a longitudinal vertical section of the device.

A suitable casing is provided in its rear wall with a calibrated scale marked off with the letters of the chromatic scale or number of vibrations per second corresponding thereto. A shaft (3) is journaled in pivot bearings in the casing and upon the shaft is fixed a balanced indicator hand (4), which is provided on each side thereof with rigidly secured armatures (5) and (6), designed to be attracted by the magnets (7) and (8) disposed adjacent thereto and in their movement in either direction to move the hand correspondingly. In the front of the casing is mounted a sound receiver of any approved type, the receiver being provided with a diaphragm (10) and a vibrating spring (11), the diaphragm and spring being provided with the carbon hemispheres (12) in spring-pressed contact with each other.

For the purpose of generating a primary current a battery is provided from which lead wires (14) and (15). The wire (14) passes through a binding post and has connection with the diaphragm. The wire (15) passes through a binding post and the primary winding of an induction coil (18), whence it leads to the vibrating spring (11). The vibrations of the diaphragm serve to induce currents in the secondary coil of the inductorium (18) by virtue of the variation in resistance between the carbon hemispheres. The frequency of the alternations of the current in the induced circuit of the coil will be directly proportional to the frequency of the vibrations of the sound received by the diaphragm.

From the secondary winding of the induction coil a wire (21) leads to the electromagnet (8), from which a return wire (22) leads back to the secondary winding of the induction coil through an inductive resistance (23). The electromagnet (7) is shunted into the secondary circuit by wires (15a) and (19), leading from the wires (22) and (21), respectively. The wire (19) leads from the magnet (7) through an anti-inductive resistance (20) and from the resistance to the wire (21).

In the practical use of the instrument the electromagnets tend to rotate the shaft in opposite directions by reason of their influence upon the armatures. They are so arranged that when the shaft rotates in one direction the torque of the magnet which tends to rotate it decreases and the torque of the other magnet increases. Under the influence of the two magnets the shaft will take a position where the torques are equal. If the torque of one magnet varies, the shaft takes up another position determined by the balance of the two forces. The resistance in series with one of the magnets is inductive and the other resistance is non-inductive. Any change in the frequency of the circuit will therefore unbalance the forces acting upon the shaft and bring the shaft as well as the pointer connected to the shaft to a new position, such new position being arbitrarily arranged to bear a direct relation to and to indicate directly the pitch or number of vibrations per second of the sound produced in the neighborhood of the receiver.

Flood Damages Pittsburg Industrial Plants.

The greatest flood in the history of the city seriously affected the industrial activity in Pittsburg, Pa., on March 15th. The flood stage early in the morning reached 37 feet and then began to recede. Loss and damage in the city and vicinity is estimated at several million dollars. Most of Pittsburg's famous steel, iron, glass and electrical plants were inconvenienced or forced to suspend operations temporarily. Steam-railroad trains entering the city were delayed, and the street-railway, electric-light and telephone service was demoralized until nine o'clock at night.

The flood was caused by the sudden rise in the Monongahela, Allegheny, Ohio, Youghiogheny, Kiskiminetas and Clarion rivers, which were swollen abnormally by the combination of warm weather, melting snows and general rain throughout Western Pennsylvania and West Virginia during the preceding 48 hours.

Many other towns in Pennsylvania, West Virginia and Ohio suffered almost as severely as Pittsburg. No railroad trains were run for 24 hours and electric-light and street-railway plants were closed down. Fifty-one lives were reported lost, and, besides the great damage to industrial plants, many families had their homes ruined.

Central Electric Railway Association.

The regular meeting of the Central Electric Railway Association will be held at the Algonquin Hotel, Dayton, Ohio, on Thursday, March 28th. A special car will leave the Traction Terminal station at Indianapolis, Ind., at 6 a. m. on that date for Dayton. Among the papers to be read at the meeting are: "Track Bonding," by Thomas B. McMath, civil engineer, Traction Terminal Company, Indianapolis; "Trolley Wheels," by M. M. Baxter, electrical engineer, Western Ohio Railway Company, Lima, Ohio; "Car Inspection," by Lees M. Jacques, master mechanic, Fort Wayne (Ind.) and Wabash Valley Traction Company; "Express Company Contracts with Interurban Railways."

H. A. Nicholl is president, and W. F. Milholland, secretary-treasurer of the association.

COMMUNICATION.

500,000-volt Transformers.

To the Editor of the Western Electrician:

I note that in abstract of my lecture before the New York Electrical Society of February 27th, which appears in your issue of March 9th, you refer to series of lantern slides, showing development of transformers built at the Worcester Polytechnic Institute for voltages up to 50,000 volts. I beg to advise that this should read 500,000 volts. There is sufficient difference between 50,000 and 500,000 volts at low frequencies to warrant calling your attention to this error.

HAROLD B. SMITH.

Worcester, Mass., March 14, 1907.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

VIII.—Dynamo-electric Machinery.

Motors.

Sufficient description of the general principles of fields and armatures has been given to enable the student to distinguish the usual types of both direct-current and alternating-current generators. It is not the object of these articles to enter into the details of the design of electrical machinery, as this subject involves a purely mathematical treatment, which is of no special value to the practicing engineer who is not a specialist in generator or motor design.

A few years ago it was not uncommon for a consulting electrical engineer to specify the details of construction and the windings of generators and motors; but such a thing would not be thought of at the present day. The manufacturing companies employ specialists in electrical designing and have long since standardized their designs, so that a generator or motor for almost any class of service can be selected from standard lines of these machines, which are not only far more efficient, but which can be purchased at much less expense than any special design of a consulting engineer.

Moreover, the practicing engineer is not concerned at all with the details of design or winding of generators and motors, further than thoroughly to understand the characteristics of the different types. His duty to his client is fulfilled when he specifies the exact requirements and results to be obtained, and it rests with the manufacturer to provide a machine filling these requirements. It is of the greatest importance, therefore, that the practicing engineer should be thoroughly familiar with the functions and performance of the different types of electrical machines.

Before studying the characteristics of electric generators, it would be well to have some understanding of electric motors and rotary converters, as these are closely allied to generators in their general construction, and there are a number of features common to all of them which can afterward be considered at one time.

The distinction between an electric generator and an electric motor is that the first has mechanical energy applied to it, and this mechanical energy is changed in the generator to electrical energy. In the electric motor, by the application of electrical energy to its windings, the rotating part gives out mechanical energy. The explanation of this is as follows:

It has been shown that when a conductor is moved so as to cut magnetic lines of force, a current is generated in the conductor. This principle is the basis of all the machines previously described. Conversely, if a current of electricity passes through a conductor at right angles to the lines of force, the conductors will move so as to cut these lines of force. The latter principle is the basis of the electric motor.

It can be seen from this that any generator can be used as a motor, by supplying it with electrical energy instead of mechanical energy, and there is therefore practically no difference between a motor and a generator except in regard to the way it is used.

In order to run a machine as a motor a certain electromotive force is applied to its armature. If the armature was held stationary, the amount of current which would pass through it in a few moments would be sufficient to raise its temperature to a point at which the conductors would melt. This would follow from the fact that the resistance of the armature winding is very low, and the conductors supplying current to the armature winding would be practically short-circuited. When the armature begins to revolve, however, it develops a counter-electromotive force, which opposes the electromotive force which is supplied to it, and as the speed of the motor increases, the counter-electromotive force increases until it reaches a point at which the electromotive force is balanced, after which it maintains constant speed.

When the current is first applied to the armature, before it has attained speed, there is almost a condition of short-circuit, and a very large amount of current passes through the armature. As the speed increases, however, the counter-electromotive force opposing the supply current cuts down this current gradually, until the normal speed is attained, at which time the current supplied is a minimum.

This counter-electromotive force of the motor is the same in principle as the electromotive force of the generator. When the conductors of the armature are revolved in the magnetic field of a generator, they develop an electromotive force. In the same way, when the armature coils revolve in the magnetic field of a motor, they tend in the same way to develop an electromotive force which opposes the electromotive force of the supply current, and is hence called counter-electromotive force.

The construction of fields and armatures of motors is the same as that of dynamos; that is to say, we may have two-pole or multipolar fields, and ring-type or drum-type armatures. The fields may be either shunt-wound, series-wound, or compound-wound, and the motors may be supplied either with constant current at variable electromotive force or constant electromotive force with variable current.

The tendency of the armature of a motor to turn is known as its torque. The torque is expressed in foot-pounds or the pull in pounds exerted at one-foot radius. The torque is proportional to the field strength and the armature current, and in a motor having a constant field strength, the torque is therefore directly proportional to the armature current. The starting torque of motors is one of the most important points to be considered, and it varies greatly with the winding of the motor.

For many purposes, as, for example, where it is necessary to start a motor on heavy load, a very high starting torque is essential, for, as we have just seen, if the torque is not sufficient to start the load when the current is applied to the motor the armature is held still and no counter-electromotive force is developed. This means that the supply current would be practically short-circuited through the armature, and the volume of current passing through it would, in a few moments, heat it to the point of destruction.

Certain kinds of alternating-current motors do not develop any torque whatever until their armatures have been brought up to their normal speed by some mechanical means. Such a motor can never be started under load, as it must be brought up to its normal speed before it develops any power

The foregoing explanation is sufficient to indicate the general theory of the electric motor, and the characteristics of the different types will be considered later.

Rotary Converters.

The rotary converter may be considered the connecting link between the alternating-current and direct-current systems. It is very similar in design to a direct-current generator, and is in effect an alternating-current motor driving a direct-current generator, the two being combined in one machine. The armature is similar to a direct-current armature, having a commutator on one end and collector rings on the other end.

On the direct-current end of the armature the commutator is connected to the armature winding in the usual manner, while on the alternating end of the armature the collector rings are connected to the same winding in the same way as described for alternating-current generators. The alternating current is supplied from the outside circuit to collector rings; this tends to drive the machine as an alternating-current motor, and the machine at the same time acts as a direct-current generator, the direct current being taken from the brushes on the commutator. The alternating-current end of the armature may be connected for either single-phase, two-phase or three-phase current, although two-phase and three-phase are most commonly employed.

In electric-railway work rotary converters are chiefly employed for reducing the high-tension alternating current of the transmission lines to 550-volt direct current for use on the cars. If two-phase alternating current is used, the voltages will be approximately 390 volts on the alternating-current side and 550 volts on the direct-current side. If the three-phase current is used, the alternating-current voltage will be approximately 335 volts.

In practice the high-tension alternating current first passes through transformers, to reduce it to the required voltage, and the current thus reduced in voltage is led to the alternating side of the rotary converter, while direct current is taken off from the opposite side. This machine, however, can be used in just the opposite way; that is to say, direct current may be supplied to the commutator end of the machine and alternating current led off from the opposite end.

The three kinds of machines described—the generator, the motor and the rotary converter—cover the entire field of dynamo-electric machinery. But there are a large number of different types of these machines, the general characteristics of which we are now prepared to examine.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Hoisting Ice on Inclined Plane.

O. L., Maroa, Ill.: Will a one-horsepower electric motor pull a 200-pound cake of ice up a 25-foot run set at an angle of 45 degrees and operated by an endless chain running on rollers? Will a 16-light dynamo run this motor to its full horsepower?

Answer.

On the assumption that the 16-light dynamo refers to a machine having sufficient capacity to supply 16 16-candlepower 110-volt lamps, or, in other words, assuming its output to be about 800 watts (this on a basis of 50 watts per lamp), and assuming a motor efficiency of 80 per cent. and a loss, due to friction, etc., of 30 per cent. in the chain, rolls, etc., the 200-pound cake of ice could be carried up the incline in 0.178 minute, and could be operated under the above conditions by a one-horsepower motor, which could be driven by the dynamo referred to above.

This conclusion was arrived at as follows:

50 watts $\times$ 16 = 800 watts, generator capacity, or 1.07 horsepower.

1.07 $\times$ 0.80 = 0.856 horsepower motor output.

0.856 $\times$ 0.70 (efficiency of chains, rolls, etc., with assumed loss of 30 per cent.) = 0.5992 horsepower available for lifting the ice.

33,000 $\times$ 0.5992 = 19,774 foot-pounds available for lifting ice.

$$\frac{19,774}{200} = 98.89 \text{ feet per minute permissible speed}$$

of vertical hoist.

Since the slope is 25 feet long and the angle of slope is 45 degrees, the vertical lift will be 17.68 feet.

$$\frac{17.68}{98.87} = 0.178 \text{ minute, or time of hoist.}$$

If the types of gearing, rolls, chain, etc., are such that their losses will be greater than 30 per cent., the time consumed for hoisting the block of ice will of course have to be proportionally increased. It will also be increased if the motor efficiency is less than 80 per cent.

Calculating Size of Wire.

G. W. P., Winnipeg: Will you kindly give me formula for calculating sizes of wire for three-phase systems? I would also like to know if the same size wire would do for a three-phase 15-horsepower induction motor, 500 volts, as used for a 15-horsepower direct-current motor, 500 volts?

Answer.

A formula in quite general use for determining the size of the conductors in any system, either "D. C." or "A. C.," is that of Mr. E. J. Berg, where the area of a conductor in circular mils equals

$$\frac{D \times W}{P \times E^2} \times K, \text{ where}$$

D = distance of transmission (one way) in feet.
W = total watts deslivered to consumer.
P = per cent. loss in line of W.
E = voltage at receiving or consumer's end of circuit.
K = is a constant, which
For continuous current = 2160.
For three-wire three-phase, all lights = 1200.
For three-wire three-phase, motors and lights = 1500.
For three-wire three-phase, all motors = 1690.

The values of the constant K for any particular power factor are obtained by dividing 2160 by the square of that power factor for single-phase and by twice the square of that power factor for three-wire three-phase. The resistance of the line wire, being taken at 10.8 ohms per mil-foot, for instance, where K = 1690, the power factor is assumed as 80 per cent.

It is evident from the above that the ratio of the cross-section of a conductor for a continuous-cur-

rent circuit to the cross-section of a conductor in a three-phase circuit is equal to $\frac{2160}{1690}$. In other words, the distance of transmission, the watts delivered, the percentage loss and the voltage at the consumer's end of circuit being the same in each case, only 78 per cent. of the amount of copper would be required in each leg of the three-phase circuit as would be required in one leg of a continuous-current circuit. The same size of wire could therefore be used for the induction motor as for the direct-current motor under the conditions referred to in the problem, provided the power factor is not less than 70 per cent.

Inspection Trip to Fort Wayne, Ind.

Messrs. E. K. Gillette, J. A. Brett and Arthur Brown, Cincinnati managers, respectively, of the Babcock & Wilcox Boiler Company, the Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company, headed a party which visited the Fort Wayne and Wabash Valley Traction Company's power plant as a compliment to Mr. Thomas Elliott, consulting engineer of Cincinnati, who designed the plant. The party left Cincinnati Saturday evening, March 9th, in a private train and arrived in Fort Wayne early Sunday morning. The Westinghouse Electric and Manufacturing Company was represented by Messrs. J. A. Brett, G. H. Gibbs, W. G. Leary and C. R. Gilliland; the Babcock & Wilcox Boiler Company by Messrs. Edward K. Gillette, F. C. Bitgood and William A. Heisel; the Westinghouse Machine Company by Arthur A. Brown of Cincinnati, and the Westinghouse Companies' Publishing Department of Pittsburg by Norman G. Meade.

Among the invited guests were Thomas Elliott, consulting engineer, Cincinnati Traction Company; J. B. Pevear, manager, Cincinnati office General Electric Company; Frank Strieby, railway department, General Electric Company; Herbert McNulta, chief engineer, Cincinnati Traction Company; James H. McCabe, manager, Cincinnati office Murphy Iron Works; Thomas J. Cookson, Cookson Steam Specialty Company; Edward McClintock, chief engineer, Union Gas and Electric Company, Cincinnati; C. T. Hughes, manager, Cincinnati office Ideal Engine Company; E. H. Lostetter, manager, Detroit Stoker and Foundry Company; John Neil, John H. McGowan Company; Arthur P. Taylor, Charles Taylor's Sons Company; Louis Arnold, Geo. Weiderman Brewing Company, Cincinnati; A. B. Jacobs, Jacobs & Arnold, Cincinnati; M. S. Folger, Cincinnati Traction Company; V. T. Price, Cincinnati office of the Buckeye Engine Company; George Knapp, Post Glover Electric Company, Cincinnati; Ralph P. Willis, R. P. Willis Company, Springfield, Ohio; George W. Cleveland and William P. Hubbell, Cincinnati Inspection and Report Bureau; W. C. Greene, American Engineering and Specialty Company; A. C. Beattie, Beattie Electric Company, Cincinnati; Dan Delaney, Dearborn Drug and Chemical Company, Chicago; L. F. Rainey, Cincinnati office General Electric Company, and Charles Kilgour, second vice-president Toledo Urban and Interurban Railway.

Remarkable Engine Performance at Edgar Thompson Steel Works.

Two of the four Allis-Chalmers rolling-mill engines purchased by the Carnegie Steel Company were installed about four weeks ago at the Edgar Thompson Works, Pittsburg, Pa., and have been in constant service ever since. These engines, said to be the most massive units ever built for rolling-mill service, have cylinders 50 and 78 inches by 60-inch stroke and frame and slide cast in a single piece which weighs 104 tons.

When the time came for installing the second engine the conditions in the mill were such that it was necessary to shut down before the work could be begun, although the engine foundations had already been duly prepared. The second engine was installed within 10 days after shutting down the mill, notwithstanding the fact that before the new engine could be erected an old one had to be torn out. The work was pushed forward unceasingly, using three shifts of men.

At the completion of the actual work of installing the second engine and within 30 minutes after steam was first let into the cylinders, the engine was doing its full work rolling steel rails. These two units since the moment they were first started, have never stopped running, except on Sundays, from 7 o'clock in the morning to 5 o'clock in the afternoon. The two remaining units of this type now being built will be installed at the Homestead plant.

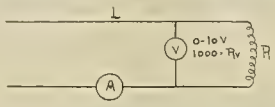
The average speed at which these engines operate is about 75 revolutions per minute. The engines are intended to work non-condensing under a steam pressure of 150 pounds per square inch. Under these conditions the horsepower developed at the most economical load is 5,000 indicated horsepower, and the maximum 8,000 indicated horsepower.

Elimination of Instrumental Error in Resistance Measurements.

By V. L. Hollister.

The practical measurement of resistance by the fall-of-potential method is subject to an error due to the introduction of the measuring instruments into the circuit, without taking into account the errors of calibration reading, or the personal equation of the operator.

Fig. 1 shows the connections normally used when the resistance (R) is small, or when a large current is employed. Since the ammeter measures not only the current flowing through (R), but also



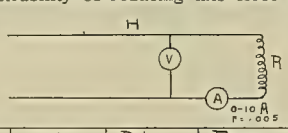
R	V	I_V	I_T	Apparent R	Error	%
.1	10	.01	100.01	.09999	.00001	.01
1	10	.01	10.01	.999	.000	.1.
5	10	.01	2.01	4.9751	.0249	.49
10	10	.01	1.01	9.90099	.1	1.
100	10	.01	.11	90.909	9.1	9.9

$$y = \left[1 - \frac{R_V}{R + R_V}\right] 100$$

FIG. 1 AND TABLE 1. RESISTANCE MEASUREMENTS.

that which passes through the voltmeter, if the latter current is appreciable in value, the error due to these connections is large. Large values of resistance (R), measuring small currents, make the voltmeter current of greater importance, and therefore the error larger. Under the latter conditions the connections shown in Fig. 2 are used. The ammeter no longer measures the voltmeter current, but a new error is introduced, viz., the resistance of the ammeter is added to that of the measured resistance (R). If the ammeter resistance is large or appreciable with the value of (R), the error is large. The ohmic drop in the ammeter used in Fig. 1 is evidently of no effect on the accuracy of the measurement.

The desirability of reducing this error to a mini-



R	V	R + r	Error	% Error
1	100	1.005	.005	.5
5	100	5.005	.005	.1
10	100	10.005	.005	.05
50	100	50.005	.005	.01
100	100	100.005	.005	.005

$$y = \left[\frac{r}{R}\right] 100$$

FIG. 2 AND TABLE 2. RESISTANCE MEASUREMENTS.

mum need not be dwelt upon. We are interested to know, however, at what value of (R), in taking a series of measurements for decreasing or increasing values of such resistance, the connections should be changed. For instance, if (R) varies from 0.1 to 100 ohms, at what point, for correct measurement, should the connections be changed from those shown in Fig. 1 to those of Fig. 2? To answer that question, let us assume a specific case, with standard instruments, and calculate the error for each set of connections.

With connections made as in Fig. 1, let the voltmeter (V) have a zero to 10-volt scale, with resistance of 100 ohms per volt for full-scale readings, or 1,000 ohms. Let the ammeter read zero to 100 amperes, and let (R) vary from 0.1 to 100 ohms. Then we may make out a table of assumed values and calculated values as in Table 1.

In Table 1 the first column gives values of (R) assumed; the second shows the voltage at the terminals of the voltmeter, while the third gives the current which passes through the voltmeter. Dividing the voltage impressed by the resistance (R) gives the value of the current flowing through (R). That current, plus the voltmeter current, is the current flowing through and recorded by the ammeter. The apparent resistance of (R) as obtained by dividing the voltmeter reading by the ammeter reading is found to be less than the true value of (R). The differences between the apparent and true resistance are recorded in the sixth column. The percentage of error is computed and shown in the last column. It is to be noted that the higher values of (R) give comparatively larger values of per-cent. error.

For connections given in Fig. 2, the calculations are shown in Table 2. Here the voltmeter used is a 0-100-volt instrument, with a resistance of 10,000. The ammeter gives a full scale reading of 10 amperes, with a resistance of 0.005 ohm. The resistance across which the voltmeter reads the drop is evidently the resistance (R) and the ammeter. Thus, in the third column (Table 2) the sum of these two resistances is given. The error is evidently only the ammeter resistance, and is recorded in column four and as percentages in column five. The per-cent. error decreases as (R) increases.

In tables 1 and 2 sufficient points have been calculated to determine the curves (H) and (L), Fig. 3, under the conditions assumed, without regard to the fact that, for instance, the current would be too large to decrease (R) to one ohm in Table 2.

In the curves, Fig. 3, resistances and per-cent. errors have been plotted for both cases. (H) shows the values for high-resistance connections, as shown in Fig. 2; (L) is the curve for values in Table 1, or the connections shown in Fig. 1.

Suppose the operator is measuring a resistance of 10 ohms = (R). The curve (H) shows him that the connections of Fig. 2 will give the least error. As (R) decreases, for those connections, the error increases. At a point of approximately 2¼ ohms the curve for the connections shown in Fig. 1 crosses the (H) curve. Continuing the measure-

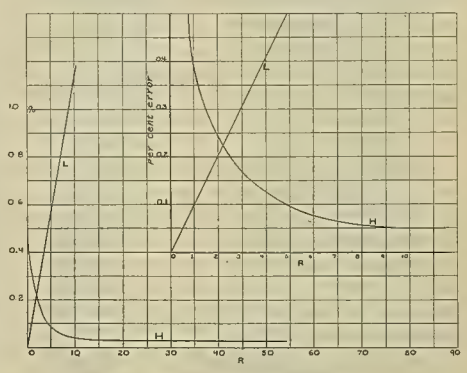


FIG. 3. RESISTANCE MEASUREMENTS.

ments for small values of (R), with connections as in Fig. 2, the error increases, but, if at 2¼ ohms the voltmeter is changed to correspond with Fig. 1, smaller values of (R) will reduce the per cent. of error.

The crossing of the two curves thus determines the point of maximum error and the value of (R) at which the change of connections should be made.

The equation of the curve marked (L) is

$$y = \left[1 - \frac{R_v}{R + R_v}\right] 100$$

Where y = per cent. error
R_v = resistance of low-reading voltmeter
R = resistance to be measured.

The equation of the curve (H) is

$$y^1 = \left[\frac{r}{R}\right] 100$$

Where r = the resistance of the low reading ammeter
y^1 = the per cent. error.

For any set of instruments for which r and R_v are known, the value of (R) at which the change of connections should be made is found by equating the two equations with the constants inserted for the particular instruments and solving for (R).

In the case here assumed,

$$r = 0.005.$$
$$R_v = 1{,}000.$$

Then for the (L) curve,

$$y = \left[1 - \frac{1{,}000}{R + 1{,}000}\right] 100,$$

and for the (H) curve,

$$y^1 = \left[\frac{.005}{R}\right] 100.$$

At the point of crossing of the two curves $y = y^1$,

$$\text{or, } \left[\frac{.005}{R}\right] 100 = \left[1 - \frac{1{,}000}{R + 1{,}000}\right] 100.$$

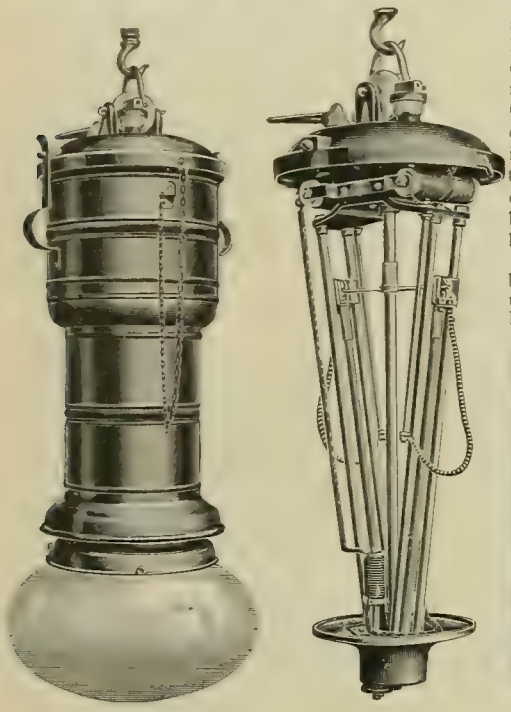
From the above we find the value of (R) = 2.24 ohms.

To the Japanese, it is asserted, belongs the credit of constructing the first torpedo to be fired by wireless apparatus. The problem has been studied for a considerable length of time by naval men in different parts of the world. Tests which were recently conducted by Japanese experts, it is said, were very successful.

Helios Flaming Arc Lamp.

Flame or flaming arc lamps are now attracting much attention. The main structure of the one illustrated consists of a heavy brass tube connecting the lower brass plate with the top casting and to which is secured a casting which supports the resistance spools and the carbon-holder guides. Inside of the main tube is a rod operated by a magnet in the top of the lamp, which is energized when the current is thrown on, draws the rod upward, and thus, by means of a presser foot at the lower end of the rod, separates the carbons and strikes the arc.

The blowing magnets (shown in the right-hand illustration), as well as the plunger magnet, are wound with asbestos insulated wire. The flexible cables leading to the carbon holders are insulated with glass beads. The resistance spools are the well-known Helios grooved porcelain spools, in the grooves of which is wound the resistance wire.



HELIOS FLAMING ARC LAMP.

It will be noted that there are no clutches, chains, gears or shunt windings in this lamp. The lamp feeds entirely by gravity, and the bridge connecting the carbon holders, which is clearly shown in the illustration, insures equal feeding of the two carbons. Substantial binding posts are provided. The cases are made of either brass or bronze, in any desired finish, and being waterproof, can be used either in or outdoors. A special shaped globe is so designed that the light rays will pass through it nearly at right angles. In other words, the shape of the globe is practically the shape of the arc itself.

As these lamps require only 40 volts at the arc, it is possible to operate two of them in series on 110 volts, and when so operated and adjusted for a current consumption of 10 amperes, they have, according to the manufacturer, the Helios Manufacturing Company of Bridesburg, Philadelphia, an efficiency of 0.25 watt per mean hemispherical candlepower. The distribution of light from the flaming arc lamp is much superior to the distribution of light from any other type of arc lamp, and particularly with a lamp such as the Helios, on account of the absence of all obstructions below the arc. It is said that two of these lamps will give as much actual light as six enclosed-type arc lamps and will consume only one-third the amount of current.

The light is of a pleasing appearance, and while lamps of this type have so far been little used except for outdoor illumination, there seems to be no reason why they should not be used indoors, particularly in railroad stations, ferry houses, foundries, machine shops and other places of that character, especially if there be any steam or smoke present, because the reddish rays from the flame lamp are more penetrating than the rays from lamps of other types. This makes the lamp very desirable for railroad stations, steel mills, foundries and the like.

All the metal parts, other than the top casting and the case, are nickel plated. The case can be furnished in any desired finish.

The lamp will burn equally as well as when operated four in series on 220 volts as when connected two in series on 110 volts, and by the addition of two resistance spools, for which provision is made in every lamp, the lamps can be adapted for single burning on 110 volts, or two in series on 220 volts. The maximum efficiency is secured when the lamps are connected two in series on 110 volts or four in series on 220 volts. However, there is no necessity for doing this, as a single lamp burning on 110 volts, adjusted to take six amperes, will give twice as much light, it is asserted, as any five-ampere enclosed arc lamp.

All parts of these lamps are built to standard gauge and are interchangeable. The resistance is self-contained, and, although the carbons are 400 millimeters (16 inches) long, the entire length of the lamp, from the top of the hanger eye to the bottom of the globe, is only 30 inches and the weight but 25 pounds complete.

Recent Steam-turbine Installations.

The successful starting of a high-power steam-driven unit, whether reciprocating or rotary, is always an operation accompanied by more or less liability to accident, due to any one of the manifold elements in design, construction or erection which may influence the final results. The Allis-Chalmers Company has been particularly fortunate in successfully placing its steam turbines and generators in service in various parts of the country. Practically without exception these units have been erected, put into operation and accepted in record-breaking time without accident or mishap of any kind.

One of the first of the large Allis-Chalmers turbo-alternators to be installed was the 5,500-kilowatt unit at the Kent Avenue Station of the Brooklyn Rapid Transit Company. Steam was turned on on March 22, 1906, to dry out the generator. On March 27th, owing to a breakdown in one of the other plants of the Rapid Transit Company, a sudden call was made for power. The new unit was hastily put in operation and within 20 minutes after the preparations had been completed it was delivering 4,000 kilowatts. Since then this turbine has been operating continuously, generating on an average 6,000 kilowatts and up to a maximum of 8,300 kilowatts, taking heavy loads on the morning and evening peaks. At the Brooklyn Edison Company's Gold Street Station the erection of a 5,500-kilowatt Allis-Chalmers turbo-alternator was begun in April and completed in very short order, the machine being operated for the first time on June 16th. From then on this unit has satisfactorily carried all the load to which it has been subjected.

ALLIS-CHALMERS STEAM TURBINE (6,000 KILOWATTS, 750 R. P. M.)

A 1,500-kilowatt Allis-Chalmers turbo-generator unit at the power house of the Memphis Consolidated Gas and Electric Company, Memphis, Tenn., was shipped on September 8th and ready for steam and condenser pipe connections on September 16th. On November 15th the steam connections were blown out and the machine placed in operation.

A 500-kilowatt Allis-Chalmers unit for installation in the power house of the Western United Gas and Electric Company of Aurora, Ill., was delivered complete on October 8th. It was ready to turn over on October 11th and the generator was dried out by the 14th. The new unit was put on the circuit October 17th and was immediately called upon to carry an overload which it did satisfactorily. Since that time this turbine and alternator have undergone rigid acceptance tests both at overload and three-quarter load, with the result of having bettered the guaranteed steam consumption by 8¼ per cent. for the overload and 9.6 per cent. for the three-quarter load test. The unit has been in continual operation since, carrying all loads placed upon it.

The power station of the city of Jacksonville, Fla., has a 500-kilowatt Allis-Chalmers turbo-generator unit fully erected and operating and a second unit of the same capacity on the way to Jacksonville. The first unit as the result of an accident to the other apparatus in the power house was suddenly called upon to pull 600 kilowatts for seven hours straight and a maximum load as high as 700 kilowatts, with entirely satisfactory results.

Several other instances of like character could be mentioned.

Out of three 1,500-kilowatt units for the Milwaukee Electric Railway and Light Company, one now being erected will probably be started up in the course of the next two or three weeks. The second turbine has been received on the ground but its erection not yet begun.

A New Couple-type Storage Battery.

In operating fire-alarm and police-signal telegraphs, private-branch telephone exchanges and railroad-signal systems, only small amounts of current are required, but it is used on a closed circuit, and absolute reliability of operation overrides all other considerations. Closed-circuit work prescribes a low rate of discharge and freedom from polarization. It is evident that the storage battery is superior to primary cells in requiring hardly more than one-third of the space for equal amperage, in freedom from the formation and creeping of salts in the jars, in requiring less cleaning, in materially reducing the cost of maintenance and renewals of parts, and in having a lower internal resistance, as well as more uniform voltage.

For fire-alarm telegraphs and similar installations an advantageous form of storage cell has been found in the "couple" type, which has but one pair of plates in each cell, as but small ampere capacity is needed, while a low rate of discharge, accessibility of parts, and absolute certainty of action are essential.

In many types of cell electrolytic action takes place at varying rates in different parts of the same grid, producing local distortion, which causes the active material to drop out as sediment, shortening the life of the plate. Necessarily the action between the positive and negative sides, which face each other, is far more intense than between the sides, turned away from each other, so that charge and discharge take place mainly on the facing sides, producing a tendency to buckle and wear unevenly.

NEW COUPLE-TYPE STORAGE BATTERY.

All these defects are eliminated by placing the plates edge to edge, as in the case of the new Gould "tandem" couple type, instead of face to face.

The positive plate of each cell is permanently joined to the negative plate of its neighbor by broad, thick lead bonds, "burned" to the plates, so that no bolts are used except at the end of each row of cells. This permanent connection saves considerable time and trouble in assembling the battery, enables the plates to be quickly lifted out for inspection, as well as for cleaning of the cell, and avoids corrosion of bolted connections by sulphuric-acid fumes, besides having practically negligible ohmic resistance. This construction presents such advantages as low internal resistance, permanent connections, convenience and simplicity in handling, accessibility for inspection and reliability of operation.

Tennessee River to be Inspected.

It was recently decided at Washington, D. C., that a board of three engineers make surveys and examinations as to the advisability of improving the navigation of the Tennessee River by the construction of three dams. The sub-committee of the House committee on rivers and harbors had not reported favorably on the bill authorizing the Muscle Shoals Hydro-electric Power Company to develop the Muscle Shoals waterpower, and only after considerable deliberation was it decided to place the matter in the hands of three engineers.

The first dam to be built will probably be located at the head of Patton's Island, the second between the fifth and sixth locks and the third six or seven miles up the river from the second dam, thereby creating slack water from the Elk River Shoals to the head of Patton's Island.

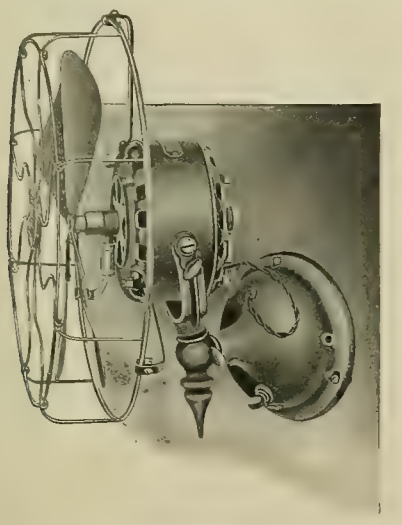
The board of engineers is to inquire into the practicability and the feasibility of overflowing the canal by means of the three dams. The engineers will report what amount the government would have to spend to make the present canal sufficient for navigation, also the amount necessary to make the river a navigable stream from the foot of Big Muscle Shoals to the head of Patton's Island. Another estimate relates to the cost to the government if it desired to make an appropriation to a power company undertaking to construct the three dams.

Japan ranks well up among the copper-producing countries of the globe. Last year it turned out 50,000,000 catties, or nearly 67,000,000 pounds of copper, of which over 13,000,000 pounds were produced in the Ashio mines by Japanese labor exclusively.

General Electric Fan Motors for 1907.

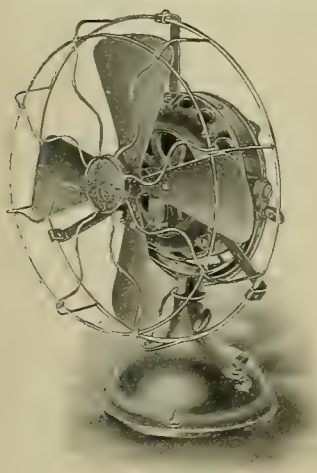
Fan motors have reached a place where they are perennially useful. Not only are they now available for cooling purposes in summer but they may be used to augment the heating during the colder months as well as to supply air in motion for dozens of other purposes. When the central-station man sells a fan motor today it becomes, with a few judicious hints, not the least valuable of revenue getters.

The General Electric Company makes a complete line of fan motors which can be advantageously introduced as business getters during both summer and winter. Desk fans, as usual, are furnished in all different types for standard voltages and frequencies, or can be wound to order. Both direct and alternating-current fans of the desk type can be obtained with 12-inch or 16-inch blades. These, with the bracket-type fans of the same design and sizes, are available for all classes of service. In addition to the ordinary uses for cooling, office desk or domestic ventilation during the summer months, they will keep the frost from the storekeeper's window or supply air currents for advertising novelties of various kinds.



ALTERNATING-CURRENT WALL FAN.

In a store on a windy street an odd use of a fan of the desk-type was recently noticed. The customers' entrance to the shop was accompanied by a stiff breeze which badly disarranged the nearby counters. A large fan motor was mounted opposite the door so that the force of the air counteracted the entering breeze, the door by this method being opened in comparative calm.



ALTERNATING-CURRENT DESK FAN.

SPRING-SUSPENSION FAN FOR TELEPHONE BOOTH.

ALTERNATING-CURRENT EXHAUST FAN.

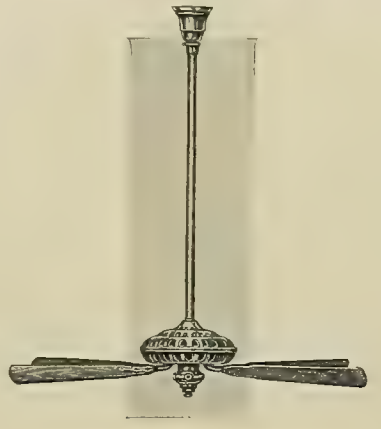
Combining the compact and efficient general design of the desk and wall-bracket types of fan motors, with special mountings, are the telephone-booth ventilating fans and the exhaust fans. The spring suspension of the former eliminates vibration in the telephone booth. The General Electric Company can furnish eight-inch telephone-booth fans for both alternating and direct current at commercial voltages and frequencies. The illustration of the exhaust fan indicates the method of mounting. This type of fan is useful in both private and public kitchens, in restaurants, lavatories and stores where a permanent method of ventilation is desirable.

Quite recently the use of the fan motor in the cold-air pipe of the hot-air furnace has been exploited as an economical addition to this heating system. The square frames of the exhaust-fan types might readily be adopted for this purpose and a permanent installation be made.

A ceiling type of fan is illustrated. The broad wooden blades of this type of fan suit them especially for the cooling of large areas without disagreeable drafts. The fan blades are 52 inches in diameter for alternating-current fans and 56 and 58 inches in diameter for the direct-current motors. All have four blades and can be obtained in plain or in ornamental designs. The alternating-current ceiling fans have two or three speeds, while the 58-inch blade direct-current fan can be operated at three speeds, and the 56-inch blade direct-current fan at a single speed. The motors are wound for all commercial voltages and frequencies.

For soda fountains, public dining tables, etc., a combination column fan and electrolier forms an artistic fixture. Such a fan is illustrated. The motor is designed for alternating current, and a 58-inch four-blade fan is used.

Fan-motor design has come to be more or less standard, but certain definite principles are involved in all these fan motors made by the General Electric Company. Both direct and alternating-current fans have special blade design, a positive trunnion adjustment and liberal lubrication. The last named is so made that oil-throwing is impossible.



ALTERNATING-CURRENT CEILING FAN.

The fan blades are designed to distribute the air at a wide angle and not deliver it in a straight column covering a limited area. Disagreeable humming has been eliminated by carefully balancing and hanging the blades.

Mention has been made of various speeds of fans. This speed variation in alternating-current motors is obtained by a six-point reactive coil and switch. In this way the General Electric standard desk or wall-bracket type is of well-nigh universal application, since it may be operated on slow speeds for the office desk or home and on the higher speeds for stores and halls. Similar speed regulation is obtained in the direct-current type of desk and wall-bracket fans by a self-contained four-point switch and indestructible resistance, giving three speeds.

All the various types of fan motors which have been mentioned are to be obtained in standard commercial sizes and for any commercial voltage and frequency. Special windings for operation on odd voltages or frequencies can also be furnished to order if desired. In general the standard finish for General Electric fan motors is black with brass trimmings, but this, too, may be varied to meet special conditions, and fans can be decorated to match office fittings or to harmonize with the hardware in private dwellings.

Extensions at Fort Wayne.

Relating to the announcement recently made in the Western Electrician that the Fort Wayne Electric Works will spend a large amount of money in erecting extensions to the plant at Fort Wayne, Ind., the Fort Wayne News of March 11th says that, in addition to the new incandescent-lamp factory, the Fort Wayne company will double the capacity of the present plant. Four buildings will be erected, one of which will be four stories high and cover an area of 250 by 257 feet.

BOOK TABLE.

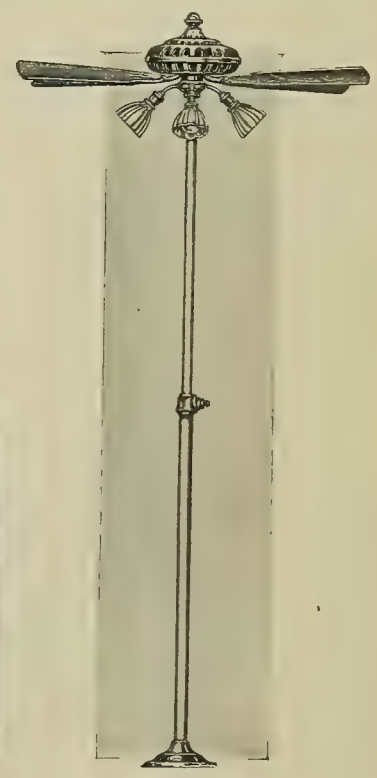
LONG-DISTANCE ELECTRIC POWER TRANSMISSION. By Rollin W. Hutchinson, Jr. New York: D. Van Nostrand Company. 1907. Pp. (5¼ by 7½ inches), 245, with 140 illustrations. Price, $3.

The object of this book is to convey a general knowledge of the present status of the hydro-electric utilization of energy: its transformation, transmission and distribution. While nothing new is contained in it, the work presents in a concise and convenient form information on the kinds of machinery and apparatus used in hydro-electric high-tension engineering, and the construction and operation of high-potential transmission properties. Only elementary mathematics is used, and while the author intended the book as a reference for engineers and a text-book for students, it can be intelligently read by any well-informed person. The first three chapters are devoted to the salient principles involved in the construction and operation of the hydraulic end of high-tension generating plants. The treatment of generators and the laws involved in transmission presuppose a knowledge of alternating currents and polyphase machinery. Illustrations are largely of standard apparatus of various types.

MODERN AMERICAN LATHE PRACTICE. By Oscar E. Perrigo, M. E. New York: The Norman W. Henley Publishing Company. 1907. Pp. (6 by 9¼ inches), 416, with 314 detail illustrations made from original drawings. Price, $2.50.

This is a really new book and probably the only complete American work on the latest practice in lathe and boring-mill operations as well as the construction of these important classes of machine tools and the latest developments in their manufacture. The author presents his knowledge of the subject in a pleasing manner, and the descriptions, illustrations and data are strictly up-to-date.

Lathe history and the relations of the lathe to manufacturing are given; also a description of the various devices for feeds and thread-cutting mechanisms from early efforts in this direction to the present time. Lathe design is thoroughly discussed, including back gearing, driving cones, thread-cutting gears and all the essential elements of the modern lathe. The classification of lathes is taken up, giving the essential differences of the several types of lathes, including, as is usually understood, engine lathes, bench lathes, speed lathes, forge lathes, gap lathes, pulley lathes, forming lathes, multiple-spindle lathes, rapid-reduction lathes, precision lathes, turret lathes, special lathes, etc.



COMBINATION COLUMN FAN AND ELECTROLIER.

There are 22 chapters on the various phases of the history, development, design and application of the lathe, ending with a chapter on electrically driven lathes. All these chapters are fully illustrated with drawings made especially for this work

The officials of the Alton (Ill.), Jacksonville and Peoria Railway announce that they are at work on the line which is ultimately to connect St. Louis, (Mo.) and Peoria and furnish freight and passenger service to all intervening cities and towns. Work has been in progress for some time and the track is now being laid north from Alton.

Electrification of the New York, New Haven and Hartford Railroad.

Within a few weeks the New York, New Haven and Hartford Railroad will put into operation the electric equipment by which all passenger trains will be run over 21 miles of its main line just outside of New York city.

The officials of the company are looking forward to a day not far distant when the same equipment will include the entire Shore Line from New York to Boston, making it, possibly, the first railroad of equal length to discard the steam locomotive entirely, except where it may be used for freight traffic.

The power used at present is an 11,000-volt alternating current, taken from overhead catenary-suspended wires. With the voltage applied directly to the wire, and with from four to six or more tracks to be equipped, the overhead construction is of the most substantial support. For the sake of maintaining high speed the wire is held comparatively horizontal, without the sagging of the ordinary street-railway trolley wire, and all danger of its falling is believed to be removed.

The normal height of the trolley wire above the track is 22 feet. The pantagraph type of trolley on the locomotives accommodates itself to any changes, up or down, in the height of the wire, due to variations in temperature. It is governed by compressed air instead of coil springs.

Another interesting feature of the construction is in connection with the pantagraph trolley on the locomotive. Instead of a wheel running along the wire, there is a cross-bar some 40 inches long for the contact, which permits a 15-inch play off the center, so that the delays caused on street-railway lines by "slipping the trolley" are obviated.

In connection with the change to electricity, the company has taken occasion to provide for future expansion of business by constructing two more tracks from Woodlawn to Port Chester, making it a six-track line. Although the two extra tracks will be used for freight exclusively, and it is planned to retain steam for the freight traffic for some time to come, the steel trolley-wire bridges have been made wide enough to cover these, as well as the four-track, which are being equipped for electricity.

Combined Stop-watch and Speed Indicator.

The accompanying cut shows Millis' combined stop-watch and speed indicator, manufactured by the W. J. Hartwig Company of Detroit, Mich.

This instrument is designed for counting accurately the revolutions of any machine or revolving

STOP-WATCH AND SPEED INDICATOR.

shafting. On pressing the instrument against the shaft center, the sweep-second hand is started which does the timing, also the minute and hour hand which does the counting. The indicator does away with the necessity of holding a watch in one hand and a speed indicator in the other. When the extension stem is removed the instrument becomes an ordinary stop-watch which can be used for timing meters or any purpose for which the stop-watch is indicated. The watch is manufactured in white metal, gold filled or silver case.

A Pointed Comparison.

Suppose two cases for comparison. Suppose one customer burns one electric lamp 20 hours. Suppose another customer burns 20 similar lamps one hour. The same amount of electric current will be required; but it takes 20 times as much machinery to supply the man who burns 20 lights one hour as it does to supply the man who burns one light 20 hours.

That's why electric-light companies have to have different prices to fit different conditions.—Edison Light, Boston.

New Electric Welding Apparatus.

W. Egel of Berlin has patented an apparatus for electrically welding thin iron plates, consisting of two easily replaceable roller electrodes, the upper of which is mounted on a spindle and driven by a hand-wheel. A bevel-wheel is fitted to the other end of the spindle to allow for driving mechanically. The fork carrying the upper electrode is extended to form a rack, into which a pinion is geared for the purpose of moving the electrode closer to or away from the lower electrode by means of a hand lever.

The plates to be welded, which may be very thin, are placed between the roller electrode and are continuously welded by the pressure between the upper and lower electrodes.

An apparatus for electrically welding spiral tubes, made by the Fabrik Elektrischer Schweissungen of Szepesvaralja (Hungary), consists of four rollers, two of copper and two of steel. The metal strip of suitable width is beveled on the edges to be welded, and after being passed through a rolling machine, the edges are introduced between the copper rollers and immediately afterward between the steel rollers. The four rollers are so arranged that the tube is wound into a spiral with the beveled edges overlapping. The copper rollers are connected to an electric circuit, causing the edges of the strip to be raised to a welding heat. The strip immediately passing between the steel rollers, the edges are rolled to the thickness of the walls of the tube, and the welding is continuous.

The same company has also devised a machine for welding together tubes at any desired angle The main tube and branch, after being cut at the joint in the required manner, are each mounted in a special clamp, the clamp carrying the branch tube being movable toward that carrying the main tube by means of a screw and hand-wheel. The clamps being connected to an electric circuit, the tubes are welded by pressure as usual. In order to weld pieces of tube at any desired angle, the carriers for the clamps are fixed in adjustable bearings.

The foregoing is taken from Science Abstracts, where it is credited to Elektrotechnik und Maschinenbau.

Electric Mining Locomotives in Colorado.

The Tomboy Mines Company has recently installed in the Cincinnati tunnel at Telluride, Colo., an electric locomotive equipped with two 7½-horsepower motors. It is capable of developing normally 15 horsepower at a speed of six miles an hour. It weighs four tons, is three feet eight inches wide and eight feet 10 inches in length over all.

With clean, dry rails this locomotive is capable of developing 2,000 pounds tractive effort on the level. The gauge of the track is 18 inches. The current used in operating the locomotive is received from a trolley at 250 volts, direct current, which is supplied by a small generator, placed in the Cincinnati shaft house. The generator is direct-connected to and driven by a two-phase 60-cycle alternating-current motor, the latter operating from the lines of the Telluride Power Company.

Installations of this nature are now considered almost indispensable in the various coal mines of Colorado, and are being extensively used by the larger metalliferous mining companies, the Newhouse tunnel at Idaho Springs having five locomotives, the Camp Bird mines having two, the Yak tunnel at Leadville two, and the Gunnison tunnel at Montrose two in each portal.

All of the above-named systems, with the exception of the Newhouse, use 250 volts on the trolley, the Newhouse using 500.

White River Power Project in Indiana.

It is asserted that the passage of the recent law authorizing electric-light and power companies to purchase and own waterpower within and without the state of Indiana, and to merge with hydraulic companies incorporated under the laws of the state, was secured by the Murdock-Marshall syndicate for the purpose of taking over the options held by Eugene Rush and others at Decker, Ind. It is said that the syndicate will now push to a rapid completion the proposed dam and power plant on White River at Decker, where 20,000 horsepower can readily be secured. The site is about midway between Evansville and Indianapolis, and it is the purpose of the syndicate to operate all the traction lines owned and now being constructed by the syndicate between Evansville and Indianapolis. Plans and specifications have been ordered for a dam and a bridge to be erected in such a way that the cars can run across the bridge over the top of the dam. There is considerable rejoicing over the matter, since it is believed that this is the beginning of the successful harnessing of White River in Southwestern Indiana for power purposes.

The Lexington (Ky.) Railway Company proposes to reconstruct its lines. About $200,000 will be spent in improvements.

Quantities of Material in Concrete.

Inexperienced contractors frequently lose money by assuming that the quantity of gravel, plus the quantity of sand required, will be equivalent to the volume of the finished concrete—that is, that 7½ cubic yards of concrete in the proportions of 1:2½:5 will require 2½ cubic yards of sand and 5 cubic yards of gravel. This is absolutely wrong, says the American Conduit Company of New York, since the grains of sand fill, to a certain extent, the spaces between the larger pebbles.

The following table is made up from Fuller's rule and represents fair averages for all classes of material. The first figure in each proportion represents the unit, or one barrel (four bags), of packed Portland cement; the second figure the number of barrels loose sand (3.8 cubic feet each) per barrel of cement, and the third figure the number of barrels of loose gravel or stone (of 3.8 cubic feet each) per barrel of cement.

Materials for one cubic yard of concrete:

Proportions.	Cement, Barrels.	Sand, Cubic Yards.	Gravel or Stone, Cubic Yards.
1:2:4	1.57	0.44	0.88
1:2½:5	1.29	0.45	0.91
1:3:6	1.10	0.46	0.93
1:4:8	0.85	0.48	0.96

If the coarse material is broken stone screened to uniform size it will contain less solid matter in a given volume than an average stone, and about five per cent. must be added to the quantities of all the materials. If the coarse material contains a large variety of sizes so as to be quite dense, about five per cent. may be deducted from all the quantities.

Example.—What materials will be required for six foundations, each containing 163 cubic feet?

$$\frac{6 \times 163}{27} = 36.2 \text{ cubic yards.}$$

If the proportions 1:2½:5 are selected, it is found, multiplying the total volume by the quantities given in the table, that 47 barrels of cement, 16½ cubic yards of sand and 33 yards of gravel will be required.

Concrete Railway Ties.

The committee in charge of way matters of the American Street and Interurban Railway Engineering Association desires to assist all who may require information upon the subject of concrete railway ties, and is to this end sending out a circular letter with the request that all roads which have been or now are engaged in experiments with concrete ties kindly notify the committee that they have been or are so doing, with information as to the method of construction used in the manufacture of the tie and the cost thereof, and forward a statement of results obtained and conclusions arrived at on account of these experiments.

The committee is also forwarding blanks to managers and engineers, through which it hopes to gather full information on the subject of rail corrugation. Information should be sent to Fred G. Simmons, chairman way committee, Public Service Building, Milwaukee, Wis.

Indiana Telephone Items.

The following-named telephone companies filed articles of incorporation with the secretary of state last week: The Patrons' Mutual Telephone Company of Plymouth; capital stock, $50,000. This company will construct and operate a system in Marshall County. The Citizens' Co-operative Telephone Company of Roachdale; capital stock, $2,000; president, T. E. Tobin; secretary, G. W. Stewart. This company will build an exchange in Roachdale and extend the system throughout Putnam County. The Perry Telephone Company of Cory; capital stock, $5,000. The declared object of the company is to build and operate a telephone system in Clay County, with principal exchange in Cory. The Citizens' Telephone Company of Ellettsville; capital stock, $2,500; directors, Fred I. Owens, John S. Brown and Thomas E. Minet. The company will establish an exchange and telephone system in Ellettsville. The Southern Indiana Telephone Company of McCutchanville; capital stock, $10,000; Philip H. Kippel, T. H. Umbech and Daniel Crisp, directors. The purpose of the company is to build and equip a telephone system in Vanderburg County, with home office in McCutchanville.

A severe wind and electric storm swept Indiana on the 13th instant, and hundreds of telephone wires were put out of commission. In many instances lightning followed the telephone wires into business houses and dwellings, but no one is reported seriously injured. At Noblesville over a hundred telephones were burned out, and the service greatly crippled.

The wires of the old Mutual Telephone Company and the Bell Telephone Company at Shelbyville have at last been connected, and the city is now served from one exchange.

Fifteen Independent co-operative telephone companies, operating upward of 1,000 telephones in Boone and Hendricks counties, have severed connection with the Bell Telephone Company, as sublicensees, and returned to the Independent fold.

They will now be furnished Independent long-distance connection.

The Chicago Telephone Company suffered a loss of $1,000 to its exchange in East Chicago by a recent fire, which destroyed the Todd Opera House Block. A new switchboard will have to be installed.

The seven telephone companies doing business in the western and southern portions of Ripley County have been consolidated under one head, and Perry F. Brown of Napoleon is president of the consolidated company. S. S.

Telephone News from the Northwest.

The Farmers' Telephone Company of Richland Center, Wis., has bought the lines and exchanges of the Union Telephone Company in Richland County.

Senator H. E. Hanson has introduced a bill in the Minnesota Legislature to prevent telephone companies making unnecessarily low rates in competition for injuring another company.

The Legislature of South Dakota has passed a bill putting telephone companies under the control of the Railway Commission, and has also created a state telephone commission. The latter has no fund for a competent telephone man, who is provided for on the board, but it is improbable that the board will be effective this year.

The Montana Legislature has passed a bill requiring railroads to maintain a telephone booth at all depots in the state.

A bill has been introduced in the Minnesota Legislature to prohibit charging tolls between municipalities which adjoin. This would do away with the toll charge of 10 cents between Minneapolis and St. Paul.

The West Liberty (Iowa) Telephone Company has sold its system to N. S. Nellick.

The Independent Telephone Company of Omaha, Neb., has begun work on its new system there.

A telephone company has been organized at Albany, Neb., with Mr. Baker as president. R.

The Proposed Telephone Merger.

At a recent hearing before Joseph Lawson it appeared that a contract had been entered into between the United States Independent Telephone Company of Rochester (allied with the Stromberg-Carlson Telephone Manufacturing Company) and the American Telephone and Telegraph Company (Bell), whereby the stock and securities of the Independent company were to be transferred to the latter company.

It was also shown, it is said, that the New Jersey Trust Company was the authorized agent of the Bell company in conducting the negotiations.

Attorney-general Jackson of New York had previously issued an injunction restraining the proposed merger.

The hearing was held for the purpose of ascertaining whether the proposed transfer of stock would be in violation of the anti-trust law of New York state. Many prominent telephone men were present at the investigation.

Central Union Inspectors and Wire Chiefs Meet.

A meeting of all chief inspectors and wire chiefs of the first district in the Indiana division of the Central Union Telephone Company was held in South Bend, Ind., on March 12th. Messrs. J. Loyd Wayne, third division equipment foreman; H. B. Lewis, division line foreman, and W. A. Cora, division wire chief, all of the division offices at Indianapolis, with Mr. J. L. Putnam, district superintendent of South Bend, spoke before the meeting. It was the general opinion that a one-day session is not long enough properly to discuss questions which come up, although much benefit was derived from the discussion at this meeting.

GENERAL TELEPHONE NEWS.

Louis Legan & Son have sold the telephone exchange in West, Tex., to A. F. Luallin.

The Interstate Telephone Company of Stuart, Neb., has been incorporated with a capital stock of $100,000.

The Winters (Tex.) Independent Telephone Company has been incorporated with a capital stock of $10,000.

The Home Telephone Company of Springfield, Mo., has been incorporated and is arranging to erect a modern telephone exchange building.

The Tavis Moore Telephone Company of Glen Ullin, N. D., has been incorporated with a capital stock of $50,000. Incorporators are L. Tavis, W. T. Moore and others.

The Chicago Telephone Company has begun the removal of telephone poles on some of the streets in Joliet, Ill., the company's purpose being to place its wires in underground conduits. The underground work will not be easy, as some of the conduits may have to be tunneled through solid rock.

CORRESPONDENCE.

Continental Europe.

Paris, March 5.—While the city of Marseilles is one of the best equipped on the Continent as regards electric tramways, this is by no means the case for electric lighting. Some of the principal avenues and streets have arc and incandescent lamps, but the lighting is confined mainly to the business quarters, and many large streets are lighted only by gas, and this in a way which leaves much to be desired. Since the contract has been renewed between the municipality and the gas company, the latter is furnishing low producer gas to a large extent, and poor lighting is the consequence, as may be expected. At present the question of improvements to be made in the city lighting has come up in the Municipal Council, and a project is on foot for adopting electric light to a large extent. After drawing up a list of the streets which are to be lighted on the proposed plan, the council is making arrangements with two different lighting companies for carrying this out. These companies are now drawing up the plans for such a lighting system and will submit them to the council. One of the plans is to be accepted, should it fill the requirements, or the council will draw up a third project by combining the two. It is probable that in any case the two lighting companies will be given the concession according to the final project. The financial question will, of course, weigh considerably in accepting one of the proposed plans.

Cannes, another city in the Mediterranean region, is looking for an increase in the electric lighting and has already advertised for bids from several of the leading companies. The Municipal Council has on hand a project for utilizing a distant hydraulic plant so as to bring a good supply of current into the town. For this purpose a fall on the Cordebasque stream could be used. A committee has been appointed for looking into the feasibility of the question and will make a report to the council. While waiting for the hydraulic project to be realized, which will take some time, the municipality proposes to erect one or more stations in the town and will no doubt use a producer-gas plant for the purpose. In this way it is expected to secure a supply of current at a lower price than is now paid.

It is proposed to erect a large electric furnace plant at Epierre, France, and this will add to the number of important electro-metallurgical works which are now operating in the country by hydraulic power. A large company has been formed, and it is applying for the concession.

News comes from Rome that the Italian Postal and Telegraph Department has brought up a bill in the Chamber of Deputies which provides for a credit of $5,000,000, to be devoted to improving the postal, telegraph and telephone service of the country. As regards the telephone and telegraph projects, the sum of $2,400,000 is to be allotted for the purchase of telegraph material. It is also proposed to connect the mainland with Sicily and Sardinia by a radio-telegraphic system on the most modern plans. The sum of $1,600,000 will be devoted to the increase of the telephone system.

It is proposed to build an electric railway from Linares to Jaen, Spain. The proprietors of the Venta Chica iron mines in the province of Linares are to construct this line and it will be used mainly for the transport of ore from the mines to the railroad station of Jaen. Passengers will also be carried upon the road. A new section of tramway line is to be built in the city of Madrid. The Societa del Tranvia del Este has applied for the authorization to build the section which will connect their tramway system with the Guindalera line in the city. A Barcelona company is asking for a concession for a double-track narrow-gauge line which will run from the city to the suburbs.

A concourse of electric appliances is to be held at Amiens, France, and it promises to bring out some interesting features. It is organized by the Société Industrielle, and the apparatus is to be shown in actual working order. Prizes will be awarded for the best exhibits. Among the instruments called for, I may mention a dynamometer for measuring the power taken by a machine tool, loom, or other such appliance, an improved fuse block which works on a well-determined current, an improved storage-battery cell which will show distinct advantages; also an incandescent lamp which can be made in sizes up to 250 volts and take below 2½ watts per candle. Gold medals and other prizes are to be awarded. A. DE C.

Great Britain.

London, March 7.—The result of the triennial London County Council elections has created a somewhat different position with regard to the electric power bills which have been deposited for this session of Parliament. Apparently, with some anticipation of eventualities, the government postponed the second reading of the bills until after the election, which took place two days ago. This has now become such a political matter, as I have before pointed out, that the complete overthrow of the late council at the polls should, at all events, equally result in the rejection of the principle of municipal trading apropos of this question. With the excision of the socialist element, and the advent of a party of municipal reformers in office, the party organs have already sounded the death knell of the council's electric power scheme. Whether this will be so is problematical.

Regarding the existing electric-light companies, the reduced dividends which have been noteworthy since Mr. Merz first introduced his bill three years ago, still call forth much comment. Only one company has been enabled this year to maintain its last dividend; and the main cause is the reductions in price, plus a very considerable and really alarming increase in the assessments of the undertakings at the hands of the respective local authorities. But the companies can hardly expect sympathy while their dividends are over 10 per cent., as the majority are.

One other matter concerning power supply: Since the idea of large power schemes was first mooted it has always puzzled me why many county councils throughout England have not taken up the idea. The Durham County Council toyed with a scheme for a bit, but subsequently dropped it. This week, however, the Middlesex County Council (which joins London, and is partly scheduled in the London power bills) has been asked to promote a similar scheme to that of the London County Council. No decision has yet been come to.

The first instance in Great Britain of the adoption of the American idea of tramway companies owning parks and providing amusements therein, is at Wakefield, in Yorkshire. The directors of this company have acquired a very fine park and have floated a separate company to exploit it. It is the intention to provide bands, etc., and to run special tramcar services in connection herewith.

Two Dolter surface-contact tramway systems are now in operation at Torquay and Rawmarsh. I shall have something fuller to say about them shortly.

The Great Western Railway Company has just completed the installation of a system of signaling which gives audible notice to the driver of a train in his cab. The apparatus has been designed and constructed by the railway company's permanent officials, and the fact that officials of other companies speak well of the arrangements is sufficient argument that the design is good. A short third rail is installed between the track rails near each signaling position, the surface of which is curved upward, so that the top is four inches above the running rails. This is electrically connected to a switch at the signal box. Under the engine is a shoe, the normal position of which is 2½ inches above the rail level. When the shoe passes over the ramp or third rail a local circuit on the engine is opened, and the whistle sounded. This whistle continues until the driver stops it. This is the caution signal. The signalman can suppress the caution signal in such a way that the contact shoe in passing over the ramp completes the circuit so that the whistle valve is kept closed, and at the same time it starts a bell ringing which the driver must, as in the case of the caution signal, stop.

It is somewhat remarkable that both London County Council stock and the shares of the London electric-lighting companies have increased in value since the result of the election on Saturday.

A delightful instance of municipal quarrelsomeness is afforded by the action of the Lambeth (London) Borough Council against the South London Electric Supply Corporation. Some years ago the company acquired the council's electric-lighting order, and at the same time entered into an agreement to maintain a refuse destructor in connection therewith, for the purpose of disposing of the local refuse. Things went smoothly until some ratepayers complained of the nuisance caused by the destructor. The council took action against the company, and as it was impossible to carry on the destructor in any other way, the latter discontinued the use of it. Thereupon the council took another action to enforce the terms of the agreement that the company should dispose of the local refuse. Thus there was the beautifully anomalous position that the council in one action sought to make the company do a thing which in another action the council sought to prevent. The whole matter is to be tried again, as, in the opinion of the Court of Appeal, the original judge was not made fully aware of the facts.

The formation of an imperial technical college, which was recommended in the report of a special committee some few years ago, is to form the subject of an official application to Parliament for a charter of incorporation.

Herr Poulsen's wireless-telegraphy system has attracted the attention of many government experts and officials in Great Britain. Since the announcement of his invention at the Berlin conference a company has been formed here, called the Amalgamated Radio-telegraph Company, for the purpose of commercially working the system. Several series of experiments have been made, and the latest set invoked the aid of an armored cruiser off the Tyne. It is stated that the system will send the same distance for one-tenth the power of the ordinary wireless-telegraph system, and the object of the cruiser above mentioned was to do its best to prevent messages being sent from Whitley, in England, to Ejsberg, in Denmark. The attempt is

stated to have been successful, the messages between the two stations being received quite well. G.

Dominion of Canada.

Ottawa, March 16.—The Ontario government has decided to grant the application of the Toronto Electric Light Company for an increase in its capital stock from $3,000,000 to $4,000,000.

The annual meeting of the West India Electric Company has been adjourned to meet in Montreal on June 12th, next. The controller's office was wrecked and the company's accountant killed during the recent earthquake in Jamaica, so that it was impossible to have all accounts ready in time. An accountant has been sent from Montreal to prepare the accounts to present at the adjourned meeting.

The Electric Light Company of Carleton Place, Ont., has agreed to sell to the town its present electric light plant, now in operation, and everything in connection with the same, together with the water-power on the north side of the river, for the consideration of $40,000.

The Silver Bell Electric Railway Company is being incorporated with a capital of $1,500,000, to operate in the cobalt region of Ontario. It is a close corporation. The road will run from Liskeard down the lake shore to Halleybury to serve the town. The west track will run to Cobalt. It will run between Sharp and Mud lakes along the northern end of Loon Lake to Portage Bay, then down the Montreal River into Latchford. Power will be developed from the Montreal River.

The Quebec legislature has incorporated the National Telephone Company, with a capital of $5,000,000 stock and $5,000,000 bonds. It will compete with the Bell Telephone Company. The new concern has been given large powers of expropriation, and it can expropriate for its work in any city in Quebec province.

The Union of Municipalities, of New Brunswick province, has made formal demand upon the provincial government to secure control of telephone lines in the province, and to carry on business as a government-owned utility. W.

Winnipeg, March 15.—The taxpayers of Yorkton, Saskatchewan, decided to take over the telephone system there and conduct it as a municipal enterprise. There are now but 105 subscribers in the town, but the council will arrange for a number of extensions to outlying districts. W. D. Dunlop is mayor.

The town council of Medicine Hat, Alberta, has decided to construct an electric street railway to connect the city with the new car works to be erected this spring. W. Cousins is mayor.

S. Edwards, formerly the Canadian Pacific railroad telegraph superintendent at Calgary, has been appointed manager of the government system for Alberta, with headquarters at Edmonton.

The taxpayers of Wetaskiwin, Alberta, have voted in favor of spending $30,000 for electric-light extensions. Duncan McEachern is mayor.

The Winnipeg and Northwestern Electric Railroad Company has been incorporated with a capital of $1,500,000 to run from Winnipeg, Manitoba, between Lakes Winnipeg and Manitoba to Edmonton and Lac du Riche. The company wanted power to engage in coal mining and lumbering, but this was struck out before incorporation was granted.

The Manitoba Radial Railway Company has also received incorporation with powers to build electric railways around Winnipeg and to adjoining towns. The charter was opposed by the Winnipeg Electric Company on the ground that the new company would interfere with its rights. R.

New England.

Boston, March 14.—The committees on railroads and street railways (jointly) having adversely reported on the petition for the prohibition of free passes on railroads and electric railways, the Massachusetts Senate on Wednesday substituted a bill prohibiting the issuing and giving passes and tickets at reduced rates.

The Boston Automobile and Power Boat Show is now under full headway, the exhibits being located in Mechanics' Building and Horticultural Hall. The daily attendance is very large and there are extensive displays of various makes of automobiles and power boats and all the accessories therefor. The show opened last Saturday night and will close next Saturday at 11 p. m.

Prof. W. O. Crosby, professor of physical geology at the Massachusetts Institute of Technology, is the first teacher at that institution to receive a Carnegie pension. His successor at the institute will be Reginald Aldworth Daly, head geologist of the Canadian Internal Boundary Commission.

The Massachusetts Institute of Technology's executive committee has received an anonymous donation of $5,000 for the maintenance of the institute's sanitary research and sewage experimental station, the only station of the kind in the country.

The local interests which handle the express business between different sections of Boston and between Boston and the near-by cities and towns are preparing to oppose the Boston Elevated Railway Company's petition for authority to carry freight and express. The Expressmen's League has taken up the matter.

Ex-Congressman William S. McNary has petitioned the Massachusetts Legislature to pass a bill authorizing the establishment of a municipal electric-light and power plant in Boston.

The agitation over better suburban service by the Boston and Albany Railroad Company has led John T. Langford of Newton, Mass., to suggest that that company and the New York, New Haven and Hartford Railroad Company should run their suburban lines with electricity, the former company to run all its trains to the Park Square Station, and that and the South Station to be connected by a subway—the electric suburban trains to be run through this subway.

The Rockland, South Thomaston and Owl's Head Street Railway was sold at auction by the receivers on March 8th and was bought by Moses Weil & Sons, Philadelphia, Pa., junk dealers, for $13,925, the sale being subject to the Supreme Court's confirmation. The road cost $65,000 to build two or three years ago.

The North Attleboro (Mass.) electric-light commissioners have issued their annual report for the year ended January 31st. In accordance with a town-meeting vote appropriating $35,000 to be used in installing the equipment necessary to furnish power for commercial use and additional light service, the board made contracts to install a steam plant. Owing to delay in getting the material this work has not been completed. The $35,000 was not sufficient, so an additional appropriation was granted.

The Edison Electric Illuminating Company of Boston has increased its capital stock from $11,494,100 to $12,643,600 and the number of shares from 114,941 to 126,436. Stockholders are offered 11,495 shares of new stock at $215 per share at the rate of one share for each 10 held by them.

James F. Shaw & Co., builders of the Boston & Worcester and other electric railways, have incorporated under Massachusetts laws. The capital is $500,000. The charter authorizes the company to do a general contracting business. The officers are as follows: President, James F. Shaw; treasurer, George A. Butman; directors, the above, Edward P. Shaw and Arthur W. Clapp.

The Edison Electric Illuminating Company of Brockton, Mass., has petitioned the Massachusetts Gas and Electric Light Commissioners to authorize it to issue stock amounting to $55,000, the proceeds to be used for outstanding indebtedness and additions to its plant. B.

New York.

New York City, March 16.—Under an agreement between the electrical workers of New York city and their employers, the possibility of a strike has been averted. The 3,000 men who are affected by the new schedule adopted will hereafter receive from $4 to $4.50 a day.

Brooklyn citizens, backed by the B. R. T., are petitioning Public Works Commissioner Dunne to move for the condemnation of nearly three blocks of buildings in the heart of the business district of the Borough for the purpose of facilitating trolley traffic and doing away with the congestion at Boerum Place, Fulton Street and at the bridge entrance. The necessity for a plaza at this point is the argument of the petitioners.

Mr. W. Kelsey, general manager of the newly formed company to provide New York and other cities with taximeter cabs and a special delivery system, is getting his project well under way. As soon as it is fully esablished in New York city it is the purpose of the company to extend its operations to Philadelphia, Boston and other large cities.

The long-expected bill validating the expired franchise of the Steinway tunnel has made its appearance at Albany. The bill restores the franchise of every bonded railroad corporation in the state which has expired because of the corporation's failure to fulfill the provision of the law that they should conclude the work of construction within a given time. The Steinway tunnel was bonded by the Belmont syndicate, and by the terms of the bill the franchise will be revived.

An ordinance has been passed by the Board of Aldermen appropriating $25,000 for the preparation of plans for a new bridge over the East River, connecting Brooklyn and Manhattan, the fifth to span that waterway. The project has already been approved by the Board of Estimates, so the construction of the bridge is practically assured. Bridge commissioners assert that within five years after the bridges now under construction are completed the congestion will be renewed, unless the traffic is now anticipated by preparations for a fifth span.

It is announced that the New York Central Railroad will construct at once an automatic electrical telltale device by means of which broken rails, misplaced switches and track troubles generally will be detected and reported immediately, while all signals guarding the danger point will be set against approaching trains. It is expected that within a month and a half the new system will be in operation. This innovation is as highly desirable as it is completely revolutionary.

The New York Edison Company, which has 50 electric vehicles and contracted for 25 more, is about to enlarge its garage very materially. One object is to distribute the current for automobiles through jobbers and to encourage the latter to establish garages.

Despite objections by Bird Coler, president of Brooklyn Borough, the Board of Estimates and Apportionment has approved the contracts for the Lexington Avenue subway and for the bridge loop subway connecting the Manhattan terminals of the East River bridges.

A special meeting of the Myrtle Avenue Board of Trade was held on March 14th in Granada Hall to consider a communication to be sent to the Board of Estimates and the Board of Rapid Transit commissioners concerning the improvement of the Flatbush Avenue extension. There was a large attendance. A resolution was adopted asking Controller Metz to have all buildings in the line of the extension torn down by July 1st, excepting Public School No. 5, which could be moved back during the summer.

Thefts of copper wire from the poles of the New York and New Jersey Telephone Company continue in the outlying districts of the borough, despite the vigilance of the police and the company's employes. During the present week hundreds of feet of wire have been taken from poles on Utica Avenue. The wire was carried away before the police were aware of the raid on the poles.

With a view to curtailing the $500,000 a year which the city now has to pay in interest on the huge sum which it owes the lighting companies and which is being contested in the courts, the controller and corporation counsel have had a conference with the companies and made an offer to pay off 80 per cent. of the bills. The city owes between $10,000,000 and $12,000,000 for light. The interest has been running for four years at a rate of six per cent., amounting to about 24 per cent. of the total amount the companies originally claimed. The probabilities are that all these long-disputed bills will be settled on this basis.

At a meeting of the Brooklyn Engineering Club held on March 14th, many facts concerning "compressed air in modern engineering" were presented in a paper on that subject by Mr. William Andrews, illustrated by lantern slides. The paper outlined a short history of compressed air, a description of the electro-pneumatic switch at the Boston terminal and of the compressed-air plants in New York city. A collation was served after the meeting. D. E. P.

Southeastern States.

Charlotte, N. C., March 16.—The waters of the Catawba River have just been turned into the dam at the Great Falls power development, where 10 turbines will do service, six of these already being in operation. This plant of the Southern Power Company is equipped with eight three-phase 3,000-kilowatt 2,200-volt Westinghouse generators connected to six horizontal turbines of the Escher-Wyss pattern and two Hercules turbines.

The consulting engineers engaged by the council of Atlanta to investigate the feasibility of municipal ownership have reported in favor of the plan. They contend that the city will be able to build a plant at an outlay of about $250,000, which sum, it is alleged, could be returned from the savings of the city in a period of six years and two months, compounded at four per cent.

The Southern Power Company, Charlotte, N. C., has let the contract to the S. Morgan Smith Company of York, Pa., for three-fourths of the water-wheel installation, and the contract for the remainder of the hydraulic machinery will be let later. About $120,000 is involved in the development.

The Hiawassee River Power Company of Georgia proposes to bring power 75 miles to Rome, Ga., to be sold to manufacturing plants and others.

The Southern Power, Electric and Manufacturing Company, which is developing several waterpowers near Spartanburg, S. C., is seeking to get a franchise for lighting the town and selling electricity therein.

By the emergency appropriation bill passed by Congress a new central power plant will be erected at the new dry dock at Norfolk, Va. An addition 80 by 220 feet will be added to the present plant and equipment, and will be furnished with the most modern designs in electrical machinery.

The Northside Light and Water Company has been chartered to build a lighting plant at Chestnut Hill, near Richmond, Va. Mr. J. C. Goodwin is president.

The Legislature has passed a bill permitting the town of Fayetteville to sell or lease its electric-light plant on contract for its operation. L.

Michigan.

Grand Rapids, March 16.—To date the Grand Rapids-Muskegon Power Company has not secured a franchise to operate here, although it is bidding for a contract to operate the city lighting plant. Members of a special committee of the council appointed to consider the proposition favor the acceptance of the company's terms as soon as a franchise has been granted, and the company will

probably experience no difficulty in securing a franchise.

Grand Haven will probably buy current of this company, and over at Holland, where a municipal plant is in operation, and there has been talk of doubling its capacity at a cost of $30,000, the city fathers are now considering the advisability of buying power of the Muskegon-Grand Rapids Power Company. This proposition will probably be submitted to the voters at the spring election.

Muskegon is endeavoring to induce the American Light and Traction Company, which owns the lighting plants in the city to reduce its rates on both electricity and gas, but so far without success. The company declares it cannot give the reduction asked for at the present time.

Myron W. Mills, president of the Michigan United Railways, has announced that the company will build the proposed line between Jackson and Lansing this year; that it will extend the Haslett Park line from Lansing to Owosso, and that it is negotiating for the purchase of the Jackson city line.

Opposition of farmers in the vicinity of Freeport has resulted in a change in the proposed right-of-way for an electric line from Grand Rapids to Battle Creek. The line will pass through Caledonia, Middleville and Hastings. Right-of-way has been secured nearly from Middleville to Hastings.

The Jackson Consolidated Electric Railway Company is projecting a line from Vandercook Lake, near Jackson, to Adrian.

The Grand Rapids Railway Company of this city is preparing to build new car barns on the West side at a cost of $75,000. The improvements being made at the Wealthy Avenue barns cost $35,000, and that barn will now house 72 cars. The company has appropriated $50,000 for the purchase of new cars.

The Detroit, Jackson and Chicago electric railway is to install a private telephone system for dispatching its cars. L. W. B.

Indiana.

Indianapolis, March 16.—The Home Light and Power Company of Andrews, Ind., has filed articles of incorporation with a capital stock of $15,000; directors, C. E. Endicott, James Kelsey and Ed. L. Taylor. The company's declared purpose is to build and equip an electric-light plant in Andrews.

The Town Council of Brookville is asking for bids for electric lighting of the city. The single applicant is offering to furnish the city with light at $63.50 a light for a period of five years. There is a strong sentiment favoring municipal ownership, the electric-light system to be run in connection with the waterworks, but the council does not favor it.

F. A. Bryan of South Bend has gone to Washington in the interests of the Berrien Springs Power and Electric Company, which has a contract for the construction of a dam in the St. Joseph River, near the Indiana line. He is consulting with Secretary Taft about the work.

The Seymour gas and electric-light plant, owned by Chicago men, is advertised to be sold on March 23d at sheriff's sale. The property was levied upon to satisfy a judgment, and was appraised at $30,000. The plant is regarded as good property, and the bidding will likely be spirited.

The Indianapolis gas bill, recently enacted into a law, requires that any contract between the city and any gas company for illuminating or fuel gas shall require the gas furnished to have "at least 600 British thermal units per cubic foot" according to standard measurements and shall bind the company never at any time during the terms of the contract to charge consumers more than 60 cents per cubic foot for gas.

Vonnegut & Vohn, architects, have completed plans and specifications for a power and electric-light plant for the Methodist Hospital in Indianapolis. Bids for this work will be advertised for in a few days.

The Board of Public Works of Terre Haute has laid aside the Terre Haute Traction Company's street-lighting bill for February with that for January, the total being $7,000, pending a settlement with the council for rebates, because of alleged poor lighting. The council had tests made of the lights some time ago, and is said to have found the lamps incapable by 25 per cent. of giving the 480 watts illumination, stipulated in the contract.

All the buildings at Fort Benjamin Harrison, near Indianapolis, have been wired for electric lighting, but the outside installation has not been put in. This means that the poles for carrying electricity over the post ground have not been set, the wires strung or any other outside work done necessary to complete a lighting system. It is the plan of the government to advertise for bids and purchase the electricity for power and lighting purposes in the open market, and not to install an electric power and lighting plant at the present time.

The traction fight at Richmond, Ind., between the city and the Indianapolis and Eastern Traction Company has been settled by the company agreeing to build a line running through the wholesale and factory districts, over which the freight cars are to be operated instead of the line on Main Street. The city in turn has agreed to grant a franchise to the Dayton and Western Traction Company, which is now operated in connection with the Indianapolis and Eastern.

Through-freight service, between Indianapolis, Ind., Columbus and Zanesville, Ohio, will be established by the Indianapolis, Columbus and Eastern Traction Company in a short time. This will constitute the longest freight service over any traction system in this country.

At a second meeting of the members of the Murdock-Dieterich syndicate in South Bend, during the present week, plans were made for the construction of a network of interurban railways over Northern Indiana. Announcement was made that through cars will be running by midsummer from South Bend to Indianapolis. There is only one connecting link necessary, and that will be built at once. S. S.

Illinois.

Peoria, March 16.—The Prairie State Traction Company has been incorporated with a capital of $6,000, with principal office at Whitehall to build an electric line from Whitehall and Roodhouse, east to Pana. Jett A. Kerby of Jerseyville is interested.

L. E. Meyers, the well-known electric-railway builder who built the Peoria and Pekin Terminal Railway Company, was in the city this week, calling on friends.

The first move to compel the steam roads to exchange traffic with the electric roads has been taken. The Chicago and Milwaukee electric railway has filed a petition against the Illinois Central and the Yazoo and Mississippi Valley roads with the Interstate Commerce Commission to compel them to enter into joint rates and traffic arrangements. The case is a test case and is brought under section 15 of the commerce act, which gives the commission the power to establish through and joint rates. This power has not been exercised, and it is doubtful if the commission will feel justified in making an order affecting the electric roads.

The proposed interurban line between Decatur and Litchfield seems now to be a certainty.

The first contract for the erection of the new building for interurban shops of the Illinois Traction Company has been let to the Decatur Bridge Company. When completed the building will be one of the largest of the new shops and will be erected at a cost of nearly $100,000. The company is receiving bids for the other new buildings, and work will be pushed as fast as possible.

The old Westinghouse suit against the Diamond Meter Company will come up again next week in the United States court here. This time the defendant is required to make an accounting by which the damages to the plaintiff are to be determined.

The new electric-light plant at Stonington was put in operation this week and light furnished to the stores.

Since the Illinois Traction Company has been operating between Springfield and Lincoln, it has taken so much of the travel that the Chicago and Alton has taken off two Sunday trains.

W. H. Schott of Chicago has purchased the Lincoln street railway. Application will be made for incorporation papers for the Lincoln Railway and Light Company with a capital of $150,000, and this company will take charge of the line. By the terms of the sale the company will get possession of the railway April 1st. The new company will rebuild and improve the entire system and install a heating and lighting plant. V. N.

Mexico.

Mexico City, March 14.—A number of Chinese residents of Torreon and other places in Northern Mexico have organized a company for the purpose of building an electric railway to connect Torreon with New Torreon. The company is headed by Foon Chuck, a millionaire Chinaman of Mexico. The federal government and municipal authorities have granted the company a concession and franchise for the proposed railway, and the work of constructing the line will soon be started. The proposed line will cost about $200,000.

The details of the transaction for the purchase of the property and franchises of La Compania Industrial de Guadalajara by Fernando Pimental y Fagoaga of Mexico City and associates, and their merging into La Electra Company of Guadalajara have been completed. Included in this purchase is a concession and franchise for an extensive system of electric street railway in Guadalajara, the power plant at Las Juntas on the Santiago River, the distribution station at Guadalajara, the transmission lines and other electrical equipment, and the company's light and power business in that city and adjacent territory. The consideration is said to be $3,000,000. The company will secure power from Las Juntas until its new station is finished.

Alfred Lilliandahl of Saltillo and associates will soon begin the construction of an electric street railway between the city of Saltillo and the town of Arteaga and the rich agricultural country beyond the latter place. An electric-lighting system will be operated in connection with the street-railway enterprise. The power plant will be located on the Choro de Agua, near Arteaga.

E. Hermann of Saltillo is also promoting the installation of an electric-light plant for that city. A number of American capitalists are associated with him in the project.

The new company headed by Enrique C. Creel, Mexico's ambassador to the United States, which was recently organized, has taken over the existing system of street railway in the city of Chihuahua; also the electric-light and power plant in that city and the Mineral Railroad, which runs from Chihuahua to Santa Eulalia. When the plans are finally consummated it is expected that Chihuahua and vicinity will be equipped with the best system of electric railway of any city in Mexico. Mr. Creel is also arranging to install a large hydro-electric plant on the Conchos River, 22 miles above Santa Rosalia, state of Chihuahua, and to build long-distance transmission lines to the cities of Chihuahua, Parral, Jiminez, Santa Rosalia and other industrial centers in the state. The company is called Compania Agricola y de Fuerza Electrica del Conchos. It has a capital stock of $10,000,000. It is estimated that 30,000 horsepower may be generated.

S. P. Applewhite of Mexico City is preparing to install a large hydro-electric plant on the Rio Grande, in the Cuicatlin district, state of Oaxaca. The power will be transmitted to the city of Oaxaca and to the several mining camps of the state. It is stated that the development of the mineral resources of the state is being retarded on account of the high price of fuel. Wood is very scarce and coal costs in the neighborhood of $31 a ton.

Four large electric hoists were recently installed in the mines of Max Friend in a remote part of the state of Oaxaca.

At the recent annual meeting of the Hidalgo Electric and Irrigation Company, held in Mexico City, it was announced that the plans for extensive enlargements and improvements of the electric system of the company have been submitted to the federal department of public communications. The capital stock of the company has been increased from $2,000,000 to $3,000,000, in order to provide for the proposed improvements. The company's revenues during the year 1906 were as follows: From power, $168,060; from lights, $82,664; from irrigation, $77,221. The president is Enrique Tron, and the manager, Porfirio Diaz, Jr., son of President Diaz.

The Guanajuato Power and Electric Company, the American concern which a few years ago established one of the largest electric power and transmission systems in Mexico, in the state of Guanajuato, has had plans prepared for a second hydro-electric plant, which it will locate on the Duero River, in the state of Michoacan. The company now transmits power to Guanajuato and many mines in the Guanto district, to the cities of Leon, Celaya, Irapuato, La Barca, Ribera Castellanos and Ocotlan. New transmission lines will soon be built to San Felipe and the Pozos mining camp. It is stated that the second hydro-electric plant will be a duplicate of the first plant. Upon its completion electric power will be transmitted to a number of other towns and cities in the states of Guanjuato, Michoacan and Jalisco. The company is composed principally of Colorado Springs (Colo.) men. W. D. H.

Northwestern States.

Minneapolis, March 16.—J. P. Thon proposes to construct an independent light and heating plant at Owatonna, Minn.

Webster Bros., investment brokers, of Minneapolis, have announced that they will apply to the Minneapolis City Council for a franchise for furnishing electrical energy to the general public.

The Marengo (Iowa) Midland Interurban Railway Company has been organized for the purpose of extending the Iowa-Missouri Traction and Power Company's lines north from Fairfield. The extensions would be about 175 miles in length.

The Iowa City-Davenport Traction Company has practically completed the survey for its proposed trolley line between those two cities.

The Minneapolis City Council has revoked the ordinances under which the General Electric Company has been doing business in that city and granted it permission to use the streets until January 1, 1908, by which time it must secure a franchise.

The North Dakota Legislature is considering a bill to allow electric roads to condemn rights-of-way for interurban lines. The measure has already passed the lower house.

The Chippewa Valley Electric Railroad Company has accepted the traction franchise granted it at Menomonie, Wis.

The Wisconsin Valley Electric Railway Company has filed articles of incorporation for an interurban line from Grand Rapids to Stevens Point, Wis., which it will construct shortly. George A. Whiting of Neenah heads the list of stockholders. The company is capitalized at $25,000.

It is thought that the Minneapolis, Rochester and Dubuque Traction Company will locate its shops at Decorah, Iowa, and a site has been tendered the company there.

The first of the three turbines of the Great Northern Power Company's plant near Duluth, Minn., has been installed and 10,000 horsepower is

now available. Two others will be installed as soon as the manufacturer can deliver them.

An election will be held March 25th at Rock Valley, Iowa, to vote a franchise to R. A. Talbot for an electric-light plant.

The electric-light plant at Marshall, Minn., will be entirely remodeled, about $8,000 worth of new machinery being necessary.

There is talk of putting in an electric-light plant at Towner, N. D. R.

Pacific Slope.

San Francisco, March 14.—The Battle Creek Power Company, which is subsidiary to the Northern California Power Company, with offices at 1380 Sutter Street, San Francisco, has just closed a contract with the Westinghouse Electric and Manufacturing Company for the power-house equipment for its new plant on Battle Creek, Shasta County, California. Two of the generating sets are of large capacity, with generators of 4,000 kilowatts each, and the third generator is of 200 kilowatts. They will generate three-phase 60-cycle current at 6,600 volts, which will be stepped up to 45,000 volts for transmission. Three Pelton impulse waterwheels, with an aggregate capacity of about 12,500 horsepower, will be direct-connected to these generators. Exciters and auxiliaries are included in the contract. This plant will be tied in with the Northern California Power Company's transmission plants and will add considerably to the efficiency and capacity of its system.

R. W. Thomas, William M. Snider, H. E. Woodward and F. S. McKee have filed upon water rights on Bubb, Paradise and Wood creeks, and the South and Middle forks of Kings River, below Kananyan Canyon, in California. They have planned to generate electric power at advantageous locations and transmit current a long distance to Greenwater, Death Valley, and the country adjacent to Bullfrog, Nev. According to the assertions of the promoters, power plants are to be constructed at the point where Bubb Creek flows into King's River. The water is to be transported by flumes and ditch over the Taboose Pass and distributed to the mines of Southeastern California and Southwestern Nevada.

The local electric-lighting plant at Tulare, Cal., which was purchased by Clarence M. Smith of the Consolidated Heat, Light and Power Company, is to be improved considerably by the new owner, who has arranged to have the exact needs of the system ascertained by a competent electrical engineer.

L. E. Hanchett of the San Jose-Santa Clara Railroad Company, which has secured franchises at San Jose, Cal., is ready to proceed with his extensions. The entire system will be broad-gauged and the cars which run on the Alum Rock road will cost $14,000 each. Mr. Hanchett promises to spend $1,000,000 on new work. C. C. Benson will have the management of the entire system.

F. J. Stillson and George Chortier of Los Angeles, Cal., have been investigating the possibilities of installing an electric-light and power plant at Kingman, Ariz. It is estimated that contracts can be closed for 1,500 horsepower, and a plant is likely to be installed soon.

During the month of May the Douglas Improvement Company will have completed and ready for operations at Douglas, Ariz., one of the most efficient electric power and lighting plants in the country.

F. E. Russell, manager of the gas, electric-light and electric-railway companies in Tucson, Ariz., says that $60,000 will be spent in improving the gas, electric-light and street-railway plants, and in extending the service of all three. The leading stockholders of these concerns are residents of Denver, Colo.

Papers have been filed incorporating the Western Umatilla Mutual Electric Company, with chief offices at Hermiston, Ore., and the object is to supply electric light and power to the territory under the Umatilla government project. The incorporators are M. B. Gwinn, Judge James A. Fee, R. Alexander and E. P. Dodd. The capital stock is $50,000. James Fee is president of the company.

Edwin G. Ammes and Hollopeter Bros. have secured a contract for the establishment of a light and power plant at Bandon, Ore. C. E. Hollopeter of the firm is here at present, making all arrangements to commence active work shortly. The contract work must be commenced not later than June 1, 1907.

Leopold Schmidt, of the Olympia Brewing Company, has made application to the Tumwater City Council for a franchise to furnish electric light and water for domestic and fire purposes to that city, the water to be supplied from the brewery's artesian wells. The plant will be designed to furnish light and power for the big brewery plant at Tumwater, Wash., but will have a surplus of about 200 16-candlepower lights to sell to the business houses and residences of Tumwater.

Advices from Tacoma, Wash., say that a large electric power plant is to be erected by the Pacific Traction Company upon a site already purchased, and preliminary construction work in connection with the power plant will probably commence within the next 30 days. Although officials of the traction company refuse to state exactly where the plant will be located, it is reported that it will be in Pierce County, on the banks of the Nisqually River.

Earles & Joyce of Seattle have taken the contract for the entire construction at Priest Rapids, on the Columbia River, for the Hanford Irrigation and Power Company's system. The contract calls for an expenditure of $300,000, and work will begin immediately. The entire system is to be completed and the 3,000 acres of land in the state of Washington are to be placed under irrigation by the spring of 1908. A.

PERSONAL.

The death is reported of Samuel Krantz, a well-known electrician of Houston, Tex.

John W. Davis has been appointed electrical inspector for the city of Terre Haute, Ind.

The death is announced of Mr. Berthelot, the famous French chemist, who passed away on March 18th.

Mr. Thomas Commerford Martin, editor of the Electrical World, has been elected president of the Engineers' Club of New York city.

P. B. White of Argenta, Ark., has resigned his position to accept a similar position with the Little Rock (Ark.) Railway and Electric Company.

William R. Remington, president of the Canton (N. Y.) Electric Light and Power Company, died at Canton, N. Y., on March 8th, after a long illness. He was 67 years of age.

A. L. Cornell of Birmingham, Ala., has been elected resident engineer for the Ninety-Nine Islands power plant of the Southern Power Company; his headquarters being at King's Creek, S. C.

W. T. Cannon, for some time superintendent of power stations for the Utah Light and Railway Company at Salt Lake City, has resigned, to enter the electrical and mechanical engineering business.

W. J. Krotz, who has been superintendent of the city lines of the Illinois Traction Company in Jacksonville, Ill., has been transferred to Granite City, holding the same office there as he held in Jacksonville. Asia Hopkins is taking Mr. Krotz's position in Jacksonville.

Colonel A. F. Ramsay, banker and capitalist of Crawfordsville, Ind., died on March 13th. Mr. Ramsey was president of the Crawfordsville and Western Traction Company, known as the "Ben Hur" route; also president of the Crawfordsville Telephone Company, and connected with many other financial enterprises.

A. A. Anderson, general manager of the Indianapolis, Columbus and Southern Traction Company at Columbus, Ind., has been appointed general manager also of the Indianapolis and Louisville Traction Company, which is building a line from Jeffersonville north to a connection with the Indianapolis, Columbus and Southern, at Seymour, Ind.

Announcement is made of the appointment of William D. Ennis, M. E., to the chair of mechanical engineering at the Brooklyn Polytechnic Institute. Professor Ennis will assume the duties of his office next fall, succeeding Prof. Mangus C. Ihlseng, who resigned last summer in order to undertake engineering and educational work in Pennsylvania.

J. F. W. Bunsen has entered the employment of Muralt & Co., engineers and contractors, New York, and will take charge of their southern office in Charleston, S. C. Mr. Bunsen, who is a nephew of the late Prof. Bunsen, the inventor of the burner which bears his name, has had many years' experience in designing and erecting important engineering works. He will have charge of Muralt & Co.'s various projects in the southern states and especially the large power plant which that company is now building for the United States government at the Charleston Navy Yard.

A. V. Schroeder, who for several years was superintendent of the Springfield (Ill.) Light, Heat and Power Company, and for the last year has been superintendent of the Decatur (Ill.) Light and Power Company, has accepted the position of general manager of the La Crosse and Winona Traction Company, with headquarters at La Crosse, Wis. W. J. Ferris, formerly assistant manager of the Illinois Traction Company, is president of the company, and it was through his association with Mr. Schroeder that the latter secured the position. Mr. Schroeder is well known among Illinois railway men and especially among the electrical engineers and electricians.

ELECTRIC LIGHTING.

F. H. Wheeler will install an electric-light plant in Havelock, Neb.

The electric-light plant of Hensley Bros. at Jacksboro, Tex., has been destroyed by fire.

The municipal electric-light plant recently erected at Napoleonville, La., at a cost of $15,000, is giving service at 15 cents per kilowatt-hour. The plant has a capacity of 20 street arcs and 1,000 incandescents.

The City Light and Power Company of Killeen, Texas, has been incorporated for $10,000.

The Western Light and Power Company of Cisco, Texas, has been capitalized at $50,000.

The Electric Light Company of Middleville, N. Y., is planning to erect a new power house.

Cheerfulness lightens labor; the electric lights are a great aid to cheerfulness.—Edison Light, Boston.

B. O. Smith of Palisade, Colo., has purchased the business of the Palisades Electric Light and Power Company.

The Northside Light and Water Company of Richmond, Va., has been incorporated for $50,000 by J. T. Goodwin and others.

The Board of Public Works of Holland, Mich., proposes to enlarge its electric-light plant. James De Young estimates the cost at $30,000.

The Cedar City (Utah) Light and Power Company has been incorporated with a capital stock of $13,000 by George W. Decker and others.

The Talladega (Ala.) Electric Power Company has sold its lighting and power plant. The new owner will spend a large sum of money in improving the plant.

The new Independent Light and Power Company of Davenport, Iowa, has secured nine acres of land as a site for its plant, the construction of which will soon be commenced.

The Vermont Power and Lighting Company of Montpelier, Vt., has notified its patrons of the installation of electric meters where lighting heretofore had been done on a flat-rate basis.

A new 2,000-horsepower steam turbine has been purchased by the Montreal (Canada) Light, Heat and Power Company. This turbine, which is the first of its kind to be used in Montreal, is said to be the largest in Canada.

In conjunction with other improvements, the Beloit (Wis.) Water, Gas and Electric Company has ordered a 500-kilowatt steam turbine for use in its plant. This machine, which is of the horizontal type, will displace much of the present machinery.

A report will be put in by the special lighting committee of the Common Council of Newark, N. J., as the result of a tour of inspection it recently made to the Pequannock watershed, showing how an alleged saving of $200,000 may be effected in the building of a municipal lighting plant to be operated by waterpower.

The conduit system of the Detroit Edison company has been completed and all that now remains to be done is to make the necessary connections in order to do away with overhead wires in the business district. Electricity is already being transmitted underground in a large area. The residential districts of the city are not included in the provisions of the underground wire act.

There was recently installed in the municipal electric-light plant at Jamestown, N. Y., a steam turbine and generator which is expected nearly to double the former capacity of the plant, the city now being able to furnish all the street lights demanded, besides selling commercial light and power. The generator is a three-phase alternator of the new "self-exciting" type. It has a capacity of 300 kilowatts for a continuous run, and will stand a load of 450 kilowatts for two hours. The machine will be run at a speed of 1,800 revolutions per minute.

Ernest Freeman, president of the Marseilles (Ill.) Light and Water Company, has just completed a deal whereby the United Electric Company, of which he is president, has bought the electric properties at Seneca and Morris, Ill., and will take over the properties on the first of April. The company at Seneca is the Seneca Electric Company and that at Morris, the Fields Electric Light Company. Both these plants are now operated by steam, but in the future the current will be generated at Marseilles and transmitted to Seneca and Morris. The distance to Morris is 17 miles, and there will be transmitted a current of 20,000 volts.

ELECTRIC RAILWAYS.

The Everett (Wash.) Railway and Electric Company will extend its lines to Silver Lake.

The Boston Elevated Railway Company has asked for the right to convey freight over its lines. It is stated that the company has made an arrangement with the Boston Suburban Express Company to do whatever teaming may be incident to the traffic in small parcels.

Allis-Chalmers Company, Milwaukee, has just secured contract for supplying all of the air-brake equipments required for all electric railways operated or controlled by the New York, New Haven and Hartford Railroad Company. This is without question one of the most important air-brake con-

tracts ever placed, and covers the air-brake equipments required by electric railways in 30 cities.

The Syracuse, Lake Shore and Northern Railroad Company has been authorized to increase its capital stock from $2,250,000 to $3,500,000. The company has taken over certain roads heretofore built with a view of operating a continuous line from Syracuse to Oswego, N. Y.

The Levant Herald reports that the Turkish government has prolonged the concession of the "Société des Tramways de Constantinople" until the year 1993, and the company has undertaken to substitute electric for animal traction, and to construct within five years three new lines: (1) To Pera, from the Galata-Séraï Tunnel; (2) from Pancaldi to Tatavla; (3) to Stamboul from the Mosque of Fatih. The company has also undertaken to double the present line from Galata to Ortakeuy.

The opinion of Justice McLennon of Elmira, N. Y., ordering the board of railroad commissioners to grant a certificate of necessity to the Rochester-Corning-Elmira Traction Company, states that the fact that electric lines parallel steam railroads does not constitute a valid objection to the former, although it may reduce the earning capacity of the latter. This, the opinion cites, has been the decision of the courts in similar cases, and electric roads have been built through the state not only parallel to, but within sight of, the roads operated by steam.

The report for the year 1906 of the Washington (D. C.) Railway and Electric Company shows the gross earnings to be $3,133,240, and the net earnings, $1,564,739. The surplus declared was $523,621. The net earnings for 1905 were $1,477,994. While the total operating expenses showed an increase of $134,630 over the expenses of 1905, the cost of maintenance increased $64,612, or 20.59 per cent. This increase in cost of maintenance was due partly to the fact that the properties have been maintained in better condition than heretofore, but more to the large increase in the cost of materials of every nature entering into the construction and operation of such properties.

A rather peculiar accident occurred in Waukesha, Wis., a few days ago, when a heavy electric gravel train dashed down a hill west of the Milwaukee railroad tracks and into a train which was just leaving. One of the coaches of the passenger train was hurled far from the track, but no one was injured. A train of five cars of gravel bound from quarries east of the city to the Oconomowoc extension was going up Tower hill after crossing the railway tracks. At the top of the hill the coupling between the motor car and the trailers gave way, and the string of gravel cars started down the hill with steadily increasing momentum. At the same time the Milwaukee train started out for Milwaukee. As the first passenger coach crossed the trolley line the gravel cars dashed into the side of the train.

On the afternoon of March 12th Joseph Menzer, a conductor on the Niagara Gorge electric railway, was killed by an avalanche of ice that plunged down the debris slope of the bank just below the railway steel arch. On January 20th the Gorge road had about a mile of track and roadbed washed out by a flood, which resulted in the construction of a temporary single track at the site of the washout. On the date first mentioned a belt-line car came up the Gorge, and had stopped to take a switch from the single-track section onto the double-track section. Conductor Menzer ran ahead to throw the switch, but as ice had blocked it Motorman Clinton Hyatt started to help him. The next instant an avalanche of ice came plunging down the steep slope, killing Menzer and slightly injuring Hyatt.

Plans have been submitted to Mayor Dunne of Chicago for the operation of street cars under the sidewalks. The cars proposed are shorter and lighter than those in present use in the city. The essential features of the Chicago sub-sidewalk railway plan are: Construction of the road under the sidewalks at a depth of 10 feet or more, paralleling all present surface lines leading into the downtown district; the subways to be constructed of concrete from the curb to the building line, and to have a subsidewalk six feet wide for the convenience of passengers and business and manufacturing industries; freight to be delivered by the sub-sidewalk line between the hours of one and five o'clock in the morning. The cost of construction is estimated at $200,000 a mile. The plans also provide for gas, electric light, sewers and water mains running through the subways, but is not taken very seriously.

POWER TRANSMISSION.

J. W. Baxter of Fayetteville, Ark., and associates propose to develop the waterpower of the White River, near Devall Bluff, Ark., and transmit electric current for operating electric railways, lighting and power plants and manufacturing industries. They expect to obtain from 15,000 to 20,000 horsepower at different locations, the total available being estimated at 200,000 horsepower. A company will be incorporated and organized to build the railway and power plants, capital stock to be nominally $150,000 and be increased in the future to $15,000,000. J. T. Evins of Fayetteville and J. C. Bonnell of St. Louis, Mo., are interested with Mr. Baxter.

The construction of an electric transmission line from the El Paso shaft to the portal of the Cripple Creek (Colo.) drainage tunnel in Gotch Park was recently authorized. The El Paso shaft is the nearest point to the portal that is connected with power. The line will be between three and four miles long and will require 60 to 90 days to construct. It will furnish power to operate the tunnel machinery.

Representatives of the Hudson River Power Company are closing, at Belvidere, N. J., options obtained on land and water rights necessary for the development of a 30,000-horsepower electric plant to be run by power obtained from the Delaware River. It is stated that $15,000,000 will be expended upon the enterprise. The plant is to operate the large cement mills, trolley lines and manufactories in the district.

The grand jury of Will County, Illinois, has passed a resolution asking in effect that the attorney-general shall take action to force the Sanitary District (Chicago Drainage Canal) trustees to permit a flow of water through the channel at Joliet sufficient to give the Economy Light and Power Company of Joliet all the waterpower that it requires for the various street-car lines, interurban lines, lighting plant and commercial enterprises of Joliet.

The water has been turned on through the gates at the dam of the Southern Power Company at the Great Catawba Falls, South Carolina. The dam is 10 feet wide at the top and 80 feet wide at the base. It is 105 feet high and 650 feet long from hill to hill. There are 100,000 cubic yards of masonry in both of the walls. In the power house there are two direct-current generators and eight alternating-current generators, capable of producing 40,000 horsepower.

PUBLICATIONS.

In Bulletin No. 145 of the University of Wisconsin, appears an exhaustive thesis by Oliver Patterson Watts, Ph.D., instructor in chemical engineering in the University of Wisconsin, on "An Investigation of the Borides and the Silicides." Reference is made in the preface to the important contributions that have been made during the last two decades, to the field of chemistry through the use of the electric furnace. The author states that "the high temperatures made available by the conversion of electrical into thermal energy, have resulted in the discovery of a host of new compounds, and the duplication by art of various of Nature's processes."

Some new publications are being sent out from the Publication Bureau of the General Electric Company, Schenectady, N. Y. They cover important subjects and will be found valuable for reference. The list is as follows: Bulletin No. 4485, portable gasoline-engine and generator outfits; No. 4487, small-plant continuous-current switchboard panels; No. 4488, Thomson recording wattmeter, type C-6; No. 4489, crane-wiring supplies; No. 4490, portable air-compressor set; No. 4491, controllers for power and mining service; No. 4492, small-plant alternating-current switchboards for 1,150 and 2,300 volts; price list No. 5162, Thomson recording wattmeters, and a complete index of bulletins. The bulletins are all well illustrated, including some interesting drawings.

The Lakes-to-the-Gulf Deep Waterway Association of St. Louis, Mo., has issued a booklet containing a recent letter of James J. Hill to Governor Johnson of Minnesota, entitled "The Solution of the Transportation Problem of the United States," and a talk by Harry B. Hawes, chairman of the speakers' committee of the Lakes-to-the-Gulf Deep Waterway Association before the Engineers' Club of St. Louis on "Fourteen Feet Through the Valley," which refers to a 14-foot waterway from the Great Lakes to the Gulf. Mr. Hill's letter abounds in statistics showing the great railroad business of the country, while Mr. Hawes deals with the deep-waterway problem as a means of facilitating freight transportation and regulating the freight rates of the country.

The new enlarged edition of Webster's International Dictionary, published by G. & C. Merriam Company, Springfield, Mass., is about to be put on the market. It contains 2,380 pages and 5,000 illustrations. The publishers state that in this edition 25,000 new words have been added in a supplement containing 234 pages. The biographical dictionary and gazetteer of the world have been revised and several hundred names of persons of recent prominence have been added to the biographical list. In the gazetteer the figures for population and area have been made to agree with the census returns taken in 1900 and 1901. Many new plates have been made to replace the old ones in which changes occur. W. T. Harris, Ph.D., LL.D., United States commissioner of education, is the editor-in-chief.

SOCIETIES AND SCHOOLS.

The New York Electrical Society will hold its next meeting on March 27th. Mr. C. J. H. Woodbury of Boston will lecture on the influence of the underwriters' rules on electrical development.

Secretary Ralph W. Pope is sending copies of the proposed new constitution of the American Institute of Electrical Engineers to all members that they may vote for or against it. All members are urgently requested to vote, as the majority of the members must express themselves before any action can be taken.

The 217th meeting of the American Institute of Electrical Engineers will be held in the Auditorium of the Engineers' Building, 33 West Thirty-ninth Street, New York city, on Friday evening, March 29th. Papers on "Lightning and Lightning Protection" will be presented by Messrs. C. P. Steinmetz, E. E. F. Creighton and D. B. Rushmore.

A meeting of the Chicago branch of the American Institute of Electrical Engineers will be held on Tuesday evening, March 26th, in the rooms of the Western Society of Engineers, Monadnock Block. W. J. Davis, Jr., railway engineer of the General Electric Company, will address the meeting on "High-voltage Alternating and Direct-current Railway Systems."

The spring term of Lewis Institute, Madison and Robey streets, Chicago, opened on March 19th to continue for ten weeks. The institute will be open from 6 to 10, four evenings a week—Monday, Tuesday, Wednesday and Thursday. Among the courses offered at the evening classes are machine sketching, mechanical drawing (elementary and advanced), machinery drawing, patent office drawing, engineering mathematics and machine-shop practice. The evening courses in electrical engineering are: First-year course—Physics Laboratory: Mechanics, heat and light; second-year course—Dynamo Laboratory: Rotary converter; third-year course—Alternating-current generators and motors.

MISCELLANEOUS.

The Western Union Telegraph Company estimates that its net revenue for the quarter ending March 31st will be $1,6 0,000. Taking this as the correct figure, the company's total surplus, after making all deductions, will be $17,024,904.87. The net revenue for the quarter ended December 31, 1906, was $1,616,791.61.

A bill has been introduced in the Illinois Legislature fixing the price of electric light at six cents a kilowatt-hour. Another bill introduced would make it compulsory upon steam and electric railways to furnish passes to members of the Legislature and other state officials when riding on official duty.

The Livermore mill of the International Paper Company at Riley, Me., will add to its generating equipment a 1,000-kilowatt Allis-Chalmers alternator of the waterwheel type, and exciter, recently purchased. This new unit is wound for 60 cycles, three-phase, 2,300 volts, and will be used on the lighting and power load of the mill.

A Frenchman who is said to be a radio-telegraph expert advances the remarkable theory that the explosion on the French battleship Jena at Toulon on March 12th was due to the fact that "wireless" currents were passing at the time and that the vessel's position in the dock "resulted in the accumulation of secondary Hertzian waves in the powder magazine" from the ship's radio-telegraph apparatus. An outside current is credited with having communicated a high-tension spark.

A New York man is said to have invented an electrical device for exterminating bugs or flies in houses. It includes a grid or screen of parallel wires alternately positive and negative and charged with electricity. A fly alighting on the grid or attempting to walk upon it and touching the adjacent wires, will fall dead from the shock. The device is composed of two bars of wood between which extend strips of brass. Live wires connect with a source of electricity of sufficient power to kill the insects.

This is a current newspaper paragraph which may be taken for what it is worth: "The extremely sensitive galvanometer devised a short time ago by Mr. Einthoven, a German electrician, consists of a silvered quartz fiber stretched between the poles of a strong electromagnet, the passage of the faintest current moving this fiber in the direction of the lines of the magnetic field. The movement can be measured directly by a microscope or recorded by photography. The new instrument will measure the millionth of an ampere, and a suggested use is for studying the electric currents of the human nerves."

The Western Maryland Railroad has recently built new shops at Hagerstown, Md., to be used for the general repair of locomotives and equipment used on the division. These new shops, which will employ approximately 100 men, have a floor space of 70 by 300 feet. The electrical equipment, which will furnish power for the shop drive, will also be used to light the company's terminal properties and operate the transfer table at the roundhouse. This

equipment comprises a 150-kilowatt and a 250-kilowatt Allis-Chalmers direct-current generator, with exciter units of 10 and 15-kilowatt capacity, respectively, and a small motor-generator set.

Secretary of War Taft has made his final decision on the application of the sanitary district of Chicago to divert the waters of the Calumet River into the Chicago Drainage Canal. General Mackenzie, chief of engineers of the United States Army, recommended that the department refuse the permit, and Secretary Taft followed this recommendation. General Mackenzie held that diversion of the Calumet would lower the level of all the Great Lakes except Superior. Chief Engineer Randolph of the Sanitary District will probably recommend to the board that a bill be introduced into Congress for a grant of authority to carry out the water diversion plan.

TRADE NEWS.

The McCleary-Harmony Company of Detroit, Mich., has been capitalized at $10,000. It will engage in a general electrical contracting business.

The Incandescent Light and Supply Company of Wichita, Kan., has been organized with capital of $20,000 by W. F. McHenry and others.

Consul-general L. M. Iddings of Cairo forwards Egyptian government specifications for electric-lighting outfits to be supplied to the Korimat and Elessi pumping stations (no date being given as to when bids must be received). The specifications will be loaned to American firms interested. Refer to file No. 784, Bureau of Manufacturers, Washington, D. C.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 30th for the installation of a conduit and wiring system for the court house, custom house and postoffice at Seattle, Wash. Drawings and specifications may be had at the above-named office, or at the office of the superintendent of construction at Seattle.

Bids have been opened at the office of the chief signal officer of the United States Army for 51,400 feet of antenna wire, as follows: National Electrical Supply Company, Washington, D. C., $363.30; Phosphor Bronze Smelting Company, Philadelphia, Pa., $2.55 per foot; Riverside Metal Company, Riverside, N. J., $315; Hazard Manufacturing Company, New York, N. Y., $420.

The Gamewell Fire Alarm Telegraph Company of New York city was the lowest bidder for the contract for the installation of the electric fire-alarm system at Fort Leavenworth, Kan. The contract calls for the putting in of 25 fire-alarm stations in the garrison. Each station, or district, will have one fire-alarm box, at which a call can be sent in to the fire department, in the case of a fire.

After April 1st Sawyer-Man lamps will be known as Westinghouse lamps, the name of the manufacturer being the Westinghouse Lamp Company, 510-534 West Twenty-third Street, New York.

The Kuhlman Electric Company of Elkhart, Ind., which was among the first to advocate three-phase transformers in this country, is preparing to produce a full line of polyphase transformers. While the trade in this country has been confined largely to single-phase units, there is said to be a growing demand for the composite-type construction for some purposes, and the Kuhlman company is in a position to supply anything that may be required along that line.

A new company is said to have been formed in Sweden under the name of the United Electric Companies, with a maximum capital of 6,000,000 kroner ($1,620,000). The new concern is an amalgamation of several firms which have been in full operation for several years, and has been undertaken in order to increase the efficiency and capacity of the works in question, of which there are three, in addition to a new large foundry capable of supplying them all. The new company has some large installations in hand, among them a power station of 10,000 horsepower, with a voltage of 40,000, the highest voltage so far used in Sweden. The same voltage is to be used at the Henisjo power station, etc. The board comprises some influential men, and a considerable export trade is expected.

BUSINESS.

The Mt. Vernon Home Telephone Company of Mt. Vernon, Ohio, has received in one shipment 100 pole seats ordered from the F. Bissell Company of Toledo, Ohio. The Bissell company reports business brisk in Security specialties.

The steel in the 27-story City Investing Building, now in course of construction in New York city, will be protected from corrosion with Dixon's silica graphite paint. This paint is manufactured in one quality and four colors by the Joseph Dixon Crucible Company of Jersey City, N. J.

The H. C. Frick Coke Company, Pittsburg, a subsidiary company of the United States Steel Corporation, has concluded the purchase of new electrical equipment for four of its different coal-mining operations in the state of Pennsylvania. These equipments, which comprise main and substation apparatus, are intended for use in the operation of coal-mining machinery. They include rotary converters, transformers, engine-type generators and switchboard apparatus, all of Allis-Chalmers design.

The H. W. Johns-Manville Company, New York, calls attention to the merits of "Electrobestos" arc deflectors. These deflectors are manufactured under great pressure, giving to the material great density and superior tensile strength. As a result "Electrobestos" arc deflectors withstand the most severe conditions of service. They are regularly made for the most of the standard railway controllers and can be furnished to order for any special types of controllers.

The Board of Public Works of Nashville, Tenn., recently awarded to the Southern Electric Company a contract for furnishing to the light department 20,000 pounds of wire at $278.50 per 1,000 pounds. Bids of the Braid Electric Company for furnishing a quantity of other equipment to the department were accepted, the bids being as follows: For furnishing to the department lots of 50 arc lamps, $984.85 each; transformers with regulators, $516 each; lots of 50 pulleys, $65 each; lots of 50 hangers, $189.54 each.

The Automatic Electric Company, Chicago, announces the closing of a contract for 10,000 additional lines of Automatic telephone equipment for the Home Telephone and Telegraph Company of Los Angeles, Cal. This is for immediate installation in the new Olive Street Exchange, and the completion of this exchange will practically mean the elimination of the manual equipment now in use in the present main exchange. Other contracts placed with the Automatic Electric Company during the first two months of 1907 are: Home Telephone and Telegraph Company, Portland, Ore., 3,000 additional lines; Montana Independent Telephone Company, Butte, Mont., 2,000 lines; Home Telephone and Telegraph Company, Tacoma, Wash., 1,000 additional lines; Rushville Co-operative Telephone Company, Rushville, Ind., 800 lines.

An expert in the manufacture of switches says: "Changes and rulings on the fusing of knife switches have been so many and have come so often in the last few years that a switch manufacturer, in order to supply the necessities of the trade, must go into the business in detail or find himself on the shelf. The increasing demand also for alternating current, which requires an entirely different line of switches, has added still further complications. The result is that, whereas a few years ago, an assortment of 1,000 switches was considered a good line, it requires today about 30,000 different switches to constitute a complete line in any one style." The Trumbull Electric Manufacturing Company of Plainville, Conn., prides itself on the completeness of its line, although, as shown by the statement quoted, the number has reached an astonishing size.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 12, 1907.

846,464. Telegraphic Instrument and the Like. Alberto Gentili, Veneto, Italy. Application filed July 17, 1905.

A Morse key consists of a pivoted key lever, a contact lever pivoted thereto, the contact lever being provided at its extremity with two rollers, one of conducting and the other of insulating material, and a contact piece with which one or other of the rollers contact so that upon the movement of the key in one direction contact is made between the contact piece and the key, while upon its movement in the reverse direction no contact is made.

846,469. Circuit-breaker. Rudolf E. Hellmund, New York, N. Y. Application filed January 21, 1904.

Combined are a contact member, an operating member, a connection between the same, a pivotally mounted current-actuated weight adapted to release the connection, means adapted to retain the contact member in inoperative position, and means carried by the operating member adapted to render the retaining means inoperative.

846,477. Oil-proof Electrical Insulating Compound and Method of Making Same. John J. Kessler, Jr., St. Louis, Mo. Application filed June 29, 1906.

The compound comprises a mixture of a non-conducting mineral and linseed-oil varnish. The process consists in hardening the mixture and grinding it together with a volatile oil.

846,479. Telephone. Stanislaw A. Koltonski, Boston, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed December 9, 1904. Renewed March 7, 1906.

In an electrical switch are a latch having two lateral arms, one arm having a catching nose bent out of plane of the main body of the latch to avoid interference with a turn latch, and the other carrying a cam, means for guiding the latch, and a push button mounted thereon.

846,480. Process of Electric Welding. Laurence S. Lachman, New York, N. Y., assignor to the Standard Pulley Manufacturing Company, New York, N. Y. Application filed October 28, 1905.

The process of electrically welding a piece of substantially thin metal to another piece of relatively thicker metal, consists in providing a point or projecting portion upon the thick piece of metal, placing the latter upon the thin piece, with the point or projection of the thick piece in direct contact with the surface of the thin piece of metal and passing a current of electricity through the pieces of metal and through the point.

846,500. Coin Collector. Frank R. McBerty, Evanston, and Howard B. Holmes, Park Ridge, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed December 7, 1904.

In a toll-box are combined with a rotating temporary coin receiver, a transverse slot therein arranged to receive the coin, and ribs formed in the receiver in the sides of the slot upon which the coin is adapted to rest, whereby sticking of the flat sides of the coin to the walls of the receiver is prevented.

846,502. Fire-alarm System. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Application filed September 24, 1903.

In the system described are a piping system provided with means for generating pressure therein when unduly heated, thermostatic switches operable to any undue amount of heat, and electric signal-transmitting means associated with the thermostats and piping system for actuation by the generation of pressure in the piping or operation of the thermostatic switches.

846,513. Street-indicating Mechanism. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed May 17, 1905.

In the device patented are an electromagnet for operating an oscillating lever having at one end a detent finger and a locking device controlled by the lever.

846,514. Circuit-closing Mechanism for Railway Indicators. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed August 14, 1906.

Two sets of electric contacts are included in the mechanism described, along which a contact member travels as the vehicle moves. The member is automatically shifted from one set to the other set of contacts when the vehicle reaches the end of its trip.

846,515. Electrically Actuated Clock. Ruben W. Smedberg, St. Peter, Minn. Application filed July 9, 1906.

In the clock referred to are a magnet in an actuating circuit, a vibratory armature subject to the magnet and a pair of reversely-acting, spring-pressed pawls connected to and receiving reversely vibratory movements from the armature. The pawls serve to retract the armature from the magnet when the actuating circuit is broken.

846,521. Electric Furnace. Le Roy W. Stevens, Syracuse, N. Y., assignor to the Advance Furnace Company of America, Utica, N. Y. Application filed September 16, 1905.

Combined with the furnace body having an interior chamber and the electrode of an electric furnace are a stuffing box, a movable sleeve mounted in the stuffing box and surrounding the electrode, and provided with an interior chamber, and means for circulating water through the chamber.

846,522. Polarized Electric Signal Bell. William M. Thomas, Chicago, Ill., assignor of one-half to Otto Eisenschiml, Chicago, Ill. Application filed August 3, 1906.

The signal bell comprises a horizontally-disposed electromagnet core having downwardly-projecting poles, a support carrying the core located between the poles and an armature centrally pivoted to the support, the ends of which confront the poles of the magnet.

846,526. Apparatus for the Production of Pigments. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Cleveland, Ohio. Application filed April 18, 1902.

In a cell for the production of white lead are an anode of lead and a suitable cathode, and means for circulating the electrolyte upwardly between the electrodes and thence to a point external to the electrolytic field.

846,533. Electric Controller. Ferdinand Volk, Pittsburg, Pa., assignor of one-sixth to Casper J. Pollman, Pittsburg, Pa. Application filed September 29, 1906.

Combined with a controller and the operating lever thereof, are a plate secured to the controller and having a sinuous path formed thereon, a hub carried by the controller shaft and provided with a laterally extending guideway, a reciprocating tooth-carrying member supported by the lever and adapted to travel in the guideway, a revoluble handle carried by the lever, and means actuated by the handle to reciprocate the member.

846,544. Electric Heater. Albert H. Bremer, William J. Chattin and August H. Hoenisch, Philadelphia, Pa. Application filed January 3, 1906.

In an electric-heating apparatus are combined with a tank or boiler, tubes suspended in the tank or boiler and closed at their lower ends, and electric-heating devices for the tubes comprising end plates, rods interposed between the end plates and upon which the resistance wires are wound, and a bolt connecting the end plates and rods.

846,557. Telephone Trunking System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 1, 1902.

In combination with a trunk circuit extending between different switchboard sections, are a trunk relay at the incoming end of the trunk energized by current over

one limb only of the outgoing end, a second relay energized over one limb only of the incoming end when a connection is established with a called line, and a signal at the incoming end which will be displayed at the actuation of either of the relays, but effaced at the actuation of both.

846,566. High-tension Direct-current Electric System. John S. Highfield, London, England. Application filed December 21, 1906.

In the system described are combined with the apparatus for generating the current and a number of consuming stations, a line connecting the stations in series, a permanently-earthed conductor at the generating place electrically connected with the generating apparatus at an intermediate and neutral point, and a number of earthed conductors at various points in the system with means for connecting the line to earth through the conductors at such points.

846,590. Hook-switch. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed December 21, 1906.

In a telephone switching apparatus are a pivoted switch hook, insulating circuit-changing springs, each and all having a free end lying adjacent the pivot, and insulated pins projecting from the hook, on opposite sides of the pivot and alternately co-operating with the springs.

846,604. Toll Box. Paul E. Oswald, Los Angeles, Cal., assignor to the Western Electric Company, Chicago, Ill. Application filed March 7, 1905.

Electromagnetically operated mechanism moves the coin distributor to transfer the coin into the cash box or into the coin chute.

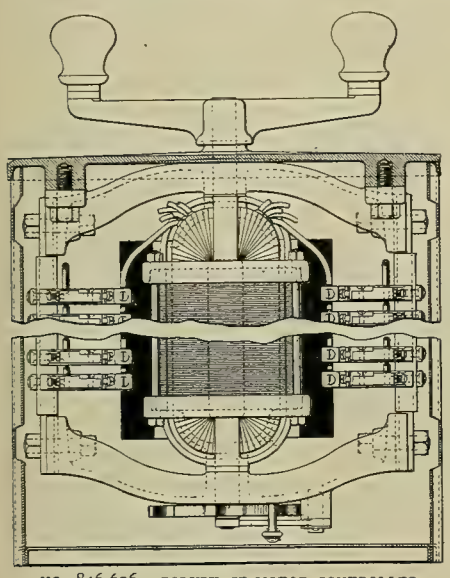
846,624. Device to Disclose Opening of the Shunt Circuits of Electric Meters. William L. Saunders, Denver, Colo., assignor of two-thirds to Daniel K. Hickey, Denver, Colo. Application filed June 27, 1905.

Combined with an electric meter are an electromagnet placed in the shunt circuit, suitably-located contacts respectively engaging the terminals of a broken wire of the main circuit, an armature adapted to simultaneously engage the contacts when in its normal position, and a seat adapted to receive the armature when released from the magnet.

846,625. Electric Switch. Harry Sawyer, Muskegon, Mich. Application filed July 11, 1904.

In the switch described are a pivotally mounted lever carrying a clamp, a rigid insulator pin adjustablp secured in the clamp, and a conductor portion rigidly carried by the pin.

846,626. Controller for Electric Motors. Frederic Schaefer, Wilkinsburg, Pa. Application filed February 20, 1906.



NO. 846,626.—POLYPHASE-MOTOR CONTROLLER.

This controller for polyphase electric motors includes a rotatably mounted transformer core, a number of windings therefor, groups of contact fingers connected to the winding and fixed relative to the core, and stationary contact members adapted to be simultaneously engaged by the groups of transformer-fingers and connected to the electric motor and supply circuits. (See cut.)

846,628. Telephone-exchange Apparatus. Edwin H. Smythe, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 21, 1905.

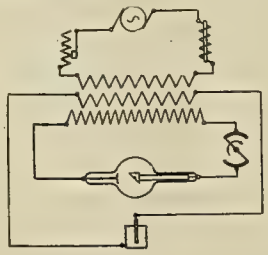
Combined with a telephone line are a subscriber's coin collector having a magnet, coin-depositing mechanism operated in the return of the magnet to normal condition after response, operator's connecting apparatus at the central office, means controlled thereby for maintaining the excitation of the magnet during connection, subscriber's refunding mechanism, and means controlled by the connecting apparatus for blocking the operation of the refunding mechanism.

846,642. Process of Reducing Metallic Sulphides. Edward L. Anderson, St. Louis, Mo., assignor of three-quarters to others. Application filed December 26, 1905.

The process consists in subjecting the compound to the action of an electric current flowing from an anode to an undecomposable cathode and to the compound in an electrolyte capable of dissolving the metal constituent of the compound and forming a soluble salt therewith, whereby the salt is decomposed and the metal constituent deposited on the undecomposable cathode.

846,672. High-pressure Electrical Apparatus. Franz J. Koch, Dresden, Germany. Application filed January 24, 1906.

In a high-pressure electrical apparatus are combined a primary alternating-current circuit, a primary coil in the circuit, resistance in the primary circuit, a secondary consumption circuit, a secondary coil in the secondary circuit, a high-pressure valve device arranged in the secondary consumption circuit, an electrical apparatus to be worked, the apparatus having a certain breaking-through pressure, a secondary auxiliary circuit, a secondary coil in the auxiliary circuit and means for letting through current not desired in the secondary consumption circuit, the means stopping the current of the sign desired in the consumption circuit. (See cut.)



NO. 846,672.—HIGH-PRESSURE ELECTRICAL APPARATUS.

846,673. Electrical Switch. Andrew Koesche, Chicago, Ill., assignor to the Liquid Carbonic Company, Chicago, Ill. Application filed December 26, 1905.

The switch comprises a stationary contact, a contact lever fulcrumed at one end, a movable contact carried by the contact lever at its other end, a handle lever fulcrumed at one end between the ends of the contact lever, the fulcrums being in a plane above the stationary contact, and a spring-controlled rod connected to the handle lever between its ends and to the contact lever between its ends.

846,684. Cigar Lighter. James H. Moore, Portland, Ore., assignor to the Moore Electric Cigar Lighter Company, Portland, Ore. Application filed October 2, 1906.

The device comprises, in combination with a source of alternating current of electricity, a transformer from which a secondary or low-potential circuit emerges, a casing through which the circuits pass, a resistance piece within the casing and connected in the secondary circuit, and making and breaking means.

846,691. Thermal Cut-out for Electric Circuits. Gwynne E. Painter, Baltimore, Md. Application filed November 13, 1906.

The device for protecting an electric circuit comprises two fuses of different carrying capacities connected in series, and a fuse block in which the fuse of greater carrying capacity is sealed against removal without detection.

846,693. Rotating Magnet for Dynamo-electric Machines. Charles A. Parsons, George G. Stoney and Alexander H. Law, Newcastle-upon-Tyne, England; Stoney and Law being assignors to Parsons. Application filed August 21, 1906.

In dynamo-electric machinery, a wound rotor comprises an oval shaft, a core having projecting pole tips integral therewith, coils on the core, the coils being bent outward and of reduced cross section in proximity to the shaft.

846,701. Socket. Ray Smith, Elkins, W. Va. Application filed July 18, 1906.

A socket is secured in the lower end of the housing of the device and is in the path of a contact key whereby when the key is turned to one position an electric circuit will be completed.

846,703. System for the Supply of Current Demands. Frank W. Springer, Minneapolis, Minn. Application filed September 17, 1906.

Combined with a primary cell or battery, are means for intermittently sending a reverse current through the primary cell or battery, immediately following each battery discharge or series of battery discharges, to depolarize the same.

846,729. Fire-alarm System. Miles Connor, Pueblo, Colo. Application filed June 22, 1906.

An attachment for alarm systems comprises a drum, contact plates on the drum, fingers to engage the contact plates to dispose the individual circuits into a common circuit, and auxiliary plates on the drum adapted to engage the fingers and dispose the common circuit into individual circuits.

846,736. Submarine Torpedo Boat. Alfred Elgar, North Brixton, England. Application filed June 12, 1905.

In a torpedo boat provided with wells in which are carried buoys for indicating the position of the boat are an armature secured to the short arm of a lever attached to a bolt passing through a ring at the bottom of the buoy, an electromagnet which attracts the armature when energized and an electric battery and a manometer to close the electric circuit when the boat reaches a predetermined depth.

846,778. Electric-light Hanger. Franklin E. Christman, Bethlehem, Pa. Application filed December 11, 1906.

The hanger includes a flexible conductor, the terminals of which are connected with a spring-actuated drum and lamp.

846,779. Signaling Apparatus. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company, a corporation of Maine. Application filed October 12, 1905.

The apparatus comprises an electromagnet for actuating a pivoted lever, an arm connected to the lever, connections between the arm and a pivoted detent for holding the signal at caution, a projection on the lever, a rock shaft, an arm connected therewith, a detent pivoted in the arm, an electromagnet for actuating the detent, and track circuits for controlling the operation of the magnets.

846,809. Spark-ignition System for Explosion Engines. Richard Varley, Englewood, N. J., and Archibald D. Scott, Providence, R. I., assignors to the Autocoil Company, a corporation of New Jersey. Application filed March 22, 1905.

In an ignition system for explosion engines there are a number of sources of electricity, a number of induction coils, an igniting device and a single switch whereby any one of the sources of electricity can be connected with any induction coil and the latter connected with the igniting device.

846,810. Ignition System. Richard Varley, Englewood, N. J., assignor to the Autocoil Company, a corporation of New Jersey. Application filed November 27, 1905.

In this system are a primary circuit including a circuit-breaking lever and a circuit-closing conductor in multiple with one another, and means whereby the circuit is first broken at the lever and subsequently completed at the conductor.

846,811. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company, a corporation of New Jersey. Application filed November 3, 1906.

In an ignition system for explosion engines are a number of vibrator induction coils having their primaries connected to a common circuit, an ammeter in such circuit, and means for simultaneously adjusting the vibrators of all the coils.

846,827. Telephone-service Apparatus. Samuel H. Couch, Boston, Mass., assignor to the Superior Automatic Telephone Company, Boston, Mass. Application filed April 12, 1906.

In a telephone-service apparatus are combined with contact make-and-break mechanism a latch for holding the same in given position, a telephone receiver hook, an arm connected to the latch and having a cam surface, and a yielding arm connected to the receiver hook having a temporary one-way connection with the arm of the latch.

846,853. Electric Heater. James T. Howell, Seattle, Wash. Application filed May 7, 1906.

The heater comprises a resistance element coiled into a spiral form, a pair of cross arms for supporting the resistance element, means for connecting the cross arms, and a handle connected to one of the cross arms.

846,889. Telephone System. Albert K. Andriano, San Francisco, Cal., assignor to the Direct-line General Telephone Company, San Francisco, Cal. Application filed March 15, 1905.

In a telephone system are combined line circuits comprising a home line for each station and a return conductor common to a plurality of the stations, a line switch at each station containing stationary contacts for the home lines of the other stations, a movable switch piece, a primary circuit including a battery, the primary circuit being normally connected into its own home line and means for disconnecting the primary circuit from its home line and connecting it into a selected home line through the movable switch piece.

846,897. Gas Engine. Reuben B. Benjamin, Chicago, Ill. Application filed January 2, 1906.

In a governing device for explosive engines are an inlet valve for the engine, a resistance device connected with the valve, and an electromagnetic governor for controlling the resistance of the device.

846,901. Insulated Rail Joint. William F. Bossert, Utica, N. Y. Application filed November 30, 1906.

Insulating material is placed intermediate to the bottom of the rail flange and the lateral extension of a chair, the extension being adapted to receive the flange.

846,912. Cluster Socket. John H. Dale, New York, N. Y. Application filed May 24, 1906.

A receptacle or cluster socket for incandescent lamps comprises a base or terminal block having threaded shells thereon, insulating bushings on the shells, and serving as a support for the base, lamp terminals on the base, and means for making series of multiple connections between the lamp terminals.

846,960. Circuit-closing Mechanism. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed January 26, 1906.

Combined with a rotatable screw having a threaded portion of insulating material and an interior electric conductor, are contact pins carried by the threaded portion in electric connection with the conductor, a traveling nut adapted to mesh with the threaded portion and having a contact co-operating with the contacts on the thread of the screw.

846,969. Shunt for Electric Circuits. Maurice J. Wohl, New York, N. Y., assignor to the Victor Electric and Manufacturing Company, a corporation of New York. Application filed December 13, 1906.

In the shunt described are a pair of terminals, each having a projecting portion therefrom, and a conductor extending between the terminals and so positioned as to be enclosed thereby and by the projecting portions.

846,998. Pyrometer. John F. Hammond, Brewster, N. Y., assignor to the S. S. White Dental Manufacturing Company, Philadelphia, Pa. Application filed November 1, 1905.

In an electric pyrometer furnace are combined a muffle, a thermocouple mounted therein and exposed upon the outside thereof, thermocouple extensions, a galvanometer, conductors between the galvanometer and thermocouple extensions, and spring-actuated carriers for the thermocouple extensions.

847,003. Electric Furnace. Basilius von Ischewsky, Kiew, Russia. Application filed February 15, 1906.

The furnace includes a hollow cylindrical body having a lining of material which is electrically conductive only at a high temperature, and a number of electrodes housed in the cylindrical wall of the body and abutting at their inner ends against the lining.

847,007. Electric Switch. Isidor Kitsee, Philadelphia, Pa. Application filed March 19, 1904.

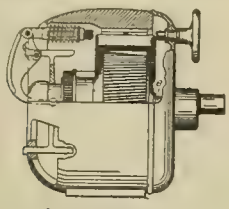
The switch embraces a support, a movable conductor provided with a longitudinal slot and pivotally secured to the support, a spring connected to the movable conductor and support respectively, a guideway in the support, a projection from the movable conductor extending through the guideway, the guideway terminating in a notch, stationary contacts adapted to be secured to the current-carrying circuit and means to move to and fro the movable conductor.

847,008. Converter. Isidor Kitsee, Philadelphia, Pa. Application filed June 10, 1904.

In the electric converter the magnetic core consists of a coil of iron wire, the individual turns being insulated from each other, the terminals of the iron core being connected to a working circuit.

847,032. Process for the Production of Pigments. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Cleveland, Ohio. Application filed April 18, 1902. Renewed February 11, 1907.

The method of producing white lead described consists in passing an electric current from a lead anode to a cathode through an electrolyte capable of yielding a lead solvent and containing a carbonating agent, causing the electrolyte to flow between the electrodes and thence to a point outside the field of electrolysis at sufficient velocity to transport the pigment, and transporting the pigment by such flow.



NO. 847,088.—VARIABLE-SPEED MOTOR.

847,044. Thermostatic Circuit-controlling Device. Louis H. Britton, Cleveland, Ohio. Application filed December 10, 1906.

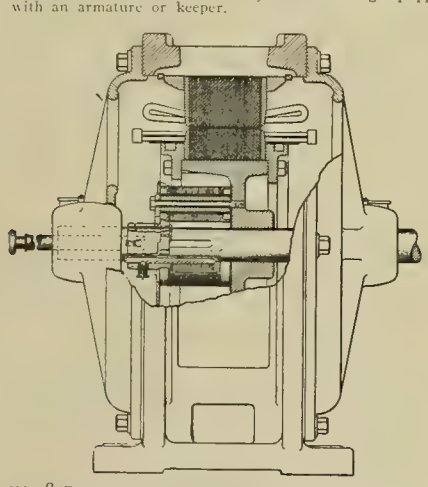
The device described has a pair of contacts, a vacuum chamber, an air opening, a fusible seal for the air opening, and a body of mercury normally upheld out of co-operative relation with the contacts by the vacuum and releasable by the breaking thereof on the fusion of the seal and movable by gravity into electrical connection with the contacts.

847,065. Body to be Heated Electrically. Ernst Haagn, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed March 16, 1906.

The method described of producing bodies to be heated electrically consists in securing a resistance in the desired position by means of organic matter, and applying a layer of fireproof insulating material to the one side of the resistance.

847,066. Cane. Francis L. Hall, San Pedro, N. M. Application filed March 19, 1906.

The device consists of a staff or stick provided with a permanent magnet with an attached rebounding ball through which the cane extends, the ball being equipped with an armature or keeper.



NO. 847,111.—STARTING RESISTANCE IN MOTOR.

847,079. Electromagnetic Transmitting Device. Max Johannet, Paris, France. Application filed November 27, 1906.

An electromechanical transmission from a motor shaft to a driven shaft, comprises two dynamos, one of which constitutes a generator and the other a receiver, the dynamos having the armatures thereof keyed upon the driven shaft, the generating dynamo having its field magnets integrally connected to the motor shaft, and the receiving machine having its field magnets subdivided into sections, and an electromagnetic regulator for placing in circuit a variable number of the sections of the field magnets of the receiving dynamo and operating automatically in proportion to the intensity of the current developed in the generating machine, for the purpose of varying the field of the receiving machine, and consequently causing the variation in the inverse sense of the two factors (couple and speed) of the constant power available on the driven shaft.

847,080. Interrupted Contact for Third-rail Systems. Adolph S. Katzman and Henry A. Vizethann, New York, N. Y. Application filed September 28, 1906.

Combined are a number of insulated supports, a feed wire extending from one of the supports to another, and contact blocks mounted upon the feed wire and provided with obliquely inclined contact faces.

847,087. Electric Switch. Gustav W. Liden, New York, N. Y. Application filed November 23, 1905.

In the electric knife blade switch described is a combined latch and conducting device carried by the knife blades and adapted for engagement with the contact posts of the blades.

847,088. Variable-speed Electric Motor. John C. Lincoln, East Cleveland, Ohio, assignor to the Lincoln Company, Cleveland, Ohio. Application filed January 12, 1906.

In the motor patented are combined with the field structure of the motor, an armature mounted normally to rotate therein, means for effecting the partial withdrawal of the armature axially from the field structure, and a heavy spring associated therewith adapted to counterbalance the inward pull of the armature during the period of its withdrawal. (See cut.)

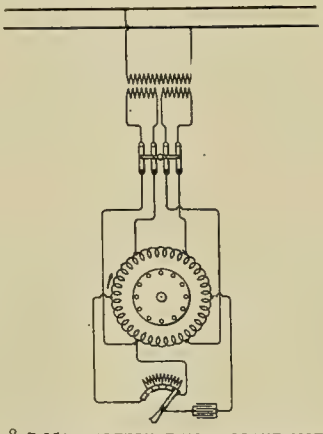
847,105. Signal. William H. Parrish, Jr., Nashville, Tenn. Application filed November 3, 1906.

In combination with a railroad crossing of a steam and electric road, are a main signal circuit, including a signal for the motorman of the electric road, the circuit being normally open and including a prescribed length of the steam-railroad tracks, and a test circuit normally closed and including the prescribed length of the steam-railroad track.

847,111. Starting Resistance for Motors. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 23, 1904.

In a motor are resistances mounted on the rotor, axially movagle contacts adapted to engage the resistances, a notched rack on the shaft, and a spring-pressed pawl carried by the movable contacts and engaging the rack. (See cut.)

847,153. Alternating-current Motor. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 19, 1903.



NO. 847,153.—ALTERNATING-CURRENT MOTOR.

Combined are an induction motor, a single-phase source of supply, independent supply circuits derived therefrom and connected to the windings of the motor, a condenser, and means for variably connecting the condenser to the windings of the motor. (See cut.)

847,157. Signaling Apparatus. Harold G. Brown, West Ealing, London, and Ernest de Mérindol Malan, Highgate, London, England, assignors of one-third to James Henry Neal, Boston, Mass. Application filed April 4, 1905.

In the apparatus combined with a frame are successively disposed groups of indicating members thereon and electromagnetic mechanism operating on the groups in succession and selectively upon the indicating members of each group.

847,163. Trolley. Thomas Cope, McKees Rocks, Pa. Application filed November 17, 1906.

Details are described.

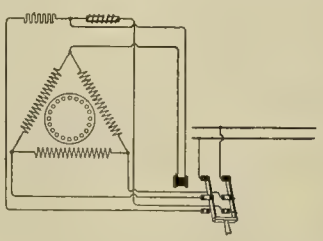
847,165. Bulkhead Door, Hatch or Other Barrier. William B. Cowles, Cleveland, Ohio, assignor to the Long Arm System Company, Cleveland, Ohio. Application filed August 18, 1905.

In an electrical system for the operation of water-tight bulkhead doors, hatches or the like, are combined with a door or hatch, an electric motor geared to the door or hatch, a motor-controlling switch electrically connected to the motor, means for connecting the controller and motor to a source of current supply, an electromagnet arranged to operate the motor-controlling switch, an emergency circuit for energizing the magnet, and a switch located at a distance from the magnet for controlling the circuit, and means for operating the controller normally independently of the magnet.

847,170. Trolley Stand. Harry E. Eastman, Richmond, Va., assignor to Louis Goldback and Edward W. Krouse, Richmond, Va. Application filed January 5, 1906.

Means are provided for automatically dropping the trolley when it is removed from a conductor.

847,172. Controlling Means for Single-phase Motors. Augustine R. Everest, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1905.



NO. 847,172.—CONTROL OF SINGLE-PHASE MOTORS.

In combination with a single-phase induction motor, are a main circuit connected to the primary winding, an auxiliary starting circuit, a switch in the starting circuit, and a magnet controlling the switch connected to the primary winding in quadrature to the main circuit connections. (See cut.)

847,188. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed June 18, 1906.

Combined with a telegraph line circuit carrying successive impulses of opposite polarities, are a polarized receiver, and means for sending the line impulses through the receiver always in the same direction.

847,189. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed August 9, 1906.

There are means to receive impulses of alternate direction and translate the same into readable characters, the means comprising one polarized device, two windings for the device and means to alternately shunt alternate coils for each impulse received.

847,197. Relay. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 25, 1904. Renewed February 11, 1907.

The relay comprises an electromagnet having a flux bar extending longitudinally thereof, contact members carried by the flux bar, means for connecting one of the contact members to the armature independent of the pivotal connection, and means on the other contact member which connects with the armature.

847,267. Producing Metallic Silicides. Thomas L. Willson, Ottawa, Ontario, Canada. Application filed April 11, 1904.

One claim provides the treating of a compound containing iron, nickel and silica, by electrosmelting it with a basic compound and carbon, to produce a ferro silicide.

847,283. Telephony. Harold J. Fisher, Hotchkiss, Colo., assignor of one-half to George H. Duke, Hotchkiss, Colo. Application filed August 25, 1903.

In a selective telephone system are combined a selecting wheel at each local station, signal and selective connections between the central and local stations, part of the connections being carried by the wheel, and means controlled at central stations to operate the wheel and connect selected local station and to maintain the signal connections from the other stations to central during the time the selected stations are connected.

847,284. Commutator. John R. Grindrod, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1904.

A cylindrical commutator comprises a number of independent conducting members separated from each other by strips of sheet mica, the conducting members and strips of mica being reversely tapered with respect to each other.

847,296. Ignition Apparatus for Explosion Engines. Henry C. Royer, Terminal Island, Cal. Application filed October 15, 1906.

Combined are a generator for normally supplying the spark, a magneto and manually operated means for storing up power in the form of momentum for driving the magneto.

847,299. Circuit-making and Breaking Device. Frederick L. Willard, New York, N. Y., assignor of one-half to George Weiderman, New York, N. Y. Original application filed October 2, 1905. Divided and this application filed February 14, 1906.

In the device described are a base plate, spring-contact devices connected therewith, an armature lever pivoted below the spring-contact devices and adapted to swing in a vertical plane and provided with an inwardly directed arm adapted to operate in connection with the spring-contact devices, means for limiting the outward movement of the armature lever, and a magnet placed between the support of the armature lever and the spring-contact devices.

847,303. Electrical Conductor. Frederick Platt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 4, 1904.

Combined are a brush having a hole or recess formed in it, and a flexible conductor extending into the hole or recess and soldered to the brush at the bottom only of the hole or recess.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 18, 1907:

423,421. Apparatus for Producing Steam Heat and Light by Electricity. Theophilus D. Farrall, Michigan City, Ind.
423,449. Electric-wire Molding. John A. Seely, Brooklyn, N. Y.
423,462. Electric Switch. George H. Whittingham, Baltimore, Md.
423,468. Electrical Connection with Car Tracks. George G. Campbell, Milwaukee, Wis.
423,487. Fire or Police Telegraph. George C. McCullough, Richmond, Ind.
423,488. Electric Switch. Thomas F. McEvoy, Waterbury, Conn.
423,495. Crossing for Electric Conductors. Henry A. Seymour, Washington, D. C.
423,527. Electrical Conductors. George E. Miller, Lynn, Mass.
423,552. Electric-railway System. Ludwig Gutmann, Fort Wayne, Ind.
423,553. Alternating-current Electric Regulator. Ludwig Gutmann, Fort Wayne, Ind.
423,575. Individual Telephone Call. Joseph Sack, Dusseldorf, Germany.
423,594. Galvanic Battery. Martin M. Clark, Chicago, Ill.
423,616. Galvanic Apparatus for Dental Surgery. Charles W. Manker, Nebraska City, Neb.
423,617. Electrical Device for Use in Dental Operations. Charles W. Manker, Nebraska City, Neb.
423,632. Electric-wire Supporter. William F. Rothenberg, Denver, Colo.
423,637. Carbon Rod for Arc Lamps. Charles E. Scribner, Chicago, Ill.
423,638. Cut-out for Electric Arc Lamps. Charles E. Scribner, Chicago, Ill.
423,708. Static Electrical Machine. Hugo Tirmann, Cleveland, Ohio.
423,733. Method of and Apparatus for Electric Welding. Charles L. Coffin, Detroit, Mich.
423,734, 423,735 and 423,736. Method of Welding Metals Electrically. Charles L. Coffin, Detroit, Mich.
423,753. Electric Burglar and Fire Alarm. William Gee, New York.
423,874. Means for Supplying Electricity to Tram Cars. Alexander L. Lineff, Chiswick, County of Middlesex, England.

WESTERN ELECTRICIAN

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A 1200-2400-volt Direct-current Electric Railroad.

By A. de Courcy.

An electric railroad in France which presents some original features is the line running through the anthracite-coal region in the Isère district. The coal trains are taken over a narrow-gauge line of some 20 miles length by a specially designed type of locomotive. The road runs through a mountainous region and its profile is very irregular. Along the line are many grades, curves, tunnels and viaducts, and the highest altitude reached by the railroad lies at 3,000 feet above the sea level.

The station of La Mure lies upon the through railroad line which runs from Grenoble southward to Marseilles. From this station a narrow-gauge road follows the gorges of the Drac River for some distance, and then enters the valley of the Motte. There is also a branch line which starts from the principal line and runs to the colliery of Comberamis. Along the main line there are a number of large anthracite-coal mines which supply a large portion of the business for the electric railroad. The grades are very heavy upon the line, and the greater part of it, about 14 miles, has a continuous grade of 2.75 per cent. In addition, there are 18 tunnels, which figure a total length of three miles or over.

Of especial interest is the fact that the Thury high-voltage direct-current system, with series connection, is used. The three-wire system is employed, with double overhead wire and bow trolley. It is operated upon 2 × 1,200 volts, or 2,400 volts maximum. The locomotive is designed for 500 horsepower and is intended to be used with a train of 20 coal cars. Since the electric system was set running it has proved to be much superior to the steam locomotives formerly operated by the railroad company. In practice the electric locomotive draws a train of 20 empty cars up the grade and descends with the same number of loaded cars, weighing 330 tons. The current taken by the motors in this case is about 150 amperes, which is less than was expected.

It was found upon trial that a train of 120 tons could be hauled at moderate speed at an expenditure of 110 kilowatt-hours upon a 12-mile stretch of track, and the maneuvers at the stations brought this figure up to 120 kilowatt-hours. This is below what was reckoned upon for this kind of work, and speaks very well in favor of the system. Reckoning per ton-kilometer, the result is 38 kilowatt-hours per ton of load, gross, including the locomotive, while it is 48 kilowatt-hours per ton of net load. The running expenses are much less than in the case of steam locomotives, in the proportion of two to three, and there is also an economy of labor.

A supply of current for the line is secured from the large hydraulic plant of Avignonet, which was described in a previous article. It will be remembered that this plant, which is controlled by the Société Grenobloise de Force et Lumière, has a plant erected upon the Drac River. In addition to the other turbine units of the station, there is installed a special direct-current generator which serves to supply the electric railroad. The appearance of this machine is shown in one of the accompanying pictures, and it will be noticed that it is a double machine, containing two generators mounted upon the same base and having a common shaft.

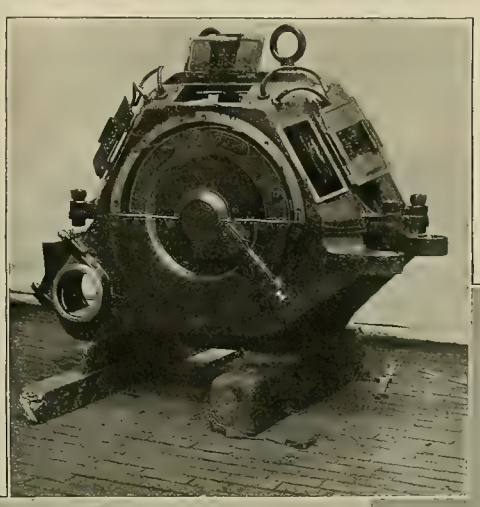
These machines have a capacity of 300 kilowatts each and are coupled direct to the shaft of the turbine. Working at 2 × 1,350 volts on the three-wire system, they will deliver 180 amperes and operate at 250 revolutions per minute. Current is supplied to the railroad by meter according to the contract which the Société Grenobloise has with the railroad company, and the meters are installed in a small structure erected at a point on the railroad.

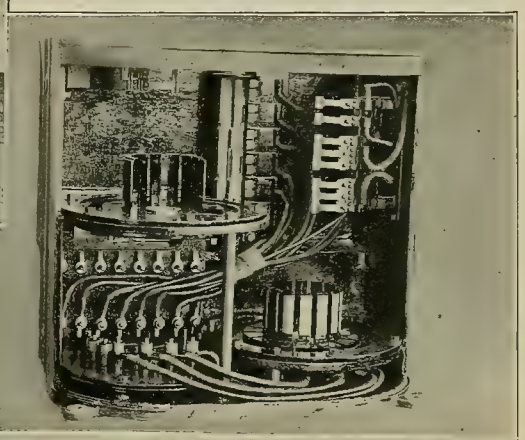
An overhead line runs from the hydraulic plant to the railroad, and it joins on to the latter at two feeding points, first at a distance of nine miles from the station, and after crossing the railroad it meets it again at the 12-mile point.

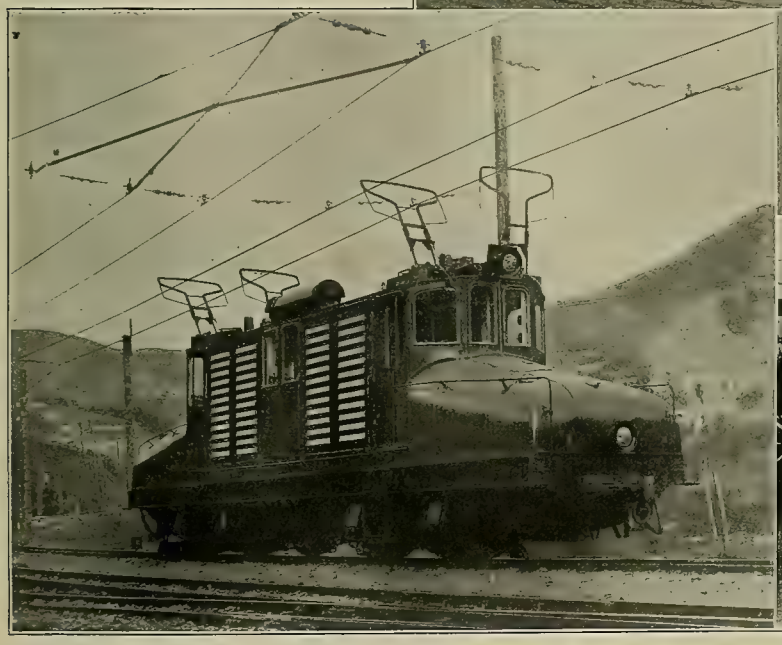
In the accompanying illustration is shown a view of the electric locomotive, which also illustrates the method adopted on the railroad lines for the construction of the overhead wiring. Another view represents the Thury six-pole motor, while the controller is also shown in detail. The La Mure locomotive is built to run upon a narrow-gauge track of one meter, which is the standard generally adopted for light railroads in France. Hence it has some peculiarities which are due to this cause. It was constructed at Paris by the Compagnie des Constructions de Saint Denis, and the electrical outfit was furnished by the Compagnie de l'Industrie Electrique of Geneva, Switzerland. It is designed for the Thury direct-current system, which is already in use upon a number of traction systems, some of these having been already described in the Western Electrician.

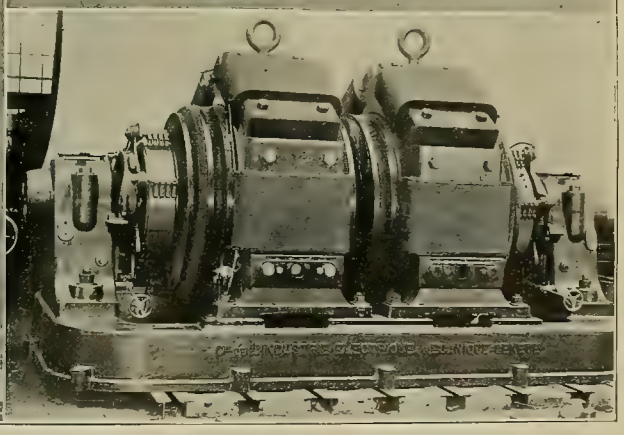
But the present locomotive has been made the object of a special design, owing to the conditions under which it is obliged to work, in relation to the amount of power needed in the locomotive for hauling the coal trains and also the gauge of the track. It was somewhat difficult to place the motors, which are designed for 125 horsepower each, upon the frame, owing to the narrowness of the latter, and the remaining space was also limited for disposing the remainder of the apparatus, but this has been carried out in a very successful manner.

The total weight of the present locomotive is about 55 tons, and, as will be observed, it has a main central portion forming the cabin for the motorman, and the ends slope down at the front and rear. There are two trucks and four axles, and each axle contains a motor of the Thury pattern. These motors are of the hexagonal ironclad pattern and are suspended from the frame in the usual way by springs. As the motors are designed to give 125 horsepower each, their combined capacity is 500 horsepower. Mounted in the motorman's cabin are various apparatus for handling the









Thury Six-pole Motor Used on the Locomotive.

Locomotive Controller with Front Casing Removed.

Electric Locomotive on La Mure Line.

Two Direct-current Generators on One Shaft in Power House.

A 1200-2400-VOLT DIRECT-CURRENT ELECTRIC RAILROAD IN FRANCE.

locomotive, such as the controller levers, starting-resistance lever, brake handles, etc. The starting resistaince are mounted in the compartments formed by the sloping ends of the locomotive.

In the present case the two motors mounted upon each of the trucks are permanently connected in series. As the overhead line works upon 2 × 1,200 volts, each motor is designed to take 600 volts when in full running. The controller is carefully designed, and is built with double cylinders, both of these being mounted in a single iron box. All the motor couplings for the different maneuvers, forward and rear motion, electric braking, starting and stopping, are carried out by the different sets of contacts.

On the roof of the locomotive are mounted four trolleys of the bow pattern. There are two trolleys of like construction for each of the overhead wires. The design of the trolley is a relatively simple one, and it is very substantial at the same time. When desired, it can be readily turned about from forward to back while the wire is still resting upon it, owing to the long span of the trolley wire. Aluminum is used for the horizontal contact piece.

Commercial Motor-vehicle Exhibition in London.

(From the London correspondent of the Western Electrician.)

The great success of previous motor-car exhibitions in Great Britain, especially from the tourist-car point of view, has been instrumental in dwarfing another and more important section of the industry—commercial vehicles. Thus it has come about that the Society of Motor Manufacturers and Traders has deemed it advisable to organize a separate exhibition for this branch, and consequently the first International Commercial Motor-vehicle and Motor-boat Exhibition was opened under the most favorable auspices by the lord mayor of London at Olympia on March 9th.

Of course, the main features of the show are not electrical, but it is pleasing to note that electricity plays a larger part than at any previous similar exhibition. The number of electrical exhibits, pure and simple, is only two, but when one reflects that there are nearly half a dozen systems of gasoline-electric transmission—the application of which to motor omnibuses and such heavy cars is regarded as the solution of noiseless and economical working—it will be realized that the interest of electrical engineers in the exhibition is not superficial. Further satisfaction is gained by the knowledge that the gasoline-electric transmission of power on motor vehicles is now being studied by electrical engineering firms, and is not being absolutely left to motor-car engineers, who, in the nature of things, must be largely mechanical engineers.

As stated above, there are two companies showing electrically driven vehicles. One is the Electromobile Company, the only concern to run electrically driven motor cars about the streets of London successfully. The other is the Electric Van, Wagon and Omnibus Company, whose electric bus met with such a hostile reception in London a short time since. The Electromobile Company showed the ambulance, of which a view is given in the photograph, and a delivery van, capable of carrying half a ton of goods.

The main features of the Electromobile Company's carriage are its "straight chassis" and "underslung interchangeable battery." The frame of the chassis is straight in elevation and rectangular in plan, and is constructed of rolled channel steel. The wheel base is seven feet six inches, and the track four feet six inches. The wheels are of the normal artillery pattern, fitted with pneumatic tires. The underslung-battery-box system has been adopted to obtain rapid interchangeability of batteries, even distribution of weight on the wheels, the collection of all the cells in a single box, and a low center of gravity.

The wooden box containing the accumulators is braced by a light steel framework, terminating in a lug at each corner. These lugs engage with strong taper pins sliding in brackets on the frame, which are operated from either side of the carriage by a simple screw mechanism. In the depot the accumulator box is lowered from its position by a hydraulic lift, and conveyed to the battery department for examination and charging. At the same time the carriage, freed from its batteries and the charging cable, can be taken to any part of the depot to be washed, or for the motor and gearing to be examined or repaired. The chassis and battery box together weigh about 1,000 pounds.

The battery consists of 44 "Contal" cells of a special pasted type, and weighs about 1,100 pounds. Its capacity is 135 ampere-hours, and it affords sufficient power to propel a victoria about 40 miles, and a double landaulet about 30 miles, over average roads in fair condition.

Each plate is formed of two thin grids of antimoniated lead, riveted together, and presenting 32 square holes for the active material, compressed into the grids by means of a hydraulic press, which rivets the plates and perforates each pellet of active material with nine holes.

The motor is of eight horsepower, at 1,500 revolutions, on a continuous load, but it can safely exert over 16 horsepower for short periods. It is of the ironclad type, bipolar, and series-wound, having two separate commutators, connected to separate armature windings. The designers, M. M. Contal and Gasnier, have introduced a very compact arrangement of field castings and coils, by which magnetic joints are avoided, and the distortion of field due to armature reaction is counteracted, resulting in a reduction of field ampere turns and a suppression of sparking.

Transmission is through a double train of double helical gearing to the differential, and thence to the hubs of the rear wheels by live shafts, which revolve in an external tubular axle. This axle is stationary except for the slight radial movement permitted by the suspension springs carrying the motor.

The controller, which gives forward speeds ranging from three to 15 miles an hour, two electric brakes and one reverse speed, has a framework of aluminum bolted direct to two longitudinal angles of the chassis, which also carry the steering bracket. Its position is thus horizontal and immediately below the floor boards, in which is a trap door exposing the brushes and terminals. The handle actuating the controller is immediately below the steering wheel and moves in a plane parallel to the wheel. The steering is effected by a wheel and spindle inclined at 30 degrees with the vertical, and transmitting a motion to the ordinary levers through beveled gearing with a ratio of four to one.

In addition to the two electric brakes, a powerful double-acting expansion brake is fitted on the hubs of the rear wheels. An ingenious form of quick-break switch is connected with the brake pedal, so that the electric current is broken before the brake is applied. Thus with a slight pressure on the pedal the carriage can run free; on further pressure being applied the brake comes into action, while on releasing the pedal the motor continues to drive as before.

During the last year various gasoline-electric systems have been introduced, which may be roughly classified as follows:

1. Those which start and accelerate electrically, after which the electrical equipment is disconnected and the drive taken up by a clutch connecting the engine mechanically to the road wheels.

2. Those employing batteries, which supply electrical energy to a dynamotor whose function is to assist the engine in starting and in climbing grades, the accumulators being replenished from the dynamotor when the vehicle is standing or running on the level.

3. Those which drive entirely electrically.

It is asserted for the first method that a more efficient drive is obtained at full speed and that since the electrical equipment is only used for starting and accelerating, the complete equipment can be made comparatively lighter and smaller. These claims, however, are not borne out in practice, since to obtain a direct drive it is necessary to introduce a bevel and differential gear, with the requisite flexible couplings, etc., the combined losses of which, after the vehicle has been in service some time, will offset any gain in efficiency.

Further, it is not practicable to limit the output of the electrical equipment to starting and acceleration duties only, since occasions will arise where hills of considerable length must be negotiated, the gradient of which must prove too severe for the direct drive and which, therefore, must be climbed entirely through the electrical transmission. Since such grades represent the duty requiring the maximum capacity of the electrical equipment, it follows that, in order to avoid overheating, the electrical equipment must be made as large and heavy as would be necessary were it called upon to propel the vehicle during the whole of the working period.

With regard to the second system, experience has shown the accumulators used are both costly and troublesome to maintain.

In the third category comes the system which has been evolved by the British Thomson-Houston Company. Briefly, the apparatus consists of a dynamo driven by a gasoline engine, the whole of the engine power being converted by the dynamo into electrical energy, which is transmitted through a controller to two motors driving the road wheels. The dynamo is coupled direct to the engine, the armature replacing the flywheel. Two motors are provided, each driving a road wheel independently, the differential gear thus being eliminated.

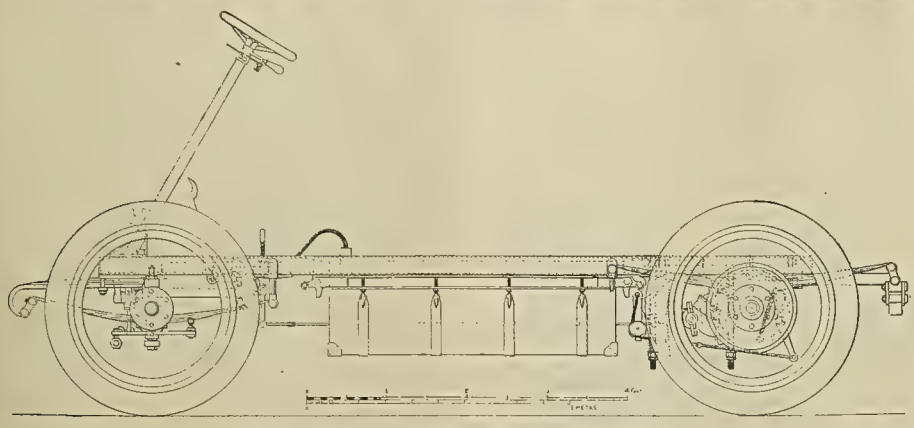
ELECTRIC POLICE AMBULANCE FOR CITY OF LONDON.

The dynamo is normally rated at 15 kilowatts, at 850 revolutions per minute, at 130-65 volts, but is capable of withstanding heavy overloads. The engine is rated at from 30 horsepower to 40 horsepower. The motors, which are rated at 7½ kilowatts, are series wound, running at 1,400 revolutions per minute; constant input, 130-65 volts. Tests have demonstrated that they are capable of propelling a fully loaded vehicle up grades exceeding 14 per cent. without injurious heating or sparking.

The control is arranged from the "operating box," which is situated to the right of the driver, and which is coupled through a chain to the controller proper. The latter is located close to the motors and generator, thus reducing the length of the connecting cables to a minimum. The controller provides the following motor connections: Speed forward, motors in series; speed forward, motors in parallel; an "off" position; reverse, motor in series. In the "operating box" is mounted a small resistance and control switch, which is connected in circuit with the generator field.

A foot pedal is arranged to be coupled to both the engine governor and to the control switch in such a manner that, when the pedal is fully depressed, the engine is governed to run at 400 revolutions per minute, and at the same time the switch is moved to insert the resistance in the generator field, which is sufficient to reduce the main volts to practically zero. No current, there-

fore, flows through the motors, and the vehicle is stopped. On releasing the pedal the first movement cuts the resistance out of the generator field, causing sufficient current to flow to the motors to start the vehicle, which will continue to run slowly, the engine remaining governed at 400 revolutions per minute. On entirely releasing the pedal the governor is "held up," allowing the engine speed to at once increase to its normal 850 revolutions per minute, and the vehicle will



CHASSIS OF ELECTRIC AUTOMOBILE (ELECTROMOBILE TYPE).

accelerate to its full speed. The engine speed is prevented from exceeding 850 revolutions per minute by the restraining influence of the generator, which exerts for all conditions of load a limited but definite load demand.

In order that the electric motors may exert the necessary additional torque in ascending a grade, they will require an increased current; the generator automatically supplies this increase of current, but at a proportionately lower voltage; thus the torque load on the engine, and, therefore, its speed, remains unaffected whatever the grade may be, and this is brought about without any hand regulation on the part of the driver.

An additional feature of the control is the stopping and restarting of the vehicle without operating the controller, and therefore without breaking the main circuit, thereby eliminating any possibility of sparking at the controller contacts.

Suburban Store Lighting.

The development of comprehensive plans for electrical distribution from large urban central stations usually includes establishment of modern substations in residential suburban areas. These substations are properly built with the requirements of the future in mind, and there is generally a considerable amount of reserve capacity installed, both in the transmission lines and in the transforming equipment. Sometimes the load is so small at first that the line is operated at half the voltage which will ultimately be applied. From the time when such sub-stations are placed in service it becomes important to increase their business rapidly, and in such cases energetic efforts to add to the connected residential load bring their own reward.

So much attention has been given to the needs of the residence customer that the requirements of the suburban store have frequently been entirely overlooked. The conditions are much like those in the small towns and villages. It is well recognized among central-station men that the suburban store offers an attractive field for power applications, and motor-driven coffee grinders, meat choppers, emery wheels, ventilating fans, elevators and ice-cream freezers are frequently found on commercial circuits, even in remote districts. There is undoubtedly a good opening in many small towns for refrigerating plants of moderate capacity. But when one examines the lighting of stores in many villages and suburban communities it is clear that there is room for much improvement.

Many such stores still adhere to the kerosene lamp, with its large tin reflector, or depend on the decadent brilliance of poor gas for their interior illumination. Even where the incandescent lamp is used in the suburban store, the tendency is to hang the unshaded bulbs over the counters too near the level of the eye for the comfort of the customer and salesman and without the reflectors which would deflect the light upon the goods instead of scattering it all around the store. The windows are apt to be illuminated in the same general way, with bare lamps hung so that they are the most conspicuous objects in sight, in which case the merchant spends good money in lighting up part of the outdoor regions.

The same principles of good lighting which are followed in the large city store are applicable to the small retail house in the suburbs. The business may not warrant the brilliant illumination of the village store, but it costs very little to distribute the lights so that they will not offend the eye of the purchaser; to change from low-efficiency units to more modern economical lamps with scientifically designed shades, or even to place a few shielded frosted bulbs at points of advantage. Sometimes a Nernst lamp, a flaming arc lamp or two, or a modest electric sign can be pressed into service outside a store or over a fruit stand. Given one or two skillfully lighted stores in a suburban community, others are pretty sure to follow suit, and work in this direction is seldom lost. It is largely a matter of keeping in close touch with customers.

Sometimes a central station can encourage a good deal of interest in the use of electricity in suburban towns by installing a striking electric sign of its own at some point of vantage. A good illustration of this is found in the practice of the Newton and Watertown Gas Light Company, an organization which distributes current generated by the Boston Edison Company through a broad suburban area at the west of the city proper. The Newton company has for several months maintained a brilliant "talking" sign advocating the various uses of electric light and power, on top of a building directly opposite the Boston and Albany station, where it is seen by every passenger who boards or

ARC-LAMP POST ON SIXTEENTH STREET, DENVER.

leaves a train after dark and also by many who pass the station daily on one of the four tracks located at this point. The fitting phraseology of this sign constitutes a telling argument in favor of extended suburban uses of electricity. H. S. K.

The Hiawassee River Power Company, operating a waterpower electrical plant near Ducktown, Tenn, is reported as considering the transmission of electricity to Rome, Ga., a distance of 75 miles, and building a sub-station at Rome, furnishing power to various manufacturing plants.

Progressive Lighting Methods in Denver.

Denver, the "City of Lights," is well known for its profuse and attractive electric lighting. The work of making Denver known as the best lighted city in the country was begun a few years ago by a "booster" organization, composed of the business men of the city, and it has progressed with enthusiasm and energy ever since.

First there was the "Welcome Arch," which was built at a cost of over $20,000, subscribed by merchants and corporations of the city. This arch is the subject of much comment by all visitors to Denver and makes a marked impression on the stranger. Another step of progress made in Denver lighting was the locating of an electric lamp on the corner of nearly every street in the city where there were more than four or five houses. The result of this is apparent in the lessening of crime. There has been hardly a "hold-up" in the city since this system was put into effect.

Sixteenth Street is now the apple of Denver's eye. The citizens declare that there is no business street in the country that can compare with it in artistic and effective lighting. The new lighting is the conception of the mayor and the members of the art commission, who are working hard to make Denver more beautiful and who consider that the Sixteenth Street lighting is a long stride in the right direction. The construction of the lighting system, which includes 98 poles of hand-

LIGHTING OF SIXTEENTH STREET, DENVER, BY ARC LAMPS.

some design, with two lamps on each pole, one of which is not lighted, cost about $16,000. The old trolley and telephone poles have been removed, so that there is nothing to interfere with the pleasing alignment of the light poles. The new downtown lighting system will be gradually extended to all of the streets in the business section.

Inspection Tour of Purdue Students.

A party of over 150 students from Purdue University was in Chicago this week. The occasion was the annual inspection trip of junior students in engineering. Three departments were represented—mechanical, civil and electrical engineering, there being something more than 50 students in each party. All came together by special train from Lafayette, Ind., arriving at 11 o'clock Tuesday morning. While in Chicago each party gave attention to matters which are peculiar to its professional purpose. The electrical engineers were scheduled to visit the Hawthorne works of the Western Electric Company, South Chicago works of the Illinois Steel Company, Underwriters' Laboratories, Northwestern Elevated Railway, Lake View sub-station of the Commonwealth Electric Company, Automatic Telephone exchange, Chicago Tribune building, Chicago postoffice, Harrison Street power station, Fisk Street power station, West Twenty-second Street sub-station of the Chicago Edison Company.

The members of the Purdue faculty accompanying the party were Professors W. F. M. Goss, W. K. Hatt, C. P. Matthews, L. V. Ludy, J. D. Hoffman, A. B. Smith, A. N. Topping and H. O. Garman.

Metric System Rejected in England.

The House of Commons of Great Britain, by 150 to 118 votes, on March 22d, rejected the bill proposing to introduce the metric-system into Great Britain. Mr. Lloyd-George, president of the Board of Trade, said in behalf of the government that the adoption of the system would be a dangerous and costly experiment by which Great Britain would lose the advantage which she now possessed in foreign markets over her metric-system competitors.

Gas, Gas Engines and Gas Producers.[1]

By J. Seton Gray.

The thermal efficiency of a modern steam plant is about 10 per cent., and that of a gas-engine plant about 20 per cent. This is the principal reason for the large amount of work that has been done in recent years on the gas engine. Again, while gas can be manufactured in a gas producer for about three cents per thousand cubic feet, city lighting gas costs between 50 and 100 cents per thousand cubic feet. This explains why so much attention is being paid to the development of the gas producer for the making of power gas.

The many methods adopted for the production of power gas may be divided into three general classes: (1) When a carbonaceous substance such as coal is heated in a closed retort, gases are given off which may be collected and used for power. This method is that at present in use for the manufacture of illuminating gas. (2) If steam be blown through a mass of incandescent fuel, a combustible gas is produced. In this process the fuel is kept incandescent by a blast of air, the steaming and blowing periods being intermittent. (3) If steam and air together be intermittently blown into incandescent fuel, a gas, containing hydrogen and carbon monoxide, is produced continuously. The amounts of steam and air are regulated so as to keep the fuel at a fairly constant temperature.

Gas produced by the first method, while generally of high calorific value, is costly. Water gas, produced by the second method, is much cheaper; but as it contains much hydrogen is a very inflammable gas, and on this account cannot be used with the high-compression pressures now employed in gas-engine practice. These high pressures are necessary if a high efficiency is required of an engine. The third method, however, gives a cheap gas, well suited for gas-engine work.

Nearly all fuels containing carbon can be used for the production of producer gas. It must be noted, however, that if the gas is going to be used in a gas-engine cylinder, it must be of uniform quality. It must also contain no tar or other impurities, in order to avoid trouble with the valves.

To Mr. Dowson we owe the first successful producer-gas plant. His plant was designed to work with anthracite coal. This coal is non-caking, and, being nearly pure carbon, contains very few condensible hydrocarbons or tar. It is therefore an ideal fuel for the gas producer. As this producer embodies in the best way the fundamental principles necessary for the production of gas from solid fuel, it will be described here.

Fig. 1 is a diagrammatic section of a Dowson gas producer, taken from "The Gas and Oil Engine," by D. Clerk. As may be seen, the producer consists of a cylindrical casing (A), lined with firebrick, and having at the bottom fire bars (B) above a closed ashpit (C). The upper part of the generator is closed by a metal plate on which is mounted a fuel hopper (D), having an internal bell valve (E) operated from the outside.

To begin operations, the upper cover is removed from the hopper (D), the bell valve is opened; a fire is built upon the bars (B), and air forced through it by a steam jet and the pipe (P). Fuel is slowly added from above till the whole mass is incandescent and fills the producer to a depth of about 18 inches at least. During this heating process, gases are given off by way of the open hopper, and are ignited there. Care must be taken not to inhale this gas. (It contains much CO, and is very poisonous, but when burned it is harmless.) When the fuel is incandescent the inner and outer valves of the hopper are closed, and the gas flows by a pipe through cooling and scrubbing devices, finally finding its way to the gas holder through the coke scrubber formed within it. From the gas holder the gas flows through another scrubber, as shown by the arrow, and thence to the engine.

In 1895 Renier, a Frenchman, after much experimental work with a Dowson gas producer, succeeded in making the engine draw its own supply of gas direct from the gas generator, without the use of a gas holder. While this plant was not a commercial success, it was the forerunner of the modern suction gas producer. The Dowson gas producer has already been described. The following is a description of a suction gas producer; the difference between the two systems may be seen from the descriptions: The adjoining sketch (Fig. 2) shows the general construction of this piece of apparatus. To set it in operation a fire is built on the grate. The door at the front of the producer allows this is to be easily done. A quantity of paraffin waste, or other combustible material, is placed inside the generator, and lighted. Broken wood is then added through the hopper at the top, and this is followed by coal until a bright fire is burning. The air for combustion is supplied by a small hand fan (B). As soon as the fire is burning brightly the water necessary for the production of the gas is turned on.

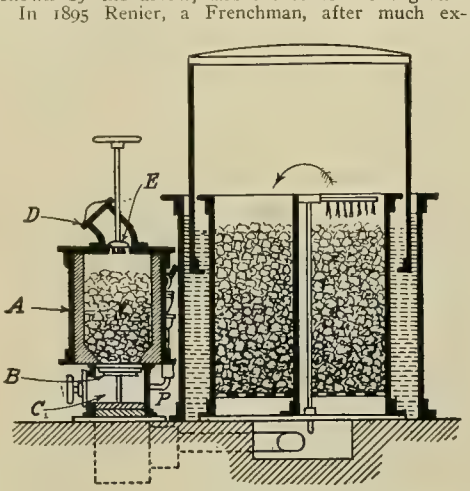


FIG. 1. DIAGRAMMATIC SECTION OF DOWSON GAS PRODUCER.

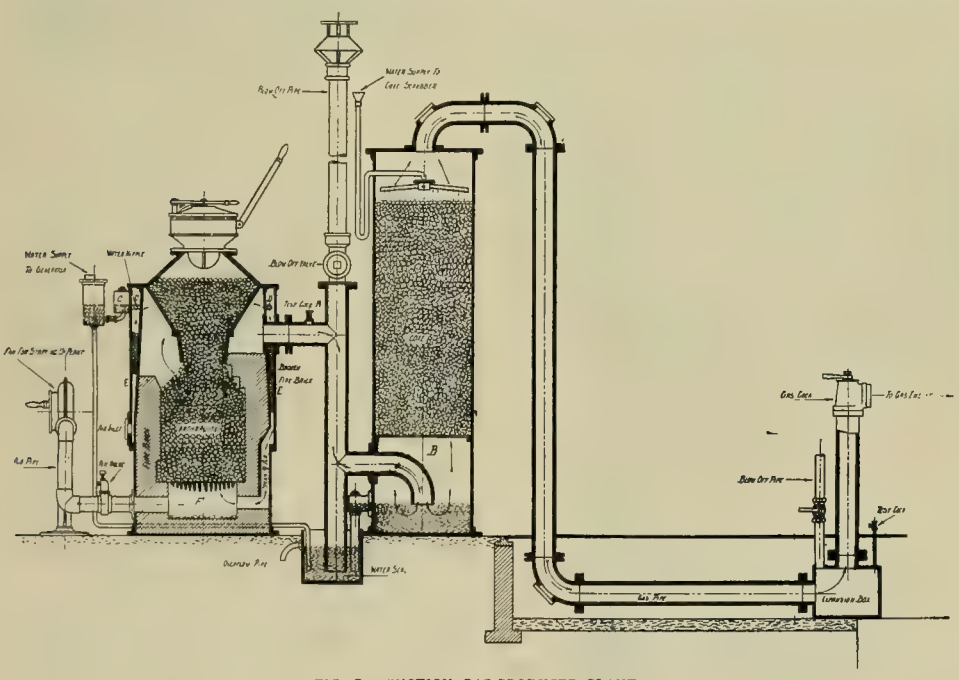


FIG. 2. SUCTION GAS-PRODUCER PLANT.

This gas is tested by opening a small test cock (A) and applying a light. If the gas burns with a blue flame it is ready for use. The gas is then allowed to enter the scrubber (B) and to pass through the expansion box to the engine. Before being allowed to enter the engine the gas is again tested, and if it still burns with a blue flame, the engine may be started. The hand fan is stopped as soon as the engine starts work, and thereafter the whole plant becomes automatic. During the suction stroke of the engine a vacuum is set up in the engine cylinder. To fill this vacuum, air and steam are drawn into the generator and are there turned into combustible gases, which pass through the scrubber to the engine.

For the production of the necessary steam a water supply (C) is fixed to the generator. This supplies water to the vaporizer (D). This vaporizer is just a pipe perforated with a number of holes. Every time the engine draws gas, which it does in proportion to the load, a small quantity of water is drawn out of the vaporizer, falls on a quantity of hot refractory material (E) in the casing, and is there converted into steam. This steam is caught up by the current of air drawn in at the air valve. The mixture of air and gas passes round the casing to a space (F) under the fire bars, from whence it is drawn up through the body of incandescent fuel, where it is turned into gas. The gas passes from the generator through a water seal at the bottom of the coke scrubber, passes through the closely packed coke, where its tar and other impurities are extracted, and then goes to the engine cylinder. A continuous stream of water is allowed to fall in a spray over the coke, whereby the gas is cooled to the normal temperature.

The producer plant last described is known as the suction plant, because it is kept in continuous operation by the suction stroke of the engine. Another plant also in common use is known as the pressure plant. A well-known example of such a plant is the Dowson plant, already described. The principal differences between the two systems are that the pressure system requires a steam boiler in which to generate the steam required for operation; also, that with this system a gas holder, in which to store the gas, is required.

There is one serious objection to the pressure system which is not found in the other system. The whole producer is under pressure. If, then, there are any leaks between the producer and the engine, gas will escape. As has already been mentioned, this gas is very poisonous, and may cause the death of a careless operator. The suction producer is foolproof in this respect, because the pressure in the system is less than atmospheric. If, then, there are any leaks in the system, all that can happen is that air will pass into the system through these leaks. While this will reduce the efficiency of the plant, it can do no other damage. The fact that no boiler or gas holder is required in the suction producer is a great point in its favor, because simplicity is the essence of good engineering, especially when we are dealing with a machine which is going to be put under the care of men who have no engineering knowledge or skill.

Dealing with efficiency, the diagram (Fig. 3) shows very clearly the values obtained from three characteristic plants. Column 1 shows how the heat is used up in a modern steam plant of 250 horsepower. The total heat contained in the coal was 952 B. T. U. Of this there is a loss in conversion of 20 per cent., much of the heat in the fuel passing up the chimney. There is a further loss of 10 per cent. in the feed pump, in condensation, and in radiation. Of the remaining 70 per cent., 57½ per cent. is lost in the engine exhaust, and after making an allowance for friction losses, we find that, out of a total of 100 per cent., only 10 per cent. is converted into actual work. While this value of 10 per cent. may be obtained in test, in actual everyday practice the efficiency will be still less.

Column 2 shows how the heat is used up in a pressure producer plant of 250 horsepower. There is, first of all, a loss of 25½ per cent. in radiation, in ashes, in gas coolers, and in steam boiler. Of the 74½ per cent. which goes forward to the engine, 33.2 per cent. is lost in cooling the engine cylinder, 20 per cent. is lost on exhaust, and after allowing for friction we find that 18 per cent. of the available heat is given as actual work in this system.

Column 3 shows the distribution of the losses on a 40-horsepower suction producer system. It may be taken for granted that the losses on a 250-horsepower system will be smaller. Of the total heat in the coal 89 per cent. is transferred in the gas to the engine cylinder. After deducting engine losses, as in the last case, we find that 23 per cent. of the available heat is transferred into mechanical work. The efficiencies then are as follows: Steam, 10 per cent.; pressure producer, 18 per cent.; suction producer plant, 23 per cent.

There are one or two other points worthy of mention while dealing with the efficiency question. In a small steam plant the loss due to bad stoking is often quite considerable; in a producer plant there is very little such loss. With regard to stand-by losses there are about three pounds of coal per hour in a moderate-sized producer plant, whereas, according to results obtained by Mr. Dowson, this loss is about 71.5 pounds of coal per hour in a steam plant of the same size. When we consider that most plants are idle for about 99 hours every week, we see how great will be the difference in coal bill due to stand-by loss. This loss is small in producer plants, because, since very little air is passing through the fire, when the fire is banked up in the gas generator that piece

1. Condensation of a paper read before the Mechanical Section of the Canadian Society of Civil Engineers, Montreal, February 28, 1907.

of apparatus is turned into a slow-combustion furnace.

With regard to the efficiencies mentioned later on, there is a point of great practical interest which is too often overlooked. When we say that the efficiency of a steam plant is 10 per cent., while that of a gas-producer plant is 23 per cent., we mean, among other things, that, for the work equivalent to 10 tons of coal, we must not only buy 100 tons, but we must also pay for the labor of handling this, and also for storage space. With the producer plant the calculations are made only on 23 tons of coal. A similar relation holds in the disposal of the ashes.

Dealing now with the problem of fluctuating loads, the following test was made on a suction producer plant by Messrs. Crompton & Co., Ltd., of London, England: A gas engine was run for four hours with a load of 10 horsepower, then a load of 80 horsepower was thrown on suddenly. The plant immediately responded, and hardly a flicker was noticed in the lights supplied from this engine. It is to be borne in mind also that this was done without the use of a gas holder. This can be done by any well-designed producer plant, and is a performance that an engine working from a steam boiler would find very hard to beat.

It has been argued against the producer plant that gas engines are not very good for the operation of electric generators. As an example, to

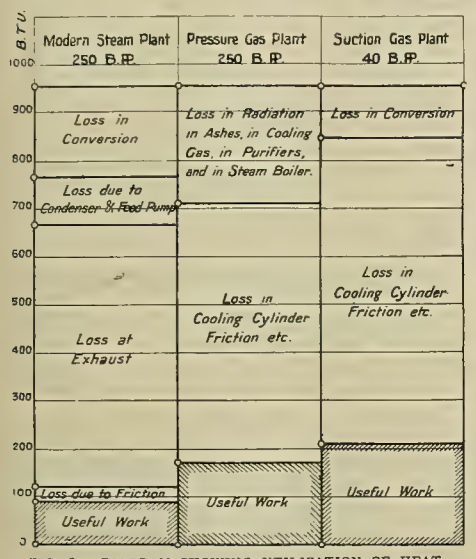


FIG. 3. DIAGRAM SHOWING UTILIZATION OF HEAT IN ONE POUND OF COAL.

contradict this statement, in Granada, Spain, three single-cylinder gas engines were installed rated at 80 brake horsepower each. These engines drive alternators in parallel, and have supplied the whole city with light for the last two years. Now, there are gas engines on the market in which the problem of balancing has been very carefully dealt with. If the result mentioned could be obtained with single-cylinder engines, there should be no difficulty in obtaining satisfactory operation from the modern three-cylinder engines.

The National Gas Engine Company installed two complete suction plants in the south of Scotland in a factory which had been buying power from a central station. Before the installation was made the engineers in charge of the work made the following calculation of probable saving: The 160,000 units of electricity required per annum at 3⅛ cents per unit, gives a power bill of $5,000 per annum. For the same power, with a suction producer, assuming one pound coal gives one brake-horsepower-hour, 108 tons of coal per annum would be required. At $3 per ton, the fuel for the producer costs $324 per annum. Allowing 10 per cent. for interest on capital and depreciation, $471 for labor, $120 for oil and sundries, the total expenditure is $1,881 per annum, and the saving due to the adoption of the producer plant, $3,119 per annum. The cost of engine and producer plant, complete, was $6,240, the electrical equipment cost $3,360 for two dynamos, switchboard and wiring, or the total cost of $9,660. A saving of $3,119 per annum would therefore pay for the whole plant in three years.

It is interesting to mark the effect of the perfecting of the gas producer on the gas-engine industry. Messrs. Thorneycroft & Co., shipbuilders, London, England, have just fitted a number of canal barges with suction producer plants and gas engines. The results of these have been so satisfactory that they are going to try them on coasting and merchant vessels. The British Admiralty is making experiments to find what are the limitations in using it for naval work. The greatest advantage the producer has for marine work is that the amount of coal to be carried is greatly reduced. In a country like Canada, where farming is done on a large scale, and where the power users are so scattered as to prohibit the building of central stations for power and light, the gas producer ought to have a large and increasing use.

Messrs. Tangye, Ltd., of Birmingham, England, have put on the market a portable gas-engine and producer plant to meet the demand of the farmers.

About 10 years ago attention was drawn to the fact that a large amount of power is available in gas which is usually thrown away from blast furnaces. It had been stated on good authority that 468 horsepower may be developed per ton of iron produced per hour. In the United States of America alone there were produced in 1905 23,000,000 tons of pig iron. This is equivalent to an available power of 1,225,000 horsepower.

The chief difficulty to be overcome in the use of this blast-furnace gas in a gas engine is that connected with the removal of the large quantities of dust which it contains. Another difficulty sometimes met in a small plant, namely, that the gas is very variable in quality, is overcome in large plants by mixing the gas obtained from several furnaces together. However, the trouble due to this is not very great in a well-designed plant. The gas, which is very hot when it leaves the furnace, is usually cooled in the process of extracting the dust.

Experience shows that furnaces using hematite ores give a gas containing very little dust, and what dust there is settles very easily, even in short lengths of pipe. Oolitic ores, on the other hand, give a gas containing much dust, which passes quite readily with the gas through long lengths of pipe.

There are two ways at present in use for the purification of blast-furnace gases: (1) Passing the gas through scrubbers containing sawdust or coke, in exactly the same way as is done with producer gas. (2) The gas is caused to pass through a centrifugal fan. A jet of water enters the axis of the fan, and is driven outward in the form of a fine spray. This spray of water gathers up all the dust in the gas. This latter method was tried in a plant at Differdingen, Belgium, with the result that, while the gas contained four grammes dust per cubic meter when it left the furnaces, it held only 0.25 gramme after passing through the fan, and could then be used with success in the engines. The calorific value of this gas, as might be expected, is very variable. It may be taken that rich gas means poor operation in the blast furnace, while poor gas represents good operation therein.

The success of the producer, during the few years in which it has been developed, makes a thorough knowledge of this piece of apparatus necessary to anyone who pretends to be up to date in power-plant works. The small producer plant has a field in sparsely settled districts which cannot be as well met by any other existing piece of apparatus. The blast-furnace engines are also growing in popularity as their operation becomes better known. As has already been pointed out, there is a great deal of power going to waste at present in existing blast furnaces. If the whole of the power from Niagara were utilized, it would only give three times the horsepower that is thrown away by the blast furnaces of the United States of America alone.

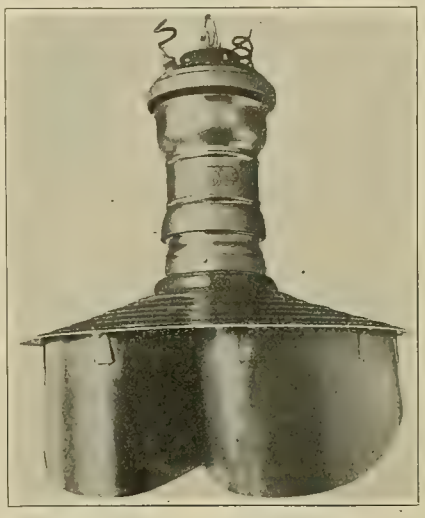
Lighting of a Railroad Yard for Night Operation.

In connection with a paper presented by him on January 23, 1907, before the Western Society of Engineers, Chicago, on "The Theory of the

FRONT VIEW OF ARC LAMP WITH REFLECTOR DIRECTING LIGHT FORWARD AND DOWNWARD.

Design of Railway Freight Terminals," Mr. H. M. North, assistant construction engineer of the Lake Shore and Michigan Southern Railway at Cleveland, Ohio, referred to the lighting of yards for night operation. The following is a condensation of Mr. North's remarks on that subject:

Yard work is dangerous, difficult and slow, durtric lights are frequently used for yard illuminating the hours of darkness and during fog. Election, and the switchmen supplement these by leaving a lantern on the ground opposite the end of the last car on each track. The electric lights, as ordinarily used, are not effective, and the cars are handled slowly as a result. The defect of these lights is due to their dimness, the lack of sufficient number, and their ineffective placing. To overcome this trouble on the humps and ladders, Mr. M. E. Shire, engineer in charge of the "Clearing Yards," Chicago, has developed a device like the reflector of a locomotive headlight, each light being equipped with one of these and placed



REAR VIEW OF ARC LAMP WITH REFLECTOR DIRECTING LIGHT FORWARD AND DOWNWARD.

so that the rays of light are directed toward the important channels of the work.

The classification yards are most in need of such a lighting arrangement, and as there are no reverse movements in this yard, not even the slight disadvantage of lines of clean light shining at times in the faces of the switchmen is experienced.

While all portions of the yard system should work smoothly and without delay, the work is concentrated at the entrances and on the ladder leads of the classification yard, as all cars must enter the yard over a single-throat track and go to their respective destinations by way of one of the ladder leads. Furthermore, the momentum required to start the cars and carry them well into the classification yard must be imparted by the grade of the throat track and ladder leads. Consequently, the maximum speed of the car occurs in its movement over the ladders, and if this speed is checked by the brakes by the rider, because he cannot see the car ahead of him clearly enough to judge of its relative position and speed, the capacity of the entire yard is thereby affected. There are no yards as far as observed where this lack of sufficient light does not lessen the operating capacity during the hours of darkness.

For lighting the ladder leads of the classification yard, one or more of these lights with reflectors is placed at proper intervals from the hump to the ladder end, on poles or on steel bridging similar to the bridging frequently used for signals; the height must be sufficient to avoid casting serious shadows from one car to another, and the reflectors properly trained to throw the rays of light where needed. In the body of the classification yard these lights are needed in greater quantity, and arranged to sweep the yard at different angles; on the outlet ladders, and in the other yards of the system, this type of reflector is undesirable, as the switching is equally backward and forward in direction, and movement toward the lights would be blinded by its rays. Accordingly, the effective arrangement in these places is a general diffused light reflected downward only.

For the Dupo yard of the Gould system there has been developed under the writer's direction, a similar system of conserving and reflecting the rays of light to the points where they are needed. Based upon this idea, a similar type of reflector was developed by the General Electric Company, in place of the locomotive headlight type, and the reflecting surface instead of being of silver plate or nickel plate, was of porcelain enamel on thin sheet steel. For the ladder leads and the portions of the classifying yards where the light rays are directed forward in one way only, there was developed the type of reflector shown in the accompanying illustrations, and for the parts of the yard where only a generally diffused illumination was needed, the skirt was omitted from this pattern. The lights were carried on systems of general current bearing lines of not greater than 440 volts, so arranged that the breakage of a single line would plunge only one part of a yard in darkness. This scheme makes its first cost, maintenance and repair economical and minimizes both the danger to employes, and the amount of interruption to work due to breakage of wire lines.

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DATES AHEAD.

Iowa Electrical Association (annual meeting), Lafayette Inn, Clinton, Iowa, April 18th and 19th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

ANDREW CARNEGIE'S liberality in presenting a building costing over a million dollars to the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers will be appropriately celebrated at the formal dedication of the Engineering Societies' Building in New York city next month. The building is a handsome one and well designed for its purpose. The societies are to be congratulated on their occupancy of it. Mr. Carnegie's gift was wisely conditioned on the societies' doing something for themselves, and they have raised or will raise a half million dollars or more for land and equipment. Thus they can utilize the building with the feeling that they are substantial contributors to the home which shelters them—rather a more comfortable feeling than to be entirely indebted to philanthropy. The dedication of a triple-society building will be unique in the history of engineering in this country and should prove of exceptional interest.

THE HIGH-TENSION committee of the American Institute of Electrical Engineers is to be thanked for bringing together so much valuable material as was "in evidence," as the newspaper reporters say, at the special meeting of the Institute in New York last week. The list of contributors to the discussion is a long one, and every man had something to say of interest on the subject of motor-generators versus synchronous converters or the desirability of generators wound for 20,000 to 25,000 volts. Considerable space is devoted in this issue of the Western Electrician to some of the facts brought out by this valuable discussion, but only a selection of extracts is made from the report. For the full account the student is referred to the Proceedings of the Institute.

Other subjects than those discussed last week will be brought forward at the special meeting to be held under the auspices of the committee in Chicago in May, probably May 24th. Transformers and transmission lines present problems which will no doubt be considered with other kindred topics. The Chicago high-tension transmission convention of June, 1904, was entirely successful, and we have no doubt that the 1907 meeting in this city of like character will be equally so.

AS THERE is no great loss without some small gain, so the derailment of a New York Central electric train in the northern suburbs of New York city on February 16th, with its sad loss of life, has been the cause of the publication of much valuable data on the performance of steam and electric locomotives on curves, contrasting varying centers of gravity, pressures of driving wheels, and the like. A contribution by Mr. William J. Wilgus, vice-president of the New York Central Railroad and chairman of the recent Electric Traction Commission of that railroad, presented in this issue of the Western Electrician, seems to give the gist of the investigation of the characteristics of the two types of locomotives in this respect. The electric locomotive comes out with rather a greater factor of safety, and we believe that Mr. Wilgus' table truthfully sets forth the actual comparison, so far as human subtlety makes such a comparison possible. The New York Central company believes, as we believe, and as all engineers and sensible men must believe, that electric train operation is at least as safe as steam locomotion. Whatever defect in track or elsewhere caused the accident, the wreck would doubtless have occurred if steam power had been used, for there is nothing to show that electricity was in any way to blame.

MAGNETIC compounds may be formed of non-magnetic elements, and Mr. Wedekind has recently conducted some researches on this comparatively little-known subject. An account has been published in L'Industrie Electrique, and from a note in the London Electrician we learn that the experiments have been for the most part carried out with compounds of manganese, which exhibit magnetic properties, although manganese itself is non-magnetic. The mixtures of these compounds with phosphorus, boron, antimony, etc., exhibit strong permanent magnetism, which disappears under the influence of mechanical shocks. A tube full of powdered borate of manganese suspended by cocoon silk places itself in the magnetic meridian. Compounds of manganese and bismuth are strongly magnetic, although bismuth is a typical diamagnetic substance. Certain compounds only become magnetic at high temperatures. Among these is a compound of nitrogen and manganese, which becomes magnetic at 2,000° C. This compound contains only six per cent. of nitrogen, but is attracted by a magnet. Silicide of manganese is not magnetic. At high temperatures, manganese placed in a current of oxygen becomes magnetic. The most magnetic compound is antimonide of manganese, whose permeability is nearly equal to that of iron. Chromium compounds have also been found to be slightly magnetic. The investigation is certainly very interesting, and we hope that it will be continued with compounds other than those of manganese.

SUBURBAN traffic in and near Boston may be completely surrendered by the steam railroads to the electric railways if Mr. Lucius Tuttle of the Boston and Maine Railroad is correctly reported in the daily newspapers. Mr. Tuttle's opinion was expressed, as reported, in a letter to Mr. Charles S. Hoyt of Winchester, who suggested that the Boston and Maine equip the portion of its line between Boston and Stoneham with electricity. President Tuttle, in answer, said that the substitution of electricity for steam power in general railroad service "has not passed beyond the experimental stage." After citing the competition of electric railways he concluded: "It is upon the whole now becoming a question whether there is any profit at all derivable by the steam railroads from the carrying of short-distance suburban travel at the existing low rates charged therefor, and not only the Boston and Maine but railroads carrying similar traffic everywhere are fast coming to the belief that the surrender of this kind of travel to the street railways and interurban trolley lines will be, from every point of view, the best solution of the problem."

This would be more cheering to the electric-railway people if it were not for the fact that in New York and elsewhere the steam railroads themselves expect to do the electrifying, substituting electric for steam power on existing suburban lines. In Chicago, for instance, one cannot well imagine the Illinois Central surrendering its very profitable suburban traffic. But that service ought to be electrical, and in the slow course of time no doubt will be, although hope deferred maketh the heart sick.

MR. FISH'S ANNUAL REPORTS as president of the American Telephone and Telegraph Company are always interesting, but that for 1906, issued this week and given in condensed form elsewhere in this issue, is more so than usual, owing to the great activity in the telephone industry last year. This activity was, in fact, unprecedented, and will probably not be equaled by this year's record. It is shown by the fact that the amount expended for new construction and real estate in 1906 by the Bell telephone companies was nearly $80,000,000. It may be remarked parenthetically that probably half or nearly half of this large amount of money was paid out for apparatus manufactured in Chicago.

Probably it is owing to the notable telephone expansion, greatly increasing the expenses, that the net revenue of the parent Bell company is less for 1906 than for the preceding year, although the decrease is but slight—from $13,034,038 to $12,970,937. The gross revenue shows a large increase, but a jump in the expenses of $2,876,368 accounts for the dropping off in net revenue. The largest item of expense is for interest and taxes, and thus the increase of interest on bonds issued to furnish capital for expanding business may largely account for the decrease in net revenue.

The report dwells on the greatly improved character of telephone plant in recent years, and Mr. Fish thinks there is no reason to doubt that at the present time it is substantially of a type which will not need replacement until it is worn out. The president of the Bell company thinks that the Independent companies have made no relative gain and asserts that investors are apparently less inclined than formerly to furnish the sinews of war for competing telephone exchanges.

High-tension Transmission Discussed by the Institute.

A meeting of the American Institute of Electrical Engineers was held in New York on March 22d under the auspices of the high-tension transmission committee, of which Ralph D. Mershon is chairman. Dr. Samuel Sheldon, president of the Institute, was in the chair. Two "introductions to discussion" were presented, the first by P. M. Lincoln of Pittsburg under the title "Motor-generators versus Synchronous Converters, with Special Reference to Operation on Long-distance Transmission Lines;" the second was by B. A. Behrend of Cincinnati, his subject being "The Practicability of Large Generators Wound for 22,000 Volts."

Mr. Behrend followed the reading of his paper by oral remarks, after which C. E. Skinner of Pittsburg presented a written discussion. The debate was continued by Mr. Murray of Hartford, Conn.; A. H. Armstrong, Schenectady; H. G. Stott, New York city; Ralph D. Mershon, New York; Percy H. Thomas, New York; Philip Torchio, New York; Charles F. Scott, Pittsburg, and others.

Contributed discussions were received from Ernst J. Berg, Schenectady; F. O. Blackwell, New York city; R. C. Corson, Hartford, Conn.; R. S. Kelsch, Montreal; William B. Jackson, Madison, Wis.; A. C. Pratt, Helena, Mont.; Leo Schuler, Frankfort-on-the-Main, Germany; B. C. Shipman, Baltimore; O. B. Coldwell, Portland, Ore.; Henry Floy, New York; W. J. Foster, Schenectady; Clarence E. Gifford, Buffalo; Farley Osgood, New Milford, Conn.; John C. Parker, Rochester; H. F. Parshall, London; John Pearson, Somerset, Wis.; Bertrand P. Rowe, Pittsburg; Carl Schwartz, New York; Miles Walker, Manchester, England; J. B. Whitehead, Baltimore; A. H. Babcock, San Francisco; E. P. Burch, Minneapolis; Guido Semenza, Milan, Italy; J. R. C. Armstrong, New York, and W. L. Waters, Milwaukee.

As will be noted, the discussion was very voluminous. In his "introduction" Mr. Lincoln considered (1) the reliability, (2) voltage regulation, (3) corrective effect, (4) efficiency, (5) cost, (6) parallel operation, (7) starting of motor-generators versus synchronous converters for long-distance work. Having done so, he arrived at the following summary:

"On three of the preceding seven counts, namely (1), (4) and (5), the converter has a distinct advantage. On one more (6), all methods are taken as being on a par. On the remaining three (2), (3) and (7), one of the other methods has the advantage. In one of these (7), the disadvantage of the converter is not marked. The converter's disadvantage on the other two largely disappears with the addition of a means of voltage regulation. This analysis, therefore, would seem to indicate that there are but few cases where the motor generator should be used in preference to the synchronous converter."

As typical of a diverging view the following from Mr. W. L. Waters' contribution may be quoted:

"Speaking generally from the operating viewpoint, a motor-generator is preferable to a synchronous converter in almost every respect, except as to efficiency and cost. And even as to cost, a motor-generator is cheaper for low voltages and larger outputs, especially if the voltage on the transmission line is not over 15,000 volts, when the synchronous motor could be wound to take the high voltage direct. When comparatively cheap, medium-size units are wanted, and under conditions where close voltage regulation is unimportant, synchronous converters would be used, but when large size units are desired and when the voltage regulation and general flexibility are important, motor-generators would be preferable. In situations where the machines were to run with practically no attention, probably induction motor-generators would be preferable to synchronous motor-generators. But the fact that synchronous motors can be used to control the power factor of the line is of such importance in long transmission line that it would make the engineer adopt them wherever possible."

Mr. Behrend's introduction, with brief extracts from the discussion, are given elsewhere in this issue.

Electric and Steam Locomotives on Curves.

By W. J. Wilgus.

A great mass of information has recently been testified to before investigating bodies and also in the technical press regarding the comparative effect on curves of steam and electric locomotives, and owing to the many conclusions that have been reached because of the different assumptions made by those investigating the matter, it seems wise to summarize all the results to see what the comparative shear on spikes will be under various conditions for an electric locomotive of the New York Central type and a steam locomotive of the Atlantic type, on a three-degree curve elevated for 46½ miles an hour and with a train speed of 70 miles an hour. These results would, therefore, show the effect on the spikes at the outer rail at a speed 23½ miles an hour in excess of that for which the curve would be elevated.

The alternative elemental assumptions are:

First—Shall the calculations be made on the basis of the front driver only bearing against the outer rail or both the first and the second drivers bearing against the outer rail? Professor Swain's calculations, as explained in his letter of March 16th, are on the basis of the first two drivers bearing, but the counter-claim is made that under certain conditions only the bearing of the first driver should be considered.

Second—Shall full allowance be made for the friction between the rail and the tie plate, based on a coefficient of, say, 0.25; or, as many claim, shall no allowance be made for friction between the rail base and the tie plate, due to the possibility of a thin layer of ice in cold weather that would practically eliminate this feature?

The accompanying table has, therefore, been prepared, summarizing the results of the calculations that have recently appeared in the technical press and which have been testified to before public investigating bodies, showing four sets of comparisons, from which it appears that in one instance, with the first driver only bearing against the outer rail and full allowance made for friction between the rail base and the tie plate, the electric locomotive exerts 50 per cent. greater shearing stress on the spikes, with a stress per spike, however, showing a factor of safety of 4; whereas in the other three cases the greatest shearing stress is caused by the steam locomotive, with factors of safety ranging from 2½, where the first driver only bears against the outer rail and with no allowance for friction between the rail base and the tie plate, to a factor of safety of 8, where both drivers are assumed to bear against the outer rail and full allowance made for friction between the rail base and the tie plate.

Comparative Shear on Spikes for Electric and Steam Locomotives.

On Three-degree Curve Elevated for 46½ Miles an Hour.—Train Speed 70 Miles an Hour; i. e., 23½ Miles an Hour in Excess of Equilibrium Speed.

Assumption of Driver Bearing on Outer Rail.	Full Allowance for Friction Between Rail and Tie Plate.						No Allowance for Friction Between Rail and Tie Plate.					
	Electric.	Steam.	Difference.		Spike Shear.*		Electric.	Steam.	Difference.		Spike Shear.*	
			Per Cent. Greater.	Greatest Shear On.	Pounds per Spike.	Factor Safety.			Per Cent. Greater.	Greatest Shear On.	Pounds per Spike.	Factor Safety.
First Driver Only Against Outer Rail.	9130 D	5970 D	50%	Electric	4565	4+	14130 D	15390 D	9%	Steam	7695	2.5+
First and Second Drivers Against Outer Rail.	3020 T	4840 T	60%	Steam	2420	8+	7460 D	8170 T	10%	Steam	4085	5—

D = Driver wheel.
T = Truck wheel.
*Spike shear data based on average result of full size tests of spikes, showing ultimate shear 19,740 pounds, two spikes assumed to carry the load with 100-pound rail.

From this the conclusion may be drawn that for the worst possible combination that can be assumed, viz., the first driver only bearing against the outer rail and no friction between the rail base and the tie plate, the steam locomotive shows 9 per cent. greater shearing stress, with a factor of safety of 2½.

It will of course be borne in mind that these results are based upon a very much higher speed around the curve than that for which it is elevated.

Therefore it would appear that for most of the assumptions the steam locomotive shows greater stress on the outer rail than the electric locomotive, and that in all instances, even at 70 miles per hour on a curve elevated for 46½ miles per hour, the shear on the spikes is well within the limits of safety.

New York, March 22, 1907.

Proposed British Patent Law Change.

Mr. Lloyd-George, president of the British Board of Trade, recently introduced a bill amending the existing patent laws in the British House of Commons. He explained that the adoption of his bill would simplify and cheapen the procedure regarding patents, but that its main object was to prevent the patent laws from being used for the hindrance and suppression of British industrial development.

He said that out of 14,700 patents issued last year, 6,500 were to foreigners. He did not object to that, but a good many patents were taken out for the purpose of preventing the working of patents in Great Britain.

The present bill proposes that any person shall be permitted to demand the revocation of a patent at the expiration of three years if it has not been adequately worked in the United Kingdom.

Direct-current Power Supply for London.

London, March 14.—It is with feelings of distinct relief that electrical engineers are able to turn their thoughts from the haunting political aspect which has surrounded the electric power problem in London for the last two years and consider the matter from the calmer and less vindictive engineering standpoint pure and simple. For this we have to thank Mr. J. S. Highfield, the chief engineer to the Metropolitan Electric Supply Company.

Two years ago this company was granted bulk-supply powers over an area to the west of London into the adjoining county of Middlesex, aggregating some 300 square miles. In a paper read before the Institution of Electrical Engineers last week Mr. Highfield went into great detail over the direct-current high-tension system with which the name of Thury is so closely allied.

Without going at great length into the paper, it may be stated that the area with which Mr. Highfield has to deal has a circumference roughly of 80 miles and an area of 300 square miles, which it was desirable to supply through underground mains from a station situated on the circumference. In this case it at once became apparent that the cost of the cable system was the dominating factor in the problem, and therefore the high-tension direct-current system was carefully considered as affording a means of economy in this respect.

The station from which the supply will be given in the particular area is a steam station, but Mr. Highfield has come to the conclusion that the series system offers several advantages over the parallel system, notably in extending the possible commercial transmission distance in the simplification of the switch and regulating gear and efficient speed regulation of sub-generators. He contends that Mr. Thury has carried the system far beyond the experimental stage and believes that there would be no difficulty in building machines of larger size than hitherto.

The discussion, so far as it has gone, is chiefly remarkable for a long utterance by Lord Kelvin supporting the paper. Lord Kelvin stated that he had never swerved from the opinion that for long-distance power transmission direct current was the right system—an interesting statement enough when his connection with the Victoria Falls power scheme in South Africa is remembered. An earlier consulting engineer to this scheme in the person of Professor Kapp, now of Birmingham University, also announced his conversion to this opinion. The remainder of the discussion will produce a variety of opinion, for there are many who hold opinions not against the direct-current system per se, but against its adaptation with underground mains, such as is proposed, and in such a district. G.

The Mercury Arc Rectifier.

Mr. W. T. Small, Purdue, '03, instructor in the electrical department of Purdue University, Lafayette, Ind., presented an interesting paper before the Purdue branch of the American Institute of Electrical Engineers on Tuesday evening, March 19th, on the subject of "The Mercury Arc Rectifier." For some years after graduation Mr. Small was connected with the Cooper Hewitt Electric Company and had especially to do with the arc rectifier. He is therefore particularly well informed on that subject. The talk was supplemented by blackboard sketches and diagrams, by the aid of which the theory and operation of the rectifier were, according to the present-day theory, shown. In addition, Mr. Small had installed a rectifier near the front of the lecture room, and gave practical demonstrations of its methods of operation. From the direct-current side an arc lamp, a fan motor and also a small multipolar motor were operated.

Besides the arc rectifier, the Cooper Hewitt lamp, which, of course, operates on the same principle, was discussed, as well as the different methods of connecting the rectifier for use in connection with constant-current transformers for obtaining direct current for street arc lighting.

One of the many interesting features brought out was that the mercury arc does not seem to obey Ohm's law, inasmuch as the drop across the arc remains about 14 volts, regardless of the value of the current.

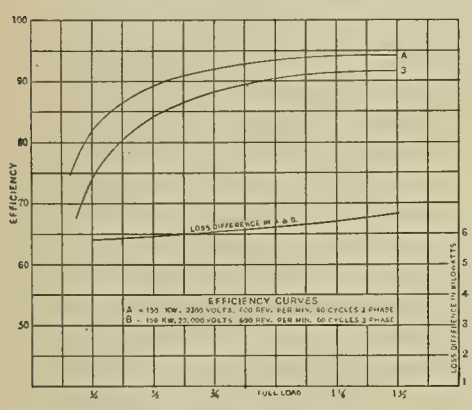
The Practicability of Large Generators Wound for 22,000 Volts.[1]

By B. A. Behrend

Summary. Where individual units of very large capacity are installed in power plants a potential of 20,000 volts is feasible, and it is to be recommended in units of 10,000 kilowatts capacity and above.

Where individual units of small capacity are needed for a potential of 20,000 volts, the conditions can be met in most cases, even down to capacities of 150 kilowatts.

With the increased capacity of individual units of alternating-current generators it is natural that the potential for which these generators are wound should be continually increased. It commends itself to limit the current capacity of generators, as the distribution and conduction of large currents from the generators to the switchboards is cumbersome and expensive. Historically the increase in voltage with the increased capacity of individual units and of power plants may be briefly summarized. The Niagara generators of approximately 3,500 kilowatts capacity, put into operation about 10 years ago, were designed for 2,200 volts. The 3,500-kilowatt generators of the Metropolitan Street Railway Company of New York were designed for 6,600 volts. The 5,000-kilowatt generators installed in the stations of the Interborough Rapid Transit Company in New York were designed for 11,000 volts. The large generators for the Brooklyn Rapid Transit



EFFICIENCY CURVES OF 2,300-VOLT AND 22,000-VOLT THREE-PHASE GENERATORS.

Company of 7,500 kilowatts were designed for 11,000 volts also.

The question of the importance of higher voltages in future plants cannot be discussed without reference to prime movers. The four types of prime mover which are likely to be of great importance in the immediate future are:

1. The hydraulic turbine.
2. The gas engine.
3. The reciprocating steam engine.
4. The steam turbine.

1. The field of the hydraulic turbine for large capacities, by which I mean capacities of 7,500 kilowatts or above in individual units, is not likely to be of great importance at the present.

2. The gas engine has been successfully built for capacities up to 2,000 kilowatts, and while it has unquestionably a great future for greater capacities, nothing as yet has been done to allow the application of the gas engine in connection with electric generators of 7,500 kilowatts or above.

3. The reciprocating steam engine still holds its own for small capacities, but for the capacities which we are here considering it has been superseded by the steam turbine.

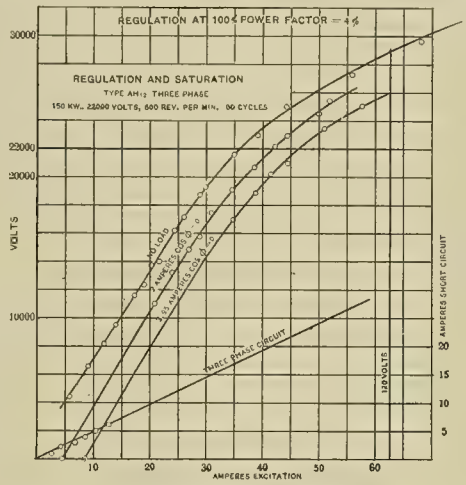
4. The steam turbine in its present condition is pre-eminently adapted to large individual capacities. I should consider a steam turbine of 7,500 kilowatts a comparatively small unit, and I am firmly of the conviction that steam turbines of 10,000 kilowatts or 15,000 kilowatts, and even of 25,000 kilowatts, will before long be developed and put into successful operation.

In thus looking to the steam turbine as the prime mover for generators of large capacity we have limited our sphere of inquiry to generators of large capacity and high speed—conditions best fitted for the operation of steam turbines. The question of high voltage in generators of small capacity and driven by other prime movers than the steam turbine will be referred to in the concluding paragraph.

Steam-Turbine Generators for Large Capacity, 7,500 Kilowatts to 15,000 Kilowatts and Above.

The difficulties encountered in winding generators for potentials of 20,000 volts or 25,000 volts are primarily mechanical difficulties. A coil containing a large number of small wires does not make a very mechanical piece of work. It would, therefore, appear to me desirable for the reasons here mentioned, and some others, that the individual coils should consist of as few conductors as possible and that these conductors should be of such size as to enable the making of mechanically and electrically strong coils. Let us take a concrete example. A certain 7,500-kilowatt turbo-generator wound for 11,000 volts and operating at 750 revolutions per minute at 25 cycles has six conductors per slot. A 7,500-kilowatt generator wound for 22,000 volts, if designed along similar lines, would have 12 conductors per slot. Increasing the capacity of the generator from 7,500 kilowatts to 15,000 kilowatts would enable the generator to be designed with six conductors per slot, and the difficulty produced by the higher voltage would be that of insulating the coils for the higher potential against ground and against one another.

The insulation of the coils against ground is easier to obtain than against one another. The question of insulating the coils from one another is particularly difficult in turbo-generators on account of the crammed conditions of the winding space, but at the present space of the art it is possible to obtain the necessary insulation for 22,000 volts, although this can be done only with considerable expense. As soon as there is a demand for



REGULATION AND SATURATION CURVES OF 22,000-VOLT THREE-PHASE GENERATOR.

large units wound for 22,000 volts this demand will be met by machines carefully designed for these conditions.

The question of reliability of service is closely allied to that of quick repairs. It will be urged that not only is the danger of the breakdown of a 22,000-volt generator greater than that of an 11,000-volt generator, but also the repairs, consequent upon a breakdown, will be more difficult to make on the 22,000-volt generator. While this statement is perfectly true, a plan can readily be devised so as completely to defeat this argument. In a large power house in which a number of units of large capacity of the steam-turbine type are installed the only rational way to make quick and satisfactory repairs consists in the carrying of spare parts. It will commend itself to the operators of power stations to carry a square revolving field for one of these units and a complete set of spare armature coils. It must be insisted upon that the armature coils of these high-potential generators can readily be replaced, and unless the machines are designed to permit this it would be necessary even to carry a spare stator completely wound, which would be almost equivalent to having a spare unit in the power house.

Economy Obtained by the Use of Generators Wound Directly for 20,000 Volts.

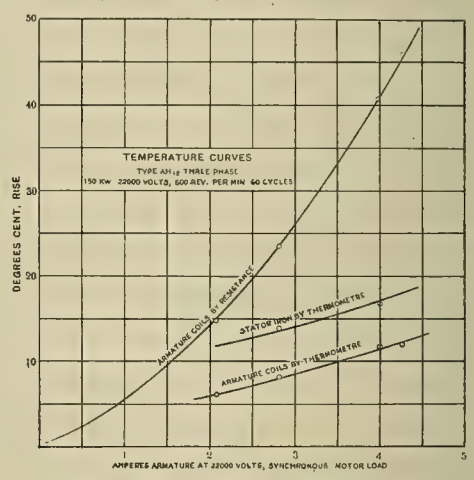
The chief gains obtained by winding generators of large capacity directly for the high potential required for distribution consist in the simplification of the power plant, and probably in a slightly reduced first cost. The question of reduced cost should certainly be considered a very minor factor, as reliability of service should be the criterion either in favor of or against the adoption of generators wound directly for high potential. Calculations of relative cost are here omitted on that account.

Winding Generators, Regardless of Size, for 20,000 Volts.

For the sake of ascertaining the feasibility of insulating coils for 25,000 volts the writer has had in operation a 150-kilowatt generator wound for 25,000 volts, 60 cycles, 600 revolutions per minute. This generator has been in operation for months, operating day and night under full load. Regulation curves and other data are illustrated in the accompanying diagrams. There is no doubt that there may be a limited field for units of small capacity wound for potentials above 11,000 volts, and the object of this paper is to call to the attention of the engineering profession the feasibility of generators of the smaller capacity, as 150 kilowatts, being wound for as high a potential as 25,000 volts. That the regulation, the heating and the efficiency of this machine are very satisfactory is amply shown by the curves accompanying this paper. Should such machines be used in the future it must always be insisted upon that the exchange of coils can readily be effected. In the 150-kilowatt generator referred to in this paper, it has so far not been necessary to replace any of the coils on account of defective insulation.

Two efficiency curves are shown. The one marked (A) refers to a 150-kilowatt, 2,300-volt, 600-revolution, 60-cycle, three-phase machine, and the other curve, marked (B), refers to a 150-kilowatt, 22,000-volt, 600-revolution, 60-cycle, three-phase generator. I have also plotted a curve here which I have called the "loss difference" between (A) and (B). This loss difference is to be taken up in the transformer, and I think you will find that the total efficiency of your transformer plant and your generator plant will be approximately equal to the efficiency of your high-potential generator plant, the difference being so small that I would consider it splitting hairs if I should endeavor to distinguish between the two. The efficiency is, in my opinion, the same in either case.

Referring to the regulation curves of the ma-



TEMPERATURE CURVES OF 22,000-VOLT THREE-PHASE GENERATOR.

chines under consideration, it will be noted that a very excellent regulation is shown—four per cent. at a power factor of 100, and in view to taking out the old winding and winding the machine for a higher voltage, thus reducing the capacity of the machine considerably, the temperature of the armature coils at 3½ amperes only rose 16 or 17 degrees by resistance method and only 10 degrees by the thermometer. The temperature tests have to be taken with a grain of salt in either case. I want to call particular attention to the difference in temperature between the outside of the coil and the inside of the coil, there being nearly 50 per cent. In other words, if a coil should rise inside to 60 degrees the temperature on the outside would be indicated as 30 degrees.

Discussion.

C. E. Skinner, Pittsburg: I agree entirely with Mr. Behrend that generators wound for voltages from 20,000 to 25,000 are entirely feasible and that as soon as there is any real demand for such machines they can be successfully made. As before stated, the question is one of cost, and it is also a question whether or not they are worth while. The use of such transmission plants would be very largely confined to districts where large amounts of power are to be transmitted comparatively short distances, as, for instance, in large cities for railway service, such as the present system installed in New York city, this being at the present time 11,000 volts. The increasing of this voltage to 20,000 or 25,000 volts involves the whole question of cables, etc., and would require very careful working out in order to determine whether there was real economy in the increased voltage. For transmitting smaller amounts of power to greater distances it is my opinion that the low-voltage generator, with raising transformers, will continue to be the most popular method for some time to come.

W. L. Waters, Milwaukee: The best answer to an inquiry as to the practicability of large alternators wound for 20,000 volts is that such alternators have already been built and are in operation. I would change the history of high-voltage alternators somewhat from that given by Mr. Behrend. The first high-voltage alternators were the 1,000-kilowatt, 10,000-volt, Deptford alternators built for Ferranti in 1889. Then in 1897 came the 1,800-kilowatt, 15,000-volt Paderno alternators, built by Brown-Boveri, and then in 1900 came the 1,050-kilowatt, 20,000-volt alternators built by Schuckert for the Valtellina line.

The possibility of building high-voltage alter-

1. An introduction to a discussion at a special meeting of the American Institute of Electrical Engineers, New York city, March 22, 1907, under the auspices of the high-tension transmission committee. The introduction is given in full, but space permits only a few extracts from the voluminous discussion.

nators depends entirely on the character of the shop work put into them. The design of such alternators in itself is practically no different from that of 6,600-volt alternators, and the only point for the designer to take care of is to make the work on the armature winding as easy as possible for the shop. After this is done it is entirely a question of careful and skillful work in the armature-winding department. The larger the output of the alternator the easier the question of making a satisfactory high-voltage armature coil, as the conductors per slot are fewer and they are of larger section and in consequence more rigid. It is only when we get to alternators of small ampere capacity that we get into serious difficulties.

On high-voltage alternators we rarely have breakdowns of the insulation to ground or between phases. Breakdowns practically always start as short-circuits between the individual turns of a coil, and as far as the writer has had experience there is very little difference between 6,000-volt alternators and those of higher voltage in regard to their liability to such short-circuits between conductors in the same coil. These short-circuits are apparently due partly to sudden surges on the line and partly to the gradual deterioration of the insulation, due to the vibration of the individual conductors in the coil. This gives us as a first requisite of a high-voltage alternator that we must have the insulation on each conductor as good and as permanent and as strong mechanically as possible, and that the conductors must be held perfectly rigid both in the slot and outside the slot. This practically means the abandonment of the scheme of threading the conductors through a closed insulating tube, and though this construction has been standard in Europe for high-voltage work and has been used to a certain extent in this country, I think we shall find that it will gradually be abandoned in favor of the form wound and subsequently insulated coil for all high-voltage work. It is almost impossible to make a perfect high-voltage coil out of small wires, such as would be used on a 150-kilowatt, 22,000-volt machine, as such a coil could not very well be made sufficiently rigid to last any length of time. For this reason I think that about 30 amperes is the minimum current capacity for which we can expect to build high-voltage alternators.

H. G. Stott, New York: I think practically all our manufacturers are agreed that above 15,000 volts it is not advisable to build transformers with air insulation or of the air-cooled type. It is the invariable practice for higher potentials than 20,000 to use oil insulation, and that it seems to me is the one governing condition in this whole question. In a generator we cannot use oil insulation, but in a transformer we can. Another point, from an operating man's viewpoint, and which is extremely important, is that in case of an accident to the generator that machine is certainly out of commission for several days, but in case of an accident to a transformer you can cut that transformer out. The practical limit of the generator capacity in the future will be the limit of the insulation of the underground cables.

Mr. Behrend: The 20,000-volt distribution for a city like New York is entirely unnecessary. You will all have to get busy and increase the population first, gentlemen. I think that 10,000 or 11,000 volts is quite enough for the area we have to cover in this city, and in practically all our cities, I am safe in saying. About 25 years from now the population of New York will be at least doubled, and then I think that the problems we are now discussing in an academic way will be foreshadowed, unless a widely different system is discovered or invented.

Ernst J. Berg, Schenectady: I quite agree with Mr. Behrend that large turbo-generators lend themselves best to very high-voltage windings. At the same time it may be of interest to know that our company has built 18,000-volt alternators directly connected to slow-speed engines. The transmission-line voltage has, in my opinion, a bearing on the best generator voltage, since with one of the high-potential lines grounded in a delta system high static stresses are introduced to the generator's windings. (These do indeed occur even in a grounded "Y" system when power is conveyed over two of the lines, and the ground used as a third conductor.) Therefore, it is evident that it is not well to make the generator voltage too low in reference to the line voltage. My judgment would be that it ought to be not less than one-sixth to one-fourth of the line voltage, corresponding to 10,000 to 25,000 volts in a 100,000-volt transmission. Judging from the amount of insulation required in transformers, the limit would seem to lie somewhere around 20,000 to 25,000 volts, provided alternators of reasonable wave shapes are demanded.

R. S. Kelsch, Montreal, Canada: In June, 1905, I endeavored to purchase 25,000-volt, 3,750-kilowatt generators for a hydro-electric development to consist of five 3,750-kilowatt generators for an 18-mile transmission. The several large manufacturers of this class of electrical apparatus were asked if they would construct such machines, and one company answered that it did not think it feasible; the other companies thought it feasible, but were not prepared to supply machines of this voltage at the present time. The plant referred to is now operating, using 3,750-kilowatt generators, step-up transformers, etc. In Montreal we have one hydro-electric plant containing eight 750-kilowatt, 4,400 to 5,000-volt generators, working direct on the transmission lines, and in nine years' service there has not been one single case of trouble on the high-tension windings of the generators, due to lightning or other abnormal strains, and this plant has yet to record the first injury to an employe or any other person from these 5,000-volt machines. When this plant was installed, the specifications for these generators called for the insulation to be such as to successfully withstand a 25,000-volt alternating-current breakdown test. The writer believes that a plant containing a large number of 25,000-volt generators can be successfully and safely operated.

W. J. Foster, Schenectady: I wish briefly to describe some 5,000-kilowatt, 50-cycle, 100-revolution engine-driven flywheel-type generators that have been constructed to operate at approximately 20,000 volts, three-phase. These generators have their ampere rating corresponding to a normal potential of 18,000 volts, but the specifications require them to be capable of operating at a maximum of 22,000 volts. Three of these generators are being installed in the plant of the Pacific Light and Power Company, Los Angeles, Cal.

Floor space required is 31 feet by 6 feet 9 inches.
Diameter of stator is 28½ feet.
Diameter of rotor is 25 feet.
Radius of gyration is 8 feet 8 inches.
Weight of rotor is 186,000 pounds.
Weight of stator is 162,000 pounds.
Weight of accessories is 12,000 pounds.
Total weight is 360,000 pounds.

The armature coils have stood a high-potential test of 40,000 volts for one minute.

Commercial efficiency is as follows:

1¼ load	96.5 per cent.
Full load	96.2 per cent.
Three-fourths load	95.2 per cent.
One-half load	93.5 per cent.
One-fourth load	88.0 per cent.

The class of generators which will undoubtedly make the best showing in the matter of cost to the customer is the large flywheel type of low periodicity, such, for instance, as a 25-cycle, 5,000-kilowatt, 75-revolution. Such generator, wound for 22,000 volts, will not cost the customer more than 15 per cent. above the cost of the generator wound for the most advantageous potential, with step-up transformers. Step-up transformers will cost him in the neighborhood of 30 per cent. of the generator. Hence there is a saving to him in the initial cost of the apparatus alone of from 10 to 15 per cent. To this should be added the saving in the station due to the elimination of space for transformers. Along with this saving in the initial cost there will accrue to the consumer a continual revenue due to the better efficiency. This will amount to at least one per cent. at full load and 1½ per cent. at one-half load. Many large water-wheel-driven generators might well be wound for 22,000 volts, where it is desirable to use that potential on the transmission lines.

In conclusion, after several years' experience in designing, I am confident that 22,000-volt generators, properly selected in the matter of their ratings, offer less difficulties in design and construction than numerous 6,600-volt generators now in operation.

H. F. Parshall, London: The practicability of winding generators for 20,000 volts depends largely on the size of the machine. In the case of the proposed installation for the London County Council, where 12,000 to 15,000-kilowatt turbo-generating sets are in contemplation, the matter was the subject of most careful consideration, the result of which was that 15,000-volt generators were considered practicable and that they would be more satisfactory in practice than low-voltage generators with step-up transformers. Voltages higher than 15,000 were considered, both in the generating and transmission systems, the transmission system in this case being underground, and thereby being subject to different considerations from an overground transmission system, and it was found that to transmit the same energy, having regard to all of the conditions, there would be no advantage in the transmission system in a voltage higher than 15,000; in fact, the maximum advantage occurred at this point.

I make particular mention of this, in that the installation has been designed to distribute 250,000 kilowatts over, perhaps, the widest area that is likely to be encountered in municipal supply. This being, therefore, practically the limit of this class of installation, it would appear there is a natural division between voltages for generation in what may be termed a municipal system and in what may be termed a long-distance transmisison system, the limiting commercial voltage for a municipal system placed underground being approximately 15,000 volts, whereas in the long-distance transmission, if overhead, three or four times this becomes commercial. At this higher voltage direct generation is out of the question. It would appear, therefore, that the particular answer would be that in practically every case, generators of large size can be wound to meet the requirements of economical transmission in the largest type of municipal plant, but that in the case of long-distance transmission step-up transformers in the generating station become a necessity.

John Pearson, Somerset, Wis.: I believe it practical to wind 20,000-volt alternators for use with large steam turbines where the distance of transmission is short. In this case, power stations using 20,000-volt alternators will need no raising transformers, resulting, of course, in higher efficiency. The danger of generator coils being punctured directly by lightning will be small, as the average steam turbine-generator will be transmitting its power through underground cables. The transmitting voltage of the future waterpower station is likely to be from 60,000 to 100,000 volts, and one would not favor using a 20,000-volt alternator where the transmitting potential was 60,000 or 100,000 volts, as transformers for raising the potential would also have to be used. Where raising transformers have to be used, I believe it practical to use generators wound for 2,200 volts, as there is very little danger of the generator coils giving away at this voltage.

Bertrand P. Rowe, Pittsburg: The proposition to wind alternating-current generators for higher voltages than are commonly used at present seems to be a step in the right direction from the viewpoint of the man who has to provide for the switching devices. As the size of unit increases, and the amount of energy to be interrupted becomes greater, it becomes more and more of a problem to build oil switches which will open the circuits from the bus-bars, because the lower voltages now employed introduce currents of large capacity. The problem of breaking circuits at high voltage has been successfully solved, and it is a simple matter to open a circuit, so far as pressure is concerned, for any generator voltage that is likely to be determined upon. But if this circuit must carry a large ampere capacity, the problem becomes more difficult, and the higher the generating voltage becomes the simpler will be the problem. Summing up the whole situation, the use of higher generator voltages will simplify the problem in the switchboard equipment, and undoubtedly reduce the cost, besides involving nothing that has not been well developed and in successful operation.

Illinois Gas Association.

At the annual meeting of the Illinois Gas Association held in Peoria last week several members were present who are well known also as electric-light men. Among them was J. N. C. Shumway of Taylorville, who responded to the address of welcome by the mayor. As Secretary Robb is removing to Chattanooga, Tenn., Mr. C. N. Quackenbosh of East St. Louis was elected to succeed Mr. Robb as secretary.

A. D. Mackie of the Peoria Gas and Electric Company read a paper on "New Business Methods," which applied equally as well to the electric field. Mr. Mackie dwelt principally on the necessity of advertising and the importance of good salesmanship. His company's greatest success was experienced through following a systematic campaign of newspaper advertising, circulars, pamphlets and then personal solicitation. Printers' ink, the speaker said, should blaze the trail for the representative who follows.

Salesmanship is an important factor in the getting of business. Mr. Mackie said that more time and attention have been given to the task of securing men adapted to the commercial or sales end of the gas business in the last few years than to any other; and a great amount of money has been spent in educating and training these commercial men in order to get the best results from them. Gas managers recognize that the commercial possibilities of the company depend largely on the sales department, and the success of this most important department depends upon the grade of men who are employed in it; and in order to get the men who can "deliver the goods," not only must the remuneration be made attractive, but also the future value of the man to the employer depends largely on the treatment accorded him.

J. M. Robb did some good work in spreading the doctrine of co-operation among the members and supply men present.

Convention in Oklahoma.

It has been decided by the executive committee of the Oklahoma Electric Light, Railway and Gas Association to hold the first annual convention of the organization on April 22d and 23d in Oklahoma City. These dates were selected after a conference with the executive committee of the Texas association, and after it was determined that they would not in any manner interfere with the convention to be held by that association, which will be some time during the month of May. An interesting program is being prepared, and there will be three papers on gas, three on electric lighting and three on electric-railway work. A question box will be a valuable feature. There will be trolley rides, a theater party, etc., and on the evening of April 22d the Sons of Jove will hold a rejuvenation.

Charles W. Ford of Oklahoma City, secretary of the association, will be glad to furnish information about the hotels, etc. F. H. Tridnam of Oklahoma City is president and J. H. Merrill of South McAlester, treasurer of the association.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

IX.—Characteristics and Uses of Direct-current Types of Machines.

Shunt-wound Generators.

The shunt-wound dynamo derives its name from the method by which its fields are excited; namely, the shunt winding, which was described and illustrated in Chapter V. The most important characteristic of the shunt machine is that when it is run at a uniform rate of speed, it gives a current of practically uniform pressure throughout its range of load.

Starting at the brushes of the machine there are two distinct circuits in a shunt-wound dynamo, one being the outside circuit and the other the shunt circuit, which energizes the fields. In starting the dynamo, the outside circuit is open, and the armature only generates sufficient current for the field coils, and as these are of very high resistance, there is but a very small current generated. The current in the field coils is of nearly the total voltage generated by the armature, so that it is as large as it ever can be under the condition of open circuit. This makes the field magnetism and the voltage generated by the armature a maximum on open circuit.

If a load is now thrown on to the machine, current flows through the outside circuit at once, and this causes a slight drop in voltage in the armature, so that the voltage of the exciting current is proportionately less, resulting in a slight reduction of the total voltage. As more load is added, the greater the amount of current generated, and the greater the drop in the armature, which in turn reduces the total voltage generated.

To secure the necessary regulation for maintaining the voltage constant over the full range of capacity of the shunt-wound generator, the shunt winding is generally wound with a size of wire a little too large to give the correct voltage, and a variable resistance, known as a rheostat, is inserted in series with the shunt winding, so that on a light load the full resistance of the rheostat can be used to cut the exciting current down to the necessary amount to obtain normal voltage, and as the load increases, more and more of the rheostat resistance can be cut out, proportional to the amount of current being generated, so that a constant voltage is maintained by this means from no load to the full capacity of the machine. As a very small fraction of the total current of the machine passes through the field winding, the field rheostat is wound with a comparatively small wire of high resistance, and the amount of energy dissipated in heat in this resistance is very small, as but a very small current passes through it.

The armature winding of shunt generator is made of very low resistance, and by this means the drop in the voltage at the brushes varies but very little through the full range of the machine, and is almost unnoticeable over moderate changes of load. Machines of this character are especially adapted to incandescent lighting, where it is necessary to maintain a practically constant voltage.

It will be evident from what has been said that the shunt-wound generator supplies a current of practically constant voltage, the quantity of which, or the amperes, depends upon the load on the outside circuit.

Series-wound Generators.

In the series dynamo all of the circuits are in series with each other, and this machine produces a current of constant quantity whose pressure varies with the load on the outside circuit. In the early days of arc lighting series-wound dynamos were used exclusively for this purpose. The old-style open-arc lamp usually required about 10 amperes at 45 to 50 volts. In order to economize wiring, these lamps were all connected in series, which required only 10 amperes. Thus a very small wire was sufficient for connecting the entire circuit of lamps. As each lamp and its connecting wire required about 50 volts, the electrical pressure on the circuit varied with the number of lamps in the series. For a series of 100 lamps, the total voltage of the circuit would be about 5,000 volts.

In the case of a machine supplying a constant current, it will be seen that when the resistance of the outside circuit is increased the amount of the current will be reduced, thereby weakening the magnetic field, and still further lowering the voltage of the machine; or, if the external resistance is reduced, a greater amount of current will flow, and the machine will generate a correspondingly higher voltage. For this reason, some method of regulation must be used for raising and lowering the voltage. The method of regulation most commonly employed with these machines consists in shifting the brushes around the commutator.

When the brushes are at the neutral point, they take current from the armature at its maximum potential. As the brushes are moved away from the neutral point some of the armature coils on either side of the brush oppose each other, and the voltage at the terminal is the difference of potential between the opposing coils. If the brushes are placed midway between the neutral points, the voltage would be zero, as the electromotive force of the coils on either side of the brush would be equal in amount, and opposite in direction, thus balancing each other.

The shifting of the brushes, where this method of regulation is used, is accomplished automatically by means of electromagnets in the circuit, which tend to counteract any change in the current. Another means of regulation consists of an automatic mechanism, by means of which the field strength is altered by short-circuiting part of the coils.

Compound-wound Generators.

The most commonly used constant-potential direct-current generators today are what is known as the compound-wound type. The shunt-wound machine, as we have seen, is able to maintain a constant potential between zero and full load by means of a field rheostat which must be operated by hand as the load varies. This same result is accomplished entirely automatically by the compound-wound machine, which, for this reason, has practically displaced shunt-wound machines in all central stations for incandescent lighting and power.

As has previously been explained in Chapter V., the compound-wound machine consists of the ordinary shunt-wound machine, to which is added a few coils of heavy wire through which the whole current of the outside circuit passes. This series coil compensates for the weakening of the field, which, as explained, takes place when the shunt coil only is used.

There are two styles of shunt winding used with compound-wound generators. One is known as the short shunt, which is ordinarily used, in which the shunt coil is connected between the two brushes, or across the armature only. The other winding is known as the long shunt, which is connected at one end to one of the brushes, and at the other end to the series winding, so as to include both the armature and series coils. The difference in the two windings, however, makes but little difference in practice, as the resistance of the series coils is extremely low.

As the outside load increases on the compound-wound machine, the main current in the series field coil also increases, and at the same time the current in the shunt coils remains constant, as the voltage now remains constant. A machine wound in this way, with the windings properly proportioned, supplies, therefore, a practically constant voltage for any load within its capacity.

Another advantage of compound-wound machines is that they can be arranged to give a rise in voltage as the load increases on the machine. This is called over-compounding. As the load increases on the generator there is greater loss of voltage in the outside circuits, and, further, the increasing load on the engine, or other prime mover which drives the generator, often reduces its speed to a slight extent, or, in the case of a belt-driven machine, the slip of the belt will increase with heavy loads.

Each of these conditions tends to decrease the voltage of the generator to a certain extent, and with the compound-wound machine the over-compounding may be calculated for five or 10 per cent. or more of the normal voltage, or whatever is necessary to make up for these losses in voltage.

A rheostat is also used in series with the shunt winding of a compound-wound machine; but in this case its function is to regulate the voltage of the machine, once for all, rather than to regulate it for each change of load.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the hole field of applied electricity for light, power and heat, was gun in the Western Electrician of February 2, 1907.

The city of Cordell, Okla., will issue $20,000 in bonds to construct a lighting system.

QUESTIONS AND ANSWERS.

A Perplexing Question.

J. L. K., United States Navy: A compound differential-wound motor is wound so that at a certain speed, say 400 revolutions per minute, the fields neutralize each other. What would be the action of the motor running at no load after it has attained the speed of 400 revolutions per minute?

Answer.

More information will be needed for an intelligent answer to this question. As it is stated, the question is not clear; apparently an impossible condition is set forth.

Rewinding Damaged Motor.

F. C. S., Chicago: I have a one-fourth-horsepower motor that has been damaged by fire. I would like to use it on 220 or 110 volts. How much and what size wire should I use to wind the fields and armature. The machine has been used as a shunt motor and was formerly a 110-volt machine, but I should like to wind it for 220 volts, if possible. The armature has 18 coils and is hand-wound.

Answer.

The motor could be used on 220 volts if rewound with the same number of turns on the field as before, but with wire a third size smaller, B. & S. gauge. The armature should have twice the number of coils and twice the number of commutator bars, but each armature coil should have half as many turns as before. The exact size of the wire and the amount cannot be given without knowing the dimensions of the iron parts.

Ammeter and Circuit-breaker Connections.

C. R. S., Charleston, W. Va.: Which side, positive or negative, should an ammeter shunt be cut in? Isn't the negative side used more in practice? Which side should the circuit-breaker be cut in?

Answer.

This depends on the connections and the service. If on a dynamo which feeds one side of a three-wire system, put the ammeter on the outside conductor. If on a compound-wound dynamo and an equalizer is used, connect the ammeter on the conductor of opposite polarity to that of the side on which the series field is connected; that is, if the compound winding is on the negative side, connect ammeter on the positive. In general, the ammeter must be so connected that it will record the total current flowing from the dynamo.

The circuit-breaker must also be connected so all of the current from the dynamo will flow through it. In the case of a compound-wound dynamo this connection will be on the same side as the ammeter.

Three-wire 440-volt System.

H. C. A., Duluth: We are figuring on an installation of a three-wire direct-current system of lighting and power, in which the question has arisen as to whether it is good engineering to use one 440-volt generator connected across the two outsides to carry the main load and two smaller 220-volt generators connected in series and to the three wires in the usual way to take the unbalanced portion of the current. We should appreciate your citing to us places where installations of this nature are operating. We would also like to know what the objections and advantages of the system are. We would also appreciate your referring us to some standard work in which we would find this subject fully treated.

Answer.

The practicability of the plan depends entirely on the conditions of the load, the balance and the regulation desired. If the maximum unbalance in the three-wire load is below the capacity of one of the 220-volt dynamos, and if about five per cent. automatic (inherent) regulation under such unbalance is satisfactory, then there is no objection to the proposal.

Perhaps some reader of the Western Electrician can give the names of one or more plants where installations of the character described are in use. In the meantime Cushing's "Standard Wiring for Electric Light and Power" or Horstmann and Tousley's "Modern Wiring Diagrams" may be consulted, perhaps.

The Philadelphia (Pa.) Electric Company proposes to increase its capacity in the center of the city, by the erection of several sub-stations. The first to be built will be at 113 Arch Street. The building with equipment will cost $100,000.

Bijur Negative Storage-battery Plate.

What is considered an important advance in storage-battery manufacture is disclosed in a recent United States patent (No. 845,391) issued to Joseph Bijur, president of the General Storage Battery Company of New York, to which company the patent is assigned. The invention relates to the process of treating negative plates and also to the plate so produced. It is applicable to both Planté plates and pasted plates, and the objects are to prevent the loss of capacity in the plate and coherence of the porous sponge into a metallic mass, insure permanent passageways for the diffusion of the electrolyte, and secure strong plates which will not become permanently sulphated.

According to the process, the active material on the plate is impregnated with inert material of a suitable character for carrying out the objects of

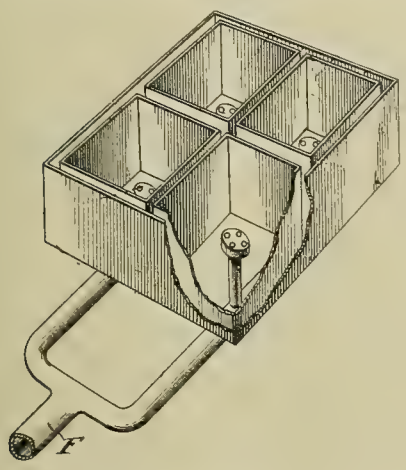


FIG. 1. BIJUR NEGATIVE STORAGE-BATTERY PLATE.

the invention. This material should be of a character which will not be chemically acted upon by the electrolyte, as for instance, carbon. One of the leading characteristics of the invention is in the fact that the plates are treated in accordance with the process after they have been formed or otherwise completed, instead of having the inert material introduced into the mass of active material before the plate is finished.

In carrying out the process for a Planté plate the plate is first formed and reduced to a negative-pole plate in the usual manner, and allowed to dry. It is then soaked for about 10 minutes in a solution of sugar or other suitable substance, by means of which the pores of the plate become filled with the solution. A solution penetrates the pores of the plate readily, and a solution of sugar has been found to operate satisfactorily and well. The sugar solution may be of about two per cent. to about 30 per cent. strength.

The plate is then removed from the solution, and it may be rinsed, to rinse the sugar solution from the surface of the plate, or else the rinsing may be omitted. The plate is then dried by permitting it to stand in air. If the plate is all lead, it is baked in any suitable apparatus at a temperature of from about 240° Centigrade to 300° Centigrade until the sugar is substantially completely carbonized, which may take five or 10 minutes. If the plate has antimonious alloy parts, as, for instance, an alloy frame melting at a lower temperature than the remainder of the plate, it is treated

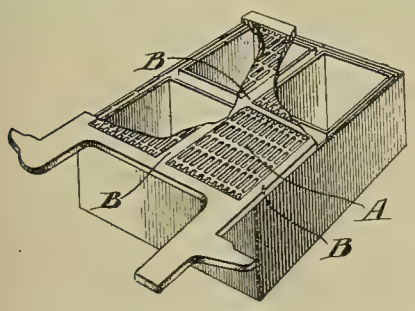


FIG. 2. BIJUR NEGATIVE STORAGE-BATTERY PLATE.

in such manner that the alloy parts are heated less than the lead parts, so as to insure that they are not partially fused in the treatment.

Fig. 1 is a perspective view, partly broken away, showing heating apparatus. In Fig. 2 (A) represents the plate, and (B) the alloy frame. The apparatus comprises a framework, preferably constructed of sheet steel and provided with compartments, under each of which there is a gas burner, connected to a supply pipe. Preferably the framework is double in form and provided with air spaces between the walls of the framework, and the compartments are of substantially the same size as the grills on the plate, so that when the plate is laid on top of the framework (Fig. 2) the grills are arranged over the burners, and the framework of the plate lies along the upper surfaces of the walls of the steel framework and over the air spaces in the framework. In accordance with this construction the grills are subjected to a higher degree of heat than the frame of the plate. Any other suitable form of apparatus may be devised for carrying out the same objects. After the plate has been baked or heated it may again be rinsed to remove any of the particles of sugar which were not converted into carbon in the heating process, and the plate is ready for use. It will be found that the pores of the plate have been impregnated with inert material in the form of carbon.

In carrying out the process after the plate is removed from the solution and allowed to dry, the sugar solution in the pores deposits finely divided organic material in the plate, which material is afterward carbonized in the step of heating. In accordance with this process the finely divided organic material is deposited very evenly and uniformly in the pores of the plate, and it does not interfere with the natural coherence of the lead.

Mr. Bijur's invention enables the inactive material to be introduced into the pores of the active mass of pasted plates, even after they have been in use and have partially lost their capacity from the lack of such material, thereby again raising the capacity of the plate. In treating pasted plates after the plate is pasted and dried, or after it has been reduced to a negative condition, it is dipped in the sugar solution and allowed to remain for about 10 minutes, as before. It is then removed and allowed to dry in the air and heated at the same temperature as for a Planté plate, thereby substantially carbonizing the organic material in the pores of the plate deposited out of the solution, so that a pasted plate is obtained having inactive material incorporated in the paste. This is a very easy way of obtaining a uniform distribution of a very slight percentage of inactive material and one which will not injuriously disintegrate the mass.

The invention also contemplates soaking a Planté or pasted plate in a solution of suitable material, as, for instance, sodium silicate, in which case the inactive material is deposited in the pores of the active mass in the plate chemically, instead of by drying and carbonization.

The Planté plate, after being treated in accordance with the process, has a light brownish-gray color instead of the usual lead-gray color of the Planté plate. The plate has a very porous and spongy appearance, as distinguished from the ordinary Planté plate which has not been treated in accordance with this process. In use the capacity of the plate either remains substantially the same or rises instead of falling off.

The Paris Electrical Strike.

By Matthew Vingoe.

Fortunately for Paris, not even the ingenuity of French administration has been sufficiently powerful to group all the various electrical interests of the capital in one general category and in the hands of a single power. Had this been the case the effects of the recent electrical strike would have been far more disastrous. The central-station men went on strike for 24 hours and that was sufficient to raise a storm of indignation against the municipal authorities who were making such a blundering mess of their lighting policy that a strike, carefully nurtured and prepared months ago, should suddenly break out and spread consternation among thousands of the business and pleasure population of the metropolis and entail loss among workers and employers alike.

Exactly what the pecuniary losses were will perhaps never be formulated, and if formulated the bill will never be met by the present concession holders whose term of office expires shortly. There are seven companies working the Paris lighting concessions and the city is divided into secteurs for their benefit. They all work on independent lines and capital and many of them furnish different kinds of current. The Secteur de Champs Elysees, for instance, gives out 25-cycle alternating current at 110 volts; the Place Clichy, 550 volts five-wire, while 220 and 110 volts direct current are also to be found. The concessions were granted some 18 years ago, when of course the state of the electric industry was in its infancy as regards standardization of machinery, and in consequence the uneconomical character and ancient type of machine can no longer supply current at rates which are acceptable to the consumer or the public body in whose power lies the renewal of the concession. Thus it is in Paris, and well the companies know it, for they have given up the hope of ever obtaining a renewal of their concessions, which all expire between now and the end of 1910. It can easily be imagined, therefore, that the public is not very anxious permanently to adopt the lighting and that the company is not desirous of extending its network, which represents capital charges thrown away, since the network will become the property of the city, and that without payment at the end of the concessions.

The events which led up to the state of affairs culminating in the recent strike are the following: There have been innumerable discussions in the Paris Municipal Council regarding its future policy in respect to the lighting of the vast extent of country which Paris and its surrounding suburbs cover. This matter was to be referred to all competent companies and bodies to submit proposals which would carry on the enterprises left by the present concession holders. Some three or four proposals had been submitted to the city and by the city to the prefect of the Seine, who is vested with power to make recommendations to this effect. This functionary selected the Schneider-Mildé scheme, named after its promoters, the Mildé company and the Schneider firm. This scheme embodied a comprehensive plan for lighting, while leaving the city open to the final adoption of one of each of the following alternatives: A further concession to a private company; farming out a municipally built and municipally owned plant; municipal management of the business (direct regie); an interested regie or jointly owned plant.

These proposals have ever since their appearance some two or three years ago excited municipal feeling to such a degree that nothing like unanimity has been reached, the Schneider-Mildé scheme not being yet finally adopted. The prefect of the Seine made a thorough examination of the situation and presented very voluminous memoirs dealing with this and other possible solutions to the much-vexed question. The municipality has discussed, appointed and dissolved committees, but nothing tangible has been done. In the meantime the Schneider-Mildé scheme was being regarded as the most probable immediate solution of the matter. The terms were discussed and modified and the claims of capital and labor set out in the strong light of public opinion. The proposal included certain demands of the men which were rejected by the Schneider-Mildé people and partly rejected by the municipality, which could, however, force its acceptance on the promoters of the new scheme.

To the minds of the 2,000 men employed in the various stations of the secteurs the Schneider-Mildé scheme was permanent enough to allow a very unstable state of affairs to intervene between the expiration of the present concessions and the adoption of a final regime to be adopted by the city of Paris. Some six months ago the men formed themselves into a syndicate for mutual protection, and the recent strike was the result of their deliberations regarding the intentions of their future employers and their lack of faith in the half-hearted interest taken in respect to their affairs by the municipality and prefecture.

Short lived as the strike was, it was effective as far as the men were concerned, for they obtained satisfaction from the first competent authorities which met their delegation some 24 hours after the strike commenced. The origin of the strike, although not trivial, was based on a misapprehension on the part of the men, and it was affirmed that had they presented their claims in the proper quarter due consideration would have been given to them.

As regards the immediate consequences of the strike, these were of course disastrous in the extreme. Of the seven secteurs feeding the Paris mains the secteur of the Champs Elysees alone was partially able to supply current, owing to a timely warning whereby an equipment of stokers was hurriedly collected and a few electricians who with the heads of the station were able to turn out a portion of the station output. The Champs Elysees secteur, however, is but a small one, perhaps the smallest, and the exception did not count.

The situation would have been far more grave had the small electric station operated by the municipality and situated in the cellars of the central markets been included in the list of the affected central stations. The Petit Parisian, which claims the largest circulation of any daily paper published at the price of five centimes and which was the only paper appearing, justified its claim when on Saturday morning, March 9th, it printed from its own presses in the space of three hours 2,500,000 copies, all of which were absorbed in Paris.

Some of the claims of the strikers were: Municipal pensions with a retroactive effect; an arbitration committee to deal with salaries, etc.; a collective contract, and an eight-hour day.

The immediate effect of the strike was to bring public attention and reproach on the dallyings of the Municipal Council, which has proved itself so incapable of dealing with the question.

Delegations of strikers were finally received by the committee of the Municipal Council and the prefect of the Seine and they obtained such formal promises that the delegates returned to their meeting at the Bourse du Travail, where a large number of strikers were in attendance, and declared that the strike was at an end.

Cheap power, however, and plenty of it, appears as far away from the Parisian grasp as ever unless the new scheme of conducting electric current from the Rhone may in time prove to be practicable and of commercial interest. This at present is a matter not yet settled, although the Rhone transmission scheme is being studied as one of the means of supplying electric power in bulk to Paris and intermediate places between that city and the Rhone River, where the power is generated.

Electrical Equipment Not Responsible for New York Central Wreck.[1]

By W. J. Wilgus

The fact that this is the annual electric night of the club leads me to believe that you will be interested in some brief remarks upon the recent fatal wreck of an electric train on the New York Central shortly after the initiation of what is undoubtedly the most important change in motive power that has taken place since the birth of railroads.

It seems to me to be very important that the true relation of the electric motive power to this wreck should be thoroughly known, so that no injustice will be done to a means of locomotion which will be of such great benefit to mankind. Any improper public impression that the use of electricity on trunk-line railroads is attended with new dangers will disturb confidence in what should be welcomed as a distinct advance in the art of transportation.

Other wrecks are daily occurring all over the United States, and the reasons freely given are broken rails, the dropping of broken portions of the equipment, high speeds, broken ties, defective roadbed and many other causes in no manner connected with the locomotive. In the case of the wreck in question, however, the mere fact that the train was hauled by electric locomotives at once placed the new motive power under grave suspicion, and all kinds of unjust attacks and criticisms have appeared.

For instance, much stress is laid upon the "low center of gravity" of the electric locomotive, although this charge is entirely unaccompanied by an analysis of the attendant conditions, such as distribution of weights, method of construction of the pony trucks, etc., which must be taken into account in arriving at a conclusion as to whether or not the center of gravity had anything to do with the wreck. Also, curiously enough, frequent statements have appeared in the public press that if the railroad company had only placed the orders for the electrical materials with other manufacturing companies than those successful in obtaining the contracts, all would have been well.

There have also been charges made that the construction of the locomotive had not been carefully considered by those entrusted with its design and testing, and that the operating department of the company had not been given full information as to the character of the new motive power. Then, we are told, that if we had only used overhead construction instead of the third-rail direct-current system, everything would have worked smoothly. Now, what are the facts?

The first trial locomotive built by the General Electric and the American Locomotive companies in accordance with rigid specifications approved by the electric traction commission, with the personnel of which you are well acquainted, was tested for 2½ years on six miles of track of a quality inferior to that in the New York zone, covering 50,000 miles of actual service (a distance equal to twice the circumference of the earth) at speeds, with different weights of trains, as high as 84 miles an hour on tangents and 75 miles an hour on curves, and without a single derailment. Such defects as developed during this extended test were carefully studied and necessary corrections made in the full order.

As the locomotives were sent to the New York zone they were put through a second trial, not only on the instruction track, 2½ miles in length between Highbridge and Kings Bridge, but also in actual service, hauling dead trains between High Bridge and the Grand Central Station. I can state personally that, as a result of running the locomotive during this long period, under varying speeds and around light and sharp curves, I found it to have wonderfully smooth riding qualities and an absence of undue effect upon the track; in fact, its superiority over the steam locomotive in this regard was very marked. I think you will agree with me that never before have such thorough and painstaking tests been made of new motive power before placing it in service in the hauling of passenger trains. New types of steam locomotives for high-speed service are used in the hauling of regular trains and defects that then develop are remedied, whereas, in this instance, all defects were studied and corrected on tracks specially set apart for the purpose.

At all times during the period of design, construction and tests, the superintendent of motive power of the company was in constant touch with the work, as were the inspectors appointed by the operating and construction departments, to watch results at Schenectady. Later the operating department inspector was detailed to instruct motormen on the instruction track at New York.

As a further link connecting the construction and operating departments, a construction committee was organized to deal with new problems in the Electric Zone, on which appeared as members the general superintendent of the electric division and the assistant general manager.

Recently very elaborate calculations have been made by the engineers of the two manufacturing companies and of the railroads, and also by Professor Swain of the Massachusetts Institute of Technology, demonstrating the correctness of the conclusions reached as a result of the practical tests above described, as to lack of any undue effect upon the track, and also as regards favorable comparison with steam locomotives. These calculations have, of course, taken into account the height of center of gravity, as well as all of the other elements that have to be considered in connection therewith. In fact, the low center of gravity has shown advantages in decreasing the chances of overturning that exist with the high center of gravity of steam locomotives, as instanced by the overturning of the newspaper train on the Little Falls curve some years ago.

It is especially unfortunate that one of the most potent factors in misleading the public as regards the true cause of this wreck is the evidence by the district attorney's expert before the coroner as to the shearing effect on spikes, which was based upon an entirely wrong assumption of the construction of the locomotive, having entirely ignored the guiding effect of the pony truck.

As to the reflections on the installation regarding the use of the third-rail direct-current system, I cannot state too emphatically the untruthfulness of the articles that have appeared to the effect that the third rail had something to do with the cause of the wreck and injuries to passengers. As a matter of fact, the third rail worked perfectly as to the automatic cutting off of the current by the circuit-breakers and the insulation of the rail from contact with equipment and passengers. All of the evidence before the coroner and Board of Railroad Commissioners shows conclusively that the third-rail system in no manner had anything to do with the accident or the results that followed it.

On this question of the adoption of direct current by the New York Central, without going into a long discussion about technical matters on which men may honestly differ, I think that I can mention three points that show conclusively that there was no other course for the company to adopt:

First—The clearances in the Park Avenue tunnel, 15 feet from the top of the rail, absolutely prohibited the use of overhead construction, especially as clearances are required for the occasional passing of steam locomotives with heights of 14 feet 10 inches above the top of the rail.

Second—The legislative act under which the Park Avenue viaduct was constructed prohibits any additions such as overhead construction, which would therefore be immediately stopped by injunction.

Third—The existence of an overhead trolley carrying high voltages within the limits of the city of New York is expressly prohibited by law.

While on this question of direct current versus alternating current, and speaking, not as an advocate of either but as an executive burdened with the responsibility of making a proper and impartial selection for specific locations, I would like to deplore the making of statement in papers before technical societies or otherwise, that, regardless of local conditions, but one of these systems, for instance, the alternating current, is proper for use in heavy traction. In my practice I have found that every location has to be considered upon its merits. For instance, in the selection of the system for the electrification of the Detroit River tunnel, I was instrumental in the preparation of specifications that left the widest latitude to bidding companies for the offering of a design that would meet our requirements of safety, reliability and economy in first cost and maintenance, and the results showed conclusively that for this particular case the direct-current system offered at least equal safety and reliability, and a saving of 27 per cent. in first cost and 20 per cent. in annual cost of operation, the latter taking into account fixed charges and depreciation.

In conclusion, I would like to state that during the searching investigations of the railroad company and also by the coroner's jury and the Board of Railroad Commissioners, nothing has yet developed that shows that the electrical installation, per se, was in any way, shape or manner responsible for this great disaster.

1. This is the substance of an address before the New York Railroad Club on March 15, 1907. Mr. Wilgus is vice-president of the New York Central and Hudson River Railroad Company.

Battleship Explosion Not Due to Wireless.

The court of inquiry appointed to determine the cause of the explosion of March 12th on board the battleship Jena at Toulon, France, decided a few days ago that the disaster was caused by a spontaneous explosion of "B" powder, due to decomposition and the elevation of the temperature of the magazine. It was also stated that this powder was very unstable and had caused previous accidents.

Referring to the theory that the explosion may have been caused by wireless currents that were passing near the ship at the time, Prof. Michael I. Pupin of Columbia University said:

"If explosives are kept in metallic cases and grounded there could be no explosion caused by wireless waves, but if explosives are not kept in metallic cases and grounded it might happen. Failure to store explosives on a battleship in any other way would be the highest degree of carelessness, I should say."

Programmes of the Iowa Conventions.

Programmes for the Iowa Electrical Association and the Iowa Street and Interurban Railway Association have been prepared and contain much which will be of interest and value to all who attend the conventions. Details as to the arrangements of the convention were given in the Western Electrician last week. Both will be held in Clinton, Iowa, the first mentioned on April 18th and 19th, and the latter on the 19th and 20th.

Besides the regular presidential address, committee reports and business sessions, the following interesting papers appear on the programme of the electric association:

"Cost of Operation per Dollar of Income," Prof. L. B. Spinney; "Central-station Economies," Gus Lundgren, Cherokee, Iowa; "Increasing the Central-station Day Load," E. S. Callahan, General Electric Company; "Manufacture of Ice," Rufus Lee, Clarinda, Ia.; "Co-operation," J. R. Crouse; "Central-station Advertising," the Curtis Advertising Company; "Central-station Heating" (steam and hot water), W. H. Schott; "Selection of Steam Engines," H. E. Chase; "Gas-producer Engines," Prof. G. W. Bissell, Iowa State College; "Electric Distribution Systems," Prof. A. H. Ford, Iowa State University; "Nernst Lamps for Street Lighting," Frank McMasters.

Following is the programme of the Street and Interurban Railway Association:

"The Steam Motor Car—Its Value for Interurban Service," W. G. Wagenhals; "Amusements—How Should This Feature be Handled by Operating Companies?" H. W. Garner; "Freight Handling by Electric Lines," H. H. Polk; "Joint Operation of City and Interurban Cars Over City Tracks," Isaac B. Smith; "Effective Methods of Handling Peak, or Rush-hour, Traffic on City Lines," E. L. Kirk; "Modern Train Dispatching Methods on Electric Railways," P. P. Crafts.

Mr. Wagenhals, who has the paper on the "Steam Motor Car," is the inventor of the car which he will describe in connection with his paper. He has given years of attention to the application of the steam motor to interurban service, and his latest type of car has excited much favorable comment. Mr. H. W. Garner, who handles the park or amusement feature, is a successful street-railway manager and will embody in his paper the best practice and ideas. Mr. Polk of Des Moines, who handles the paper on "Freight Handling by Electric Lines," is the president of the companies which are conspicuous for the success they have met in the freight field.

Mr. Isaac B. Smith of Cedar Rapids is expected to produce an interesting paper on prevailing practice which covers the "Joint Operation of City and Interurban Cars Over City Trackage." Mr. E. L. Kirk, general manager of the Sioux City system, has for years handled an enormous summer business, the pleasure resorts of Sioux City being admirably located from a street-railway point of view. Mr. Crafts, the general manager of the I. and I. Railway at Clinton, is giving much attention to "Train Despatching Methods," through the fact that he is operating an electric railway, maintaining a schedule of 35 miles per hour—a service which has been successful in competing with parallel steam lines.

There will be ample entertainment features provided by the local committee named in the Western Electrician last week and the supply men will receive a full measure of far-famed Iowa hospitality. Ample arrangements have been made for space for exhibitors (for this space there is no charge), and the Clinton Gas Light and Coke Company will furnish service and connections free to exhibitors.

Brooklyn Edison Extensions.

Last year was one of unexcelled prosperity for the Brooklyn Edison Company. In order properly to handle the large volume of new business, one-half of which was made up of increased motor load, it was necessary for the company to hurry to completion the recent extensive addition to its generating and distributing equipment, and even to undertake further improvements. The generating station at the foot of Gold Street was entirely remodeled, and in it, among many up-to-date features of equipment, is installed an Allis-Chalmers 5,500-kilowatt horizontal steam turbine and alternator. The erection of this unit was begun in April, 1906, and less than two months later, on June 16th, the operation was completed. The machine was started up for the first time on this date, and since then has satisfactorily met every load demand placed upon it. Among the features incorporated in the Allis-Chalmers turbine are the channel-shaped shrouds protecting the tips of blading from injury; the machine-cut slots in the foundation rings, insuring absolutely accurate spacing of the blades, and the improved balance pistons, reducing the diameter of the cylinder and preventing distortion under varying temperatures.

High-voltage Direct-current and Alternating-current Systems for Interurban Railways.

At a meeting of the Chicago branch of the American Institute of Electrical Engineers held in the rooms of the Western Society of Engineers on March 26th W. J. Davis, Jr., railway engineer of the General Electric Company, read a paper on "High-voltage Direct-current and Alternating-current Systems for Interurban Railways." James Lyman, engineer of the western district of the General Electric Company, presided at the meeting.

The systems adopted by some of the most important lines recently built, or now under construction, were divided by Mr. Davis into three classes: (1) 600-volt direct current, using either overhead trolley or third rail; (2) 1,200-volt direct-current, overhead trolley; (3) single-phase alternating-current, 3,300 or 6,600-volt, overhead trolley. The General Electric Company, according to Mr. Davis, is the only company in the United States manufacturing apparatus for the operation of the 1,200-volt direct-current system.

The largest installation undertaken during the last year was that of the West Jersey and Seashore Railroad, comprising equipment for 145 miles of single track and 35,600 horsepower in railway motors. Six months only from the date of selecting the power-house site being allowed for the completion of the installation, it was impossible to furnish apparatus of special type, making the selection of the 600-volt direct-current system obligatory.

Mr. Davis recommended the standard 600-volt direct-current apparatus for street railways and elevated roads in cities, and for suburban lines 10 to 15 miles long operating cars on frequent headway. For high-speed interurban railways operating cars 50 feet long or more at speeds of 40 miles an hour or more, the 600-volt direct-current system is the most reliable, the 1,200-volt direct-current system being somewhat cheaper than the former, the single-phase alternating-current system showing in most cases material saving in cost over the direct-current systems.

Mr. Lyman, in introducing Mr. Davis, referred to the fact that the steam railroads in Chicago would, in the course of a year or two, be confronted with the problem of electrifying the suburban sections of the roads. No branch of engineering, he said, was more active at present than that of the electrification of steam railroads.

In the discussion Mr. Hessen, general manager of the Bloomington (Ill.), Pontiac and Joliet electric railway, stated the road over which he has charge was an alternating-current line, operating at 3,300 volts, for a distance of 22 miles, the cars weighing 35 tons being equipped with General Electric motors of 75 horsepower. The operation, the speaker said, was very satisfactory, considering the severe treatment to which the cars are subjected. Mr. Hessen thought it a difficult matter to improve on the alternating-current system. His road, which runs parallel with the Chicago and Alton Railroad, manages to give quite as good service as the steam road.

Mr. P. Junkersfeld, on questioning Mr. Davis as to whether the fixed charges of 10½ per cent. in the comparison of cost referred to by him (Mr. Davis) held good for the three systems, was informed by Mr. Davis that the 10½ per cent. represented interest, taxes, etc., with money at five per cent.

Mr. H. R. King, who wished to know what the equipment was in stations supplying 1,200 volts direct current, was informed that two rotary converters were used, connected in series. Others who took part in the discussion were Messrs. Blake, Blanck, Carrol, Bruck and Zapp.

Conference on Municipal Ownership and Public Relations.

On March 14th an invitation was extended to the members of the committees on municipal ownership and public relations of the American Street and Interurban Railway Association to attend a joint conference of similar committees of the electric-light, gas, telephone and railway interests, to be held in New York city on March 22d. This conference took the form of an invitation to attend a dinner at the Waldorf-Astoria Hotel in New York city on the evening of that day. In view of the fact that it seemed highly desirable to have representatives of the street-railway interests present at the joint conference in the evening, it was decided to call a meeting of as many of the members of the two committees of the street-railway association as might be able to be in New York at that time. The afternoon was devoted to a general discussion of the subject of municipal ownership and the relations of corporations to the public and to the state. No definite action was taken by the members of either of the two committees.

Both of the committees of the street-railway association will probably issue within the next few weeks a series of questions to be answered by the street-railway companies of the country. The data obtained in this way will be used as a basis for the reports which will be presented by the committees at the 1907 convention.

The street-railway men present at the New York meeting were Charles D. Wyman of Boston, chairman of the committee on municipal ownership; W. Caryl Ely of Buffalo and Henry A. Robinson of New York, of the committee on public relations, and Bernard V. Swenson of New York, secretary of the association.

Holophane Reflector-stalactites.

The Holophane Glass Company of New York has placed on the market a new "reflector-stalactite" similar in construction and application to the well-known Pagoda bell, which has been used in many public buildings in this country.

Fig. 1 shows one of these reflector-stalactites, the

FIG. 1. REFLECTOR-STALACTITE, HEIGHT 7 3-4 INCHES.

upper part consisting of scientific prisms, while the lower part is of ground glass, the whole being made in one piece, thereby uniting the effects of the frosted glass with the efficiency of Holophane prisms. This globe is made for a 3¼-inch holder, has a width of six inches and a height of 7¾ inches.

Fig. 2 shows a similar type of reflector-stalactite having exactly the same dimensions in regard to holder and width, but having a height of 10 inches. The globes, in point of efficiency, achieve the standard set by the Holophane system. When lighted

FIG. 2. REFLECTOR-STALACTITE, 10 INCHES HIGH.

up, they appear very brilliant and add greatly to the artistic features of any place where used. The ground-glass bottoms of these stalactites can be cut into a number of different patterns. In this way the beauties of cut glass are combined with the Holophane system of illumination. Lamps of from 16 candlepower to 22 candlepower are recommended for use in these globes.

Ohio Electric Light Association.

The thirteenth annual convention of the Ohio Electric Light Association will be held in the New Boody Hotel, at Toledo, Ohio, on August 20, 21 and 22, 1907. The following committees have been appointed for the convention: Committee on general arrangements, chairman, E. J. Bechtel; F. Bissell, W. G. Nagel and J. E. Lockwood, all of Toledo, Ohio; entertainment committee, chairman, W. J. Hanley, Columbus; Clifford P. Billings, Cleveland; F. W. Wilcox, Harrison, N. J.; A. C. Robeson, Greenville, and H. C. Boyer, Toledo; reception committee, chairman, B. S. Young, Ada; A. A. Serva, Ft. Wayne, Ind.; L. B. Hoit, Cleveland; N. C. Cotabish, Cleveland; J. H. Maxon, Gallipolis; Elliott Reynolds, Pittsburg, Pa.; E. N. Riddle, Toledo; L. C. Norton, Toledo; T. D. Buckwell, Toledo; Frank Maunsell, Toledo, and H. E. Adams, Toledo.

The committee on general arrangements will be pleased to receive suggestions upon any matters desired to be carried out at the convention.

The secretary, D. L. Gaskill, Greenville, O., who is in charge of the programme, will be pleased to receive suggestions and questions to be answered.

The programme so far completed will consist of papers upon the following subjects: "Report of Committee on High Efficiency Lighting Units;" "Report of Committee on Uniform Records;" "Report of Committee on Cost Determinations;" "Report of Committee on Electric-heating Devices;" "Relationship of the Co-operative Electrical Development Association to the Central Stations;" "Luminous Arcs from the Standpoint of Central-station Operation;" "Proper Type of Prime Mover for Stations of 500-kilowatt Capacity or Less;" "Factory Lighting;" "Helps to a Solicitor, and What 50 Cents' Worth of Electricity Will Do;" "Best Ways to Meet Natural Gas and Gasoline Competition."

There will be one or two papers upon each of these subjects.

Maintenance of Way Association.

The eighth annual convention of the American Railway Engineering and Maintenance of Way Association was held at the Auditorium Hotel, Chicago, on March 19th, 20th and 21st, and was attended by about 300 engineers of various steam railroads throughout the country. H. G. Kelley, president of the association and chief engineer of the Minneapolis and St. Louis and Iowa Central railroads, in opening the convention, stated that 89 applications for membership were received during the last year, the present total membership being over 600. During the year 1906 a sub-committee was appointed to co-operate with a special committee from the American Railway Master Mechanics' Association to consider the question of gauge on curves.

A special committee, Mr. Kelley said, was also appointed by the board of direction at the request of the American Railway Association to confer with a committee from that association upon the subject of "Third-rail Working Conductors and Their Relation to Equipment." The subject of "Electrification of Steam Roads" was therefore brought directly before the association and would require in the immediate future special attention in the matter of its effect upon maintenance-of-way methods and operation.

Mr. Kelley urged that the association consider seriously the increasing scarcity of tie timbers and the extraordinary advance in the price of ties. Particular attention, the speaker said, should be given to the consideration of providing for future supplies by the use of softer and inferior timbers for the purpose, and, in addition, a study of the availability of other classes of material for use as ties. The investigations of the United States Forest Service and its publications upon this and kindred subjects affecting the timber supply are of the highest value in studying this subject.

Reports by committees on the following subjects were submitted to the association: "Ballasting;" "Signaling and Interlocking;" "Economics of Railway Location," by Prof. C. Frank Allen of the Massachusetts Institute of Technology; "Buildings;" "Roadway;" "Iron and Steel Structures;" "Wooden Bridges and Trestles;" "Signs, Fences, Crossings and Cattle Guards;" "Track;" "Water Service;" and "Masonry."

The committee on "Signaling and Interlocking" favored the placing of the indications in the upper right-hand quadrant of the signal, stating that this type of signal was considered best by signal engineers.

C. T. Crawford of the United States Forestry Service addressed the convention upon the subject of the experiments now being made by the government with a view to the determination of the merits of various methods of timber preservation with special reference to ties.

At the annual banquet, held on the evening of March 20th, addresses were delivered by G. F. Fitzhugh, counsel of the Nashville, Chattanooga and St. Louis Railway, Charles L. Hutchinson, president Corn Exchange National Bank, Chicago, F. R. Coates and Willard A. Smith.

The officers of the association elected for the ensuing year were: President, A. W. Johnston, New York, Chicago and St. Louis Railroad, Cleveland, Ohio; vice-president, W. McNab, Grand Trunk railway system, Montreal, Can.; secretary, E. H. Fritch, 962 Monadnock Block, Chicago; treasurer, W. S. Dawley, Missouri and North Arkansas Railroad, St. Louis, Mo.

Electric and Gas Show in Lincoln, Neb.

During the week of April 22d to 27th the Lincoln Gas and Electric Light Company of Lincoln, Neb., will give an exposition of applied electricity and gas on a large scale. The Lincoln Auditorium, accommodating 4,000 people, has been secured for the purpose and will be wired and piped so that elaborate demonstrations can be made in the exhibits. There will be a large number of exhibitors, both gas and electric, and the latest lighting, power and domestic appliances will be shown and their uses demonstrated. All space, gas and current necessary will be furnished free by the Lincoln company. Admission will be free.

Annual Report of American Telephone and Telegraph Company.

The report of Frederick P. Fish, president of the American Telephone and Telegraph Company, to the stockholders of that company, under date of March 26, 1907, contains the following information:

The results of the business for the year 1906, as shown by the treasurer's statement appended, were as follows:

Gross revenue	$24,526,007.82
Expenses, including interest and taxes	11,555,161.06
Net revenue	12,970,936.76
Dividends paid	10,195,233.80
Carried to reserve	1,773,736.62
Carried to surplus	1,001,966.64

The following were the corresponding figures for the year 1905:

Gross revenue	$21,712,831.29
Expenses, including interest and taxes	8,678,792.90
Net revenue	13,034,038.39
Dividends paid	9,866,355.00
Carried to reserve	1,743,295.16
Carried to surplus	1,424,388.23

The net output of telephones during the year 1906 was 1,409,578, making the total number in the hands of the operating companies 7,107,836.

The number of exchange stations at the end of the year operated by the companies which constitute our system in the United States was 2,727,289, an increase of 485,922. In addition to this number there were 297,220 exchange and toll stations operated by so-called sub-licensees, namely, independent companies or associations under sub-license or connection contracts and making use of our telephones. Adding also our telephones employed for private-line purposes, our companies had a total of 3,068,833 stations as against 2,528,715 stations at the close of the previous year.

The total mileage of wire in use for exchange and toll service was 7,468,905 miles, of which 1,688,987 were added during the year. These figures do not include the mileage of wire operated by sub-licensees.

Including the traffic over the long-distance lines, but excluding sub-licensees, the daily average of toll connections was about 462,000, and of exchange connections about 16,478,000, as against corresponding figures in 1905 of 368,000 and 13,543,000; the total daily average for 1906 reaching 16,940,000, or at the rate of about 5,455,000,000 per year, being 64 telephone calls for each man, woman and child in the United States.

The amount added to construction and real estate by all the companies, excluding sub-licensees, constituting our system in the United States during the year 1906, was:

For exchanges	$59,971,094
For toll lines	13,585,659
For land and buildings	5,810,196
Total	$79,366,949

The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500; in 1903, $35,368,700; in 1904, $33,436,700; and in 1905, $50,780,906; making the grand total of expenditure upon these properties during the seven years, $298,914,255.

During the year 1906, the amount expended for maintenance and reconstruction, independent of construction, by all the Bell telephone companies in the United States was $32,814,568. This amount came from the earnings of the properties, and was charged into the expenses of the year. As a result of these expenditures for maintenance and reconstruction, the plant of our companies is in a better condition than ever before. That plant could not at the present time be reproduced for a less sum than $70,000,000 in excess of its cost. The scrap value of the lead and copper in the lines and cables alone is not less, at present prices, than $80,000,000. Every year the plant becomes more permanent in character and of longer life. There is no reason to doubt that at the present time it is substantially of a type which need not be replaced until it is worn out.

The amount contributed by the American Telephone and Telegraph Company in 1906 by way of investment in its own long-distance plant ($5,642,000), in telephones ($1,737,000), in real estate ($330,000), and in the purchase of stock and bonds and in loans to its operating companies ($53,432,000), was in all $61,141,000, an addition of almost 26 per cent. to its entire investment up to January 1, 1906.

In the earlier stages when, as in 1896, there was a gain of only 43,549 stations, or, as in 1900, a gain of only 167,934, it was impossible to realize how rapidly the demand for telephones would increase. It seemed consistent with sound policy to assume a rate of growth not greatly in excess of that then prevailing. If this policy were to be continued, it would be a matter of great difficulty to adjust the plant conditions to the demands of a vastly increased business, and the difficulty would be greater every year.

The improvement in cables, made within the past few years, has revolutionized the art of telephone line construction. Not only is it now possible to place in underground ducts, cables containing 400 or even 600 circuits, but a pole line the carrying capacity of which would have been exhausted by 40 pairs of open wires, can carry 600 pairs of wires in the form of cables. The old-fashioned exchange pole line rarely carried more than 20 pairs of open wires. When an open wire aerial line has reached the low limit of its carrying capacity, it must be taken down and a larger line built unless there is an opportunity for a new line, which frequently is not the case. In either event, there is a great waste as compared with a type of construction in which, by the use of cables, a given pole line may have a capacity many times as great. Sound economy has many times in the past year required the scrapping of all the wires on a pole line, cable being substituted for them, as the only way of securing the enlargement of facilities that was required, and not infrequently it has been necessary to reconstruct the whole line as the cheapest way of securing the opportunity for growth that was required.

In so far as cable construction is concerned, it is not only of great advantage, as a matter of economy and as affording opportunities for growth that are not possible with open wires, but by the use of cables the chances of interruption of service are lessened, and the expense of maintenance is very greatly reduced.

There will always be a substantial amount of open-wire construction where few circuits are likely to be required, but the substitution of cable for open wires as the demands upon the plant increase is a sound practice, even though it involves an investment based upon the certain requirements of the future rather than upon what is immediately necessary.

The great extent to which the telephone business was sure to develop became apparent about the year 1901, when the number of new subscribers increased nearly 220,000, as compared with about 167,000, the largest increase in any prior year. The increase was 257,336 in 1902; 247,184 in 1903; 274,466 in 1904; and 441,734 in 1905.

These large increases in the number of subscribers, which were attended by an equally large increase in the demand for toll service, practically exhausted the plant of the Bell companies and involved rebuilding that plant to a large extent. The year 1906 has seen additions to construction which not only enabled the companies to take care of the 2,241,357 subscribers connected with the system on the first of January, 1906, and the nearly 500,000 added during the year 1906, but which resulted in plant conditions, based on scientific study, which will enable the growth of future years to be taken care of with an economy and efficiency due to the application of the most approved methods of work. Constant additions will have to be made to the plant, but they will largely be on predetermined lines, utilizing, extending and rounding out the systematic plant conditions that now exist.

It has been necessary to erect, from time to time, lines of poles which carried a single circuit, or only a small number of circuits, no larger number being required to do the business between the points connected by the pole line. Every circuit added to such a pole line reduces the cost of the installation per circuit mile, and it is a satisfaction to know that the number of miles of wire per mile of pole line has increased from 5.6 January 1, 1900, to 9.4 January 1, 1907. For the year 1906, the increase in miles of pole lines was 9,334, while the increase in miles of wire was 195,937, the ratio being more than 20 to 1.

Another, and by no means the least important, advantage of systematic engineering such as now characterizes our work, lies in the fact that, by reason of it, we shall be much better able to meet promptly and satisfactorily the demands of the public for good service.

As an indication of the extent to which the companies have built for the future, attention is called to the fact that at the present time not less than $25,000,000 are invested in circuits in cable that are not yet in use, but all of which will soon be in service, and that pole and conduit facilities are now installed which will take care of a very large number of cables over and above those that now exist. The extensive building for the future and the very high cost of labor and material during the past year have somewhat increased the cost per station added to the Bell system over the corresponding costs of 1905. The cost per mile of toll wire did not increase.

Since January, 1900, the number of telephones in the hands of Bell licensees, under rental, increased from 1,580,101 to 7,107,836, the total number of stations using Bell telephones, from 632,946 to 2,727,289; the total number of employes in Bell exchanges, from 25,741 to 90,324.

The aggregate capitalization of the American Telephone and Telegraph Company and its associated companies, in the United States, including capital stock, and bonded and floating debt, was, on January 1, 1907, $353,801,015.16.

As stated in prior reports, the unintelligent views of our competitors as to what rates for service are possible have created conditions in the portions of the country in which the return from the business is not satisfactory, under which neither they nor the Bell companies are getting proper returns for the service rendered. These conditions are sure to correct themselves in time, particularly as almost everywhere, except in some of the comparatively few places in which new promotion schemes are being exploited, our competitors have discovered their mistake and are as anxious to raise their rates as they formerly were to do business at a loss. We have now developed our plant, business and organization in most of these localities to such an extent as to have the situation in hand, and have now only to proceed on sound lines to establish such relations with the public as will enable us to secure a fair return for the service rendered. There are definite indications that the public in these localities appreciates the situation to a greater extent than ever before, and that it will ultimately co-operate to secure the adequate telephone service which it needs, by encouraging our companies to make the readjustment of rates that is necessary to enable us to give that service under fair conditions.

In by far the greater part of the country, rates are established and maintained with the approbation of the public, which permit the reasonable return required by the Bell companies to enable them to meet the demands of those who use the telephone.

Considering the difficulties in telephone rate-making, and the fact that even now there has not been sufficient experience with the constantly changing phases of the business to make it possible to establish rigid theories fitting all conditions, it is a satisfaction to find that the complaints made as to the rates of the Bell companies are comparatively few in number, and are generally based upon some special feature of the system employed in a particular locality, and not upon the scheme of rates as a whole.

The so-called Independent telephone companies which are in competition with the Bell companies throughout the United States have, as far as can be learned, except in a few localities, made no relative gain. It is a matter of common notoriety that many of them recognize that their situation is unstable. Comparatively few new Independent plants have been established in competition with the Bell during the past two years. A number of franchises for competing companies have been granted in various cities, but during the year 1906, and up to the present time in the year 1907, substantially no work has been done under any of the franchises in the more important places. The investors from whom Independent telephone promoters have secured money in the past, are apparently less inclined than formerly to make the advances required to install telephone exchanges under the very unfavorable conditions, among others the excessive cost of material and labor and the high rates for money, which now prevail. The known financial situation of some of the larger Independent enterprises undoubtedly also operates to check such investment.

In spite of the fact that during the last year a large portion of the time and energy of the executive officers of the Bell companies have been absorbed in construction work and in the extension of the plant and business, the character of the service throughout the country has undoubtedly improved. Effort is everywhere made to keep the service at a proper standard and to improve it. The time and thought of hundreds of engineers and traffic men are devoted, not only to applying the present methods of giving service as efficiently as possible, but to finding out, by careful and intelligent study, methods of operation and of handling the business that will lead constantly to better and more efficient service. Substantial progress has been made in this direction; and while the service in this country is conceded to be the best in the world, there is every reason to believe that it can and will be improved as the result of the comprehensive and intelligent efforts that are being made to that end.

There was during the year 1906 at least the usual amount of destruction of plant by sleet storms, washouts and fire. The San Francisco catastrophe undoubtedly inflicted upon the plant of the Pacific States Company, which operates on the Pacific Coast, a greater injury than any telephone plant ever suffered before. If it had not been for this disaster, the Pacific States Company would have gained not less than 30,000 subscribers more than it did in fact gain. The telephone plant in San Francisco has been rebuilt, and the service restored to a surprising extent.

The gross revenue for the year 1906 of all the Bell companies in the United States, taken as a whole and excluding duplications, was over $114,000,000. This does not include the Bell Company, of Canada, nor does it take into account the revenue of the Western Electric Company. The business of that company for the year 1906 was the largest in its history.

Wireless Telephony Apparently Successful.

Count Arco of Berlin, Germany, in his recent wireless telephone experiments, it is asserted, has succeeded in obtaining distinct exchanges of words in a tolerably natural voice at a distance of two miles by using poles 30 feet high. He has avoided the previous trouble of having high and low tones coming in rapid succession. He does not regard the apparatus as commercially valuable yet, but is said to believe that it will not be long before wires may be dispensed with for city and suburban telephones. The Telefunken Company has telephoned

25 miles by wireless with a 300-foot pole, but the high and low tone feature makes conversation difficult. At Count Arco's experiments Rear Admiral Manney, who was a delegate of the United States to the international conference on wireless telegraphy at Berlin, and Lieutenant Commander Howard, U. S. N., the American naval attache, were present.

Annual Convention of Iowa Independent Telephone Association.

The eleventh annual convention of the Iowa Independent Telephone Association was held at the Garretson Hotel, Sioux City, Iowa, on March 19th, 20th and 21st. Among the first members of the association to arrive were P. C. Holdoegel of Rockwell City, president; Charles C. Deering of Boone, secretary-treasurer; James H. Shoemaker of Waterloo and H. A. Douglas of Cedar Rapids, members of the programme committee, and J. M. Plaister of Fort Dodge, secretary-treasurer of the Independent Telephone clearing house.

In his opening address President Holdoegel declared that the Bell Telephone Company during the last year had been more active than ever in its fight against the Independent companies of Iowa.

Mr. Holdoegel said that that company had kept a large number of men in the field, soliciting patrons of Independent lines to change to Bell telephones. In one county alone, he stated, four men had been representing to rural subscribers that the Bell company could give better switching service. Mr. Holdoegel asserted that the Bell opposition in many towns had offered to give telephone service free, and in many others it was operating exchanges at one-half the actual cost of operation. He said this fact was sufficient to indicate that where they are losing in one place they are making up for it in another, and that as soon as they get control of the field in a certain place they raise the prices to where they were before Independent competition was known.

According to Mr. Holdoegel, the ratio of Independent telephones to Bell telephones now in use is seven to one, with the proportion in favor of the Independents increasing all the time.

The new constitution which the association adopted last year has worked very successfully. Under it there are now five districts in the state, each one of which has a president, who, by virtue of his office, is a vice-president of the association. Working under him is a captain in every county in his district. These captains are the men on the ground who combat the efforts of the Bell company.

Mr. Holdoegel urged a closer and more complete district organization, that a more solid front might be presented to the opposition.

The first paper read at the convention was by F. McNally of Carroll, Iowa, on the topic, "Is It Advisable to Appoint a State Toll-line Inspector?" Following the reading of Mr. McNally's paper, W. J. Stanton of Waterloo spoke on "The Necessary Standardization of Clearing-house Toll Lines and Equipment." The evening of March 19th was given to the exhibitors.

The morning session of the 20th was opened by Mayor W. G. Sears, who praised the automatic system in Sioux City. Reports were made by the following representatives of four states: E. H. Moulton, St. Paul, Minn.; Judge C. B. Kennedy, at Canton, S. D., president of the Independent Telephone Association of South Dakota; R. E. Mattison, Lincoln, Neb., manager of the Telephone Traffic Association of Nebraska, and C. A. Hollis, Hudson, Iowa.

James B. Hoge of Cleveland, Ohio, president of the International Independent Telephone Association, delivered an address on "The Work of the International Independent Telephone Association." In the course of his remarks Mr. Hoge intimated that the postmaster-general of the United States was using the prerogatives of his office in opposition to the Independent telephone men of the nation. Mr. Hoge appealed to the telephone men of Iowa for assistance in the fight to get an Independent franchise in the District of Columbia.

"We ask the aid and co-operation of your representatives in the House and in the Senate," said the speaker, "in our effort to secure the right to build a plant in the city of Washington, and thus prevent present and future postmasters-general from issuing orders prohibiting the installation of telephones in the various postoffices throughout the length and breadth of this country, unless they connect with Washington."

The International president explained the organization of a syndicate which sought at the hands of Congress a franchise for an Independent telephone system in the District of Columbia, and how the proposed effort was foiled by Congress.

Mr. Hoge reviewed the progress which the Independent companies are making, claiming that in every state wonderful advancement has been made. He spoke of great cities in which the Independents have been successful in getting a franchise. The speaker declared that the competitors of the Independents had depreciated the value of their securities by short-sighted methods in carrying on the campaigns, making it impossible to sell their stocks and bonds.

Mr. Hoge also explained plans which have been made to establish a national telephone journal in Cleveland, the first number of which is to appear in April. He said that the international association would establish an information bureau for the purpose of taking care of the thousands of interrogations which constantly flow into the international Independent headquarters from all parts of the world.

In the morning session of the 20th the association voted for the appointment of a committee to investigate the advisability of fixing a uniform toll rate for Iowa.

J. S. Bellamy of Knoxville vigorously opposed the resolution. He said that in his town the Bell people had made a cut, and that he did not think it fair that a rate schedule should prevent him from meeting this competition. He said it would only increase the dissension that already was rife in the association. He asserted that the Bell people were sending messages as far as 50 miles for five cents. Mr. Hoge advised the association to stick to the average of six-tenths of a cent per mile.

The afternoon session was given over to representatives of farmers' and mutual companies. The feature of this session was an address on "Economy of Construction, Labor, Equipment and Management," by W. D. Dunsmore of Oskaloosa, Iowa, vice-president and manager of the Oskaloosa Home Telephone Company.

In the evening a stereopticon lecture on "A Fight with an Octopus" was delivered by James H. Shoemaker. The lecture was based on Paul Latzke's article regarding the Independent telephone movement in its fight with the Bell people.

In the morning session of March 21st George T. Hewes of Des Moines, manager of the Iowa telephone clearing house, presented the report of the clearing house for 1906. The report showed a big increase on long-distance business. The month of October last showed 644 per cent. greater volume of messages than the month of March of the same year.

E. E. England of Mt. Pleasant reviewed the development of the Independent long-distance business in Iowa, giving the convention some pointers on how to increase the Independent toll business. Roy Walker of Des Moines, manager of the Mutual Telephone Company, spoke on "Hints on Management of Traffic."

In the afternoon closing session, A. T. Averill of Cedar Rapids, president of the Corn Belt Telephone Company, spoke on "Conservative Financing."

The election of officers for the ensuing year resulted in the re-election of the president and secretary-treasurer. The re-election of Mr. Holdoegel as president breaks a precedent which has been an unwritten law of the organization for 10 years. It has been customary to give each president but one term, upon the theory that the honor should be passed around. But Mr. Holdoegel's record during the last year and his personal popularity united to bring about a unanimous request that he accept office for a second term.

It was decided to hold the 1908 convention of the association at Cedar Rapids.

The convention came to a close in the evening with a banquet at the Hotel Mondamin.

Developments in Telephone Merger Plan.

Much interest has been manifested in the hearing of arguments before Attorney-general Jackson of New York city in the case of the proposed telephone merger of the United States Independent Telephone Company of Rochester and the Bell Telephone Company, owing to the fact that it is the first time the new Donnelly anti-trust law has come up for test.

In the argument as to whether Mr. Jackson should begin an action under the anti-trust law to prevent the consummation of the proposed agreement made between the two telephone companies by which the Independent company was to be acquired by the Bell company, it was disclosed that the United States Independent Telephone Company, while controlling many of the Independent exchanges of New York state, also owns 90 per cent. of the stock of the Stromberg-Carlson Telephone Manufacturing Company of Rochester.

The point was further made that the acquisition of the Independent company's stock by the Bell company would not only tend to kill competition between local telephone companies, but would give the Bell people more of a monopoly of the telephone manufacturing business.

As before stated in the Western Electrician, Attorney-general Jackson had secured a temporary injunction from Justice Fitts of Albany, preventing the merging of the two companies.

The testimony of F. P. Fish, president of the American Telephone and Telegraph Company, before Joseph A. Lawson of Albany, confirmed the report that his company owned the controlling interest of the subsidiary Bell companies of New York state. D. Cady Herrick, counsel for the Bell company, argued that by the acquiring of the stock of the Independent companies of the state no law would be violated. Mr. Herrick asserted that the Independent companies came to the company represented by him and proposed the merger.

Arthur C. Wade, president of the Home Telephone Company of Jamestown, N. Y., strongly opposed the merger. He said that he did not know anything as to the solvency of the other Independent telephone companies, but he objected seriously to having his company turned over to a competitor, J. McCormack Mitchell, of the National Independent Telephone Company, also objected.

Southeastern Telephone Developments.

A company is being organized to build a telephone system in Liberty, N. C., with long-distance connections to Ramseur and Asheboro. A line has been recently completed from Asheboro to Troy, N. C.

The Cedar Grove-Elfland Telephone Company has been chartered in Orange County, N. C., with $1,000 capital. Joel F. Anderson, Cedar Grove, and Chas. A. McDade, Hillsboro, N. C., are interested.

The North State Telephone Company (Independent) at High Point, N. C., is making numerous improvements, including cables, etc. The company claims to have made 30 per cent. last year over expenses, charging a considerably less rate than its competitor.

The People's Telephone Company has just been organized at Taylorsville, N. C., to build a line to Statesville, touching a number of stations en route. A. L. Watts and E. L. Hedrick of Taylorsville are among the stockholders. J. L. Stevenson of Loray was elected president of the new company.

The Southern Bell Telephone Company has begun the installation of a long-distance wire between Statesville and Salisbury, N. C., and will put in a small exchange at Cleveland, N. C., on the route of this line.

After a long fight between the Southern Bell and the Iredell Telephone companies, the latter claims to have won a foothold in the town, and has announced that the service, hitherto given free, would be charged for. This company also has a number of county connections.

The Old North State Telephone Company, Beaufort, N. C., has been chartered with $125,000 authorized capital, to maintain and operate telephone and telegraph lines. The incorporators are D. P. Bible, J. W. Boon and Forrest W. Bible.

The Southern Power Company has installed a private telephone exchange in the Trust Building, Charlotte, N. C., to connect the several departments on different floors of the building.

Manager Z. V. Croom of the Bell Telephone Company at Statesville, N. C., has been promoted to the position of special agent under General Manager J. Epps Brown of Atlanta, and is succeeded by Mr. Salley of Burlington, N. C.

The People's Telephone Company, Taylorsville, N. C., has been chartered with $20,000 authorized capital, to build telephone lines in Iredell and Alexander counties. R. E. Tatum, O. L. Holler and others are the incorporators.

The South Carolina Railroad Commission has adopted rules requiring telephone companies to make semi-annual statements of their financial condition, as to each exchange, number of telephones in use, and also requiring that certain long-distance connections with other companies shall be made. Several complaints on these rules have been lodged and will be given a hearing. L.

Indiana Telephone Items.

In Logansport, telephones in business houses have been advanced by the Logansport Home Telephone Company in the rental $5 a year, making the price $30 a year. The franchise of the company provides that when 1,000 telephones are installed and in actual use the company may advance the rate for business houses. Officials of the company state that they had the required number of telephones to allow the increase in price in December, 1902.

A great deal of activity is being shown at the exchange of the Central Union Telephone Company at Columbus. The new exchange will be ready for use, Manager May says, within five days or a week. The new local board has been installed and is all ready for work. The chief operator's desk is ready and the wire chief's desk fitted up. The battery room and the general-equipment rooms are being finished, and in a few days the Bell people expect to cut-in their new equipment. After that date all Bell telephones will be central energy, and there will be no more ringing the exchange when subscribers want a number.

The Farmers' Mutual Telephone Company of Fort Wayne, the Laporte Telephone Company of Laporte and the Roanoke Telephone Company of Roanoke, each contemplates the installation of new switchboards.

The Majenica Telephone Company of Majenica has secured a franchise to establish a branch system in Mt. Etna. S.

Telephone News from the Northwest.

The Mutual Telephone Company of McHenry, N. D., has been incorporated with $10,000 capital.

The Centerville Rural Telephone Company of Centerville, Minn., has been incorporated with $5,000 capital stock.

L. G. and C. H. Sanders have been granted a

franchise at Mahnomen, Minn., for a telephone exchange.

The Northwestern Telephone Exchange Company has extended its corporate existence in Minnesota for 30 years, incorporating for $15,000,000.

Fargo, N. D., is credited with having one telephone for every eight persons of population.

The American Telephone and Telegraph Company will dredge a deep trench across the bay between Duluth and Superior in which to carry its telephone cables. The company has had its cables caught by anchors of passing boats and seeks to avoid a repetition.

Bids are in for the erection of the Mississippi Valley Telephone Company's new exchange building at Keokuk, Iowa.

A franchise will be voted at Sloan to the Farmers' and Business Men's Telephone Company of Ute, Iowa.

The Hemingford (Neb.) Telephone Company has decided to incorporate. It will also shortly begin the erection of a new exchange building.

A mutual telephone company has been organized at Williamsburg, Iowa, with D. O. Jones, president, and U. S. Butler, secretary.

A new telephone company will be organized at Alden, Iowa.

M. F. Mellick has purchased the West Liberty (Iowa) telephone exchange.

The Standard Telephone Company of Waukon, Iowa, will issue $50,000 worth of 6 per cent. bonds for refunding the present indebtedness and for making improvements to the system. R.

GENERAL TELEPHONE NEWS

The City Telephone Company of Sidney, Iowa, is seeking a franchise for a telephone system there.

The Filley (Neb.) Independent Telephone Company has increased its capital stock from $3,000 to $9,000.

A subscriber of the New York Telephone Company suggests that the company could save much time and loss of temper to its subscribers by supplying a thumb index to the present form of directory.

Legal proceedings are being brought against prominent officials of both telephone companies in San Francisco, charging bribery in connection with franchise proceedings. Louis Glass, vice-president and general manager of the Pacific States Telephone and Telegraph Company, and A. K. Detwiler have been indicted, and it is said that other indictments will be returned against officials of the Home Telephone Company.

At a meeting of the executive committee of the Virginia State Independent Telephone Association, held in Richmond on March 19th, there were admitted into the assocation four new members. The next annual meeting will be held at Norfolk, Va., May 21st. This will be after the opening of the Jamestown Exposition, and a large attendance is expected. B. L. Fisher of Rocky Mount, Va., is secretary of the association.

The following-named telephone companies have recently been incorporated: The Earlsboro (Okla.) Telephone Company, capital stock, $5,000; Farmers' Mutual Telephone Company of Taupa, Okla., $5,000; Farmers' Mutual Telephone Company of Shattuck, Okla., $15,000; Better Creek Mutual Telephone Company, Blackwell, Okla., $10,000; Summerfield (Neb.) Mutual Telephone Company, $1,000; Farmers' Mutual Telephone Company, Lawton, Okla., $5,000; McLoud (Okla.) Telephone Company, $15,000; Grant County Rural Telephone Company, Pond Creek, Okla., $20,000; Winters (Texas) Independent Telephone Company, $10,000; Azel (Texas) Telephone Company, $2,000; Hereford (Texas) Telephone Company, $16,000.

Tests of Street-railway Fenders.

A record of tests of street-railway fenders and wheel guards made during 1906 under the direction of the Massachusetts Board of Railroad Commissioners, with headquarters at Boston, has just been published. Among the various types of fenders and wheelguards tested were: Pfingst platform fender, exhibited by Louis Pfingst, Boston, Mass.; Pickett fender, William Pickett, Lynn, Mass.; Weeden automatic fender, Charles H. Weeden, Quincy, Mass.; Barnes patent lifeguard, Thomas Barnes, Lowell, Mass.; Sterling lifeguard, Jerry M. Hayes, Newark, N. J.; Eclipse lifeguard, Eclipse Railway Supply Company, Cleveland, Ohio; Multiple wheelguard, Eclipse Railway Supply Company, Cleveland; Parmenter automatic wheelguard, George A. Parmenter, Boston, Mass.; Sherwood automatic wheelguard, Earl Sherwood, Brooklyn, N. Y.; Clark automatic wheelguard, Ira P. Clark, Decatur, Ill. The greatest speed of any car under which the tests were made was 15 miles an hour, when a Pickett fender picked up the body of a small dummy placed in the center of the track, the legs of the dummy having been broken off by contact with the fender platform. The Pfingst fender is used by the Boston elevated railway.

Braking System for West Jersey and Seashore Electric Railroad.

It is apparent that a change in motive power so radical as that following the electrification of the West Jersey and Seashore Railroad (Pennsylvania system) involved many new problems. Not the least of these was the determination of a suitable form of power brake to meet the conditions presented.

Automatic brakes are fundamentally essential in passenger train service, not merely, as some might suppose, because they insure greater safety to human life, but to enable high speeds and a fast schedule. It does not, however, follow that the automatic brake which has been standard for many years in steam road passenger service, is satisfactory for electric train operation, and, as a matter of fact, it has been necessary to provide so many improved features that several new systems have resulted, depending upon the kind of service contemplated and number of cars operated in a train.

In the case of the West Jersey and Seashore road, normal operation will be in trains of three motor-cars, any one of which may be operated separately as an independent unit. For this service the "AMT" brake equipment, as recently perfected by the Westinghouse Traction Brake Company, has been installed. Without attempting to go into details of construction, it is to be noted this equipment consists primarily of an air compressor for producing air pressure, a governor for automatically controlling pump operation, a simple form of a brake valve, a brake cylinder, an improved triple valve, a feed valve for reducing main reservoir pressure to 70 pounds, and the ordinary brake pipe or train line, as well as the usual switches, cocks, gauges, reservoirs, etc.

In addition, what is known as the "control" line extends throughout the train and besides insuring pump labor on all cars, accomplishes certain valuable results in connection with graduated release.

With AMT equipment, the motorman is able, by manipulating the brake valve handle, to divide the process of release into as many steps or gradations as may be desired, and a flexibility in release is thereby secured equivalent to that obtained with the straight air brake and single-car operation. This feature insures smooth stops. With the ordinary automatic brake, graduated release is not possible, since there is no control of the brake-cylinder exhaust when the release operation is once started.

Since innumerable stops and the heavy grades usually encountered in traction work necessitate frequent brake applications, it is of vital importance that the system be charged at all times. With the standard automatic equipment in steam road service it is quite possible, by reason of the relatively slow recharge of auxiliary reservoirs, practically to deplete the auxiliary reservoir pressure so that braking power is no longer available. The AMT equipment, however, provides against the possibility of such a contingency by a quick recharge feature which automatically maintains auxiliary reservoir pressure through three separate feed ports, so that any number of brake applications can be made in quick succession without depleting the system.

The AMT equipment also includes a quick-service feature so that in service applications, communication is established between the brake cylinder and the brake pipe pressure, which materially assists the auxiliary reservoir to build up brake cylinder pressure in the ordinary manner. The use of brake pipe pressure in this way has heretofore been confined, in the ordinary automatic brake, to emergency applications, but it will be apparent that the quick-service feature must result in a more prompt and uniform braking effect throughout the train, inasmuch as a local brake pipe reduction is accomplished at each triple.

A uniform "working" pressure is maintained by the feed valve, which reduces main reservoir pressure to 70 pounds, so that, while providing ample reserve, the danger of overcharging the brake pipe and auxiliary reservoirs is eliminated.

Large Direct-current Generators.

Stone & Webster of Boston, acting for the Boston Elevated Railway, recently placed contracts for two large Allis-Chalmers direct-current railway generators, which rival in size and capacity any machines of a similar type in the country.

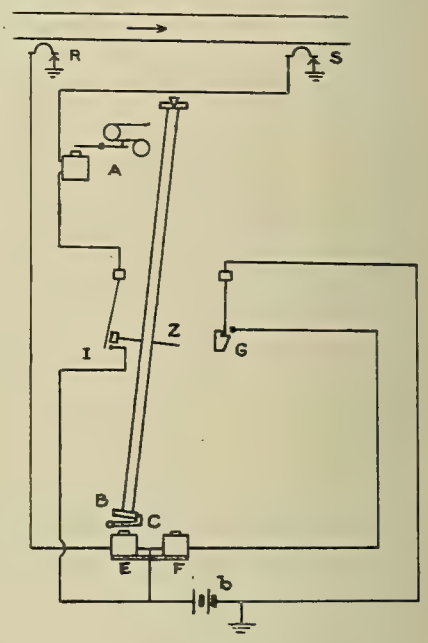
These machines, which are to be installed in the new extension to the Boston Elevated Railway Company's Lincoln Wharf station, on Atlantic Avenue, are to have a capacity of 2,700 kilowatts, 600 volts, and operated at a speed of 75 revolutions per minute. In this station is generated the larger portion of the current used for operating the elevated-railway division and the cars through the East Boston tunnel.

The generators, which will be driven by vertical cross-compound engines, will have armatures of such diameter that they will have to be built up on the ground. Each machine will have 32 poles, will have no band wires on the armature, and will be equipped with the Allis-Chalmers patented brush oscillating device, by means of which the brushes travel back and forth on the commutator in a direction parallel with the engine shaft, thus keeping the commutator in condition and avoiding the usual wearing of grooves.

Electric Speed-indicating Device for Trains.

A new speed-indicating device has been brought out in Holland by Maas Geesteranus and is designed to be used upon railroads so as to check the speed of trains and to show whether at any given point the speed is not greater than that allowed by law. It is intended to be used specially near curves of small radius, metallic bridges, and in general on all sections of the track which should be approached at slow speed and which would not be favorable for a sudden braking.

The action of the device is based upon the use of a pendulum which is set free by the train and makes a double swing, after which it is locked



SPEED INDICATOR FOR TRAINS

again by a catch. The duration of a double oscillation of this pendulum is known in advance. On the other hand, two electric contacts are disposed along the track with a conveniently chosen interval. The first of these contacts is designed to set free the pendulum upon the train's passage by closing an electric circuit with battery and electromagnet, whose armature sets free the pendulum when it is attracted. The second contact establishes the other circuit, which actuates any kind of a signal, and if need be a registering apparatus. But the operation of registering does not take place before the pendulum has come back to the starting point, and when it takes place it shows that the train has passed over the interval between the two contacts faster than it should have done—that is, faster than the normal swing of the pendulum.

The accompanying diagram shows the working of the apparatus. The train closes first the circuit of the contact (R), then that of contact (S), these circuits being connected with the battery (b) and with earth return. An arm (Z) is carried on the pendulum and is properly placed so as to keep the contact (I) open in its position of rest and on the contrary to close the contact (G) in its other extreme position. The contact (G) sends current into the auxiliary electromagnet (F), which gives the pendulum the needed impulse so as to cause it to make a full swing upon its return to the left or to the starting point. It is thus locked by the catch at (I) upon coming back and is held in this position for a fresh start.

The starting of the pendulum by means of the electric contact which is made by the train at (R) is accomplished by a trip device (BC). The pawl (C) is depressed by the action of the electromagnet (E) when current passes in the same, and this releases the pendulum, which swings by its own weight toward (F). Upon reaching the right-hand side the arm (Z) makes contact at (G) and sends current into the electromagnet (F). This causes the armature (B) of the pendulum to be attracted strongly toward (F) and it arrives thus at the end of its stroke, thus giving the full swing upon the return stroke toward the left.

At (A) is a device which is used for registering the action of the apparatus. When the arm (Z) leaves the contact (I) the latter is closed by its own weight or by a spring and prepares the circuit of the electromagnet on the registering device. But no current can pass in that circuit before the train on the track has reached the contact (S) and closes it. Should this closing occur while the pendulum is swinging, the electromagnet of the

register will operate and trace a mark of a certain length upon the paper. This action ceases as soon as the pendulum comes back to the left and opens the circuit at (I), or else when the train ceases to make contact at (S). Should the train have been running under the regular condition of slow speed it will not have reached (S) before the pendulum returns to (I), and thus there will be no record upon the register, but should it be running faster than the standard a mark will be made on the paper which shows at what speed it was running during the passage between the contacts.

In the present device all the apparatus except the two outside contacts, which are placed on the track, is contained in a waterproof iron box and can be installed in any convenient place near the track or in a station building. The new device is now running under trial upon some of the railroads in Holland.

New Swedish Tariff.

Among the provisions of the new Swedish tariff are the following:

Electric meters, 10 per centum ad valorem.

Electric lamps, 40.2 cents per kilogram. No deduction is allowed for the weight of the boxes, paper, wrappers and like packages.

Electrical machinery, including dynamos, electric motors and electric transformers and spare parts for same, 15 per centum ad valorem.

Copper wire, twisted for cable and cordage, not insulated, 0.04 cent per kilogram (2.2 pounds).

Copper wire, covered exclusively with silk or thread of other textile material, 26.8 cents per kilogram.

Copper wire, covered exclusively with caoutchouc or guttapercha, and electric cables insulated in the same manner, free.

Copper wire covered with lead or strengthened with iron, even combined with another material; also electric cables covered with lead or strengthened with iron, free.

Copper wire, otherwise insulated; also other electric cables, 10 per centum ad valorem.

Dedication of Engineers' Building, New York.

During the week of April 16th to 19th the formal dedicatory exercises of the new Engineering Societies Building in New York city will be held. The outline programme is as follows:

Tuesday (April 16th) afternoon—Formal dedication exercises.

Tuesday evening—Reception.

Wednesday afternoon—Founder's Day. Addresses by representatives of the founder's societies; greetings from sister organizations; presentation of medals.

Thursday afternoon—Session of the American Institute of Mining Engineers, with paper by Mr. H. T. Hildage describing the tunnel work of the Pennsylvania Railroad.

Thursday evening—Session of the American Society of Mechanical Engineers, with address by General Crozier on the Ordnance Department.

Friday afternoon—Session of the American Institute of Mining Engineers.

Friday evening—Informal smoker for all societies.

New Electric Smelter Developed in Canada.

A company consisting of New York and Ottawa capitalists has been organized and has applied for a patent for an invention to smelt, separate and refine all kinds of ores by a continuous process in which arc furnaces capable of generating a terrific heat will be employed. The ore after being crushed is fed through an opening, and in dropping through the first arc the sulphur and arsenic are taken off. Each consecutive unit is of a different temperature and will be in number as many as there are different metals contained in that particular ore to be smelted. It is called the vaporizing process, and the ore undergoes a continuous treatment from the time it leaves the hopper until all the metals are separated in passing the arc which is generating the required number of heat units to vaporize that particular metal. The company claims to be able to smelt and refine ores at half the cost as at present obtains. J. H. Reid of Newark, N. J., is the inventor.

Power Company Takes Over Grand Rapids Edison Company.

Announcement of the ownership of the Grand Rapids (Mich.) Edison Company by the Grand Rapids-Muskegon Power Company was made at a council meeting, when the question of a franchise for the power company was being considered. The franchise, granted in 1887, to the Grand Rapids Edison Electric Light and Fuel Gas Company, fixes no time limit for its operation. The charter is good for 30 years from its granting under the state law. The Edison franchise contains only one restriction for the company, and that is that the City Council shall govern the time and place of setting poles and stringing wires, and otherwise the company is unhampered.

CORRESPONDENCE.

Continental Europe.

Paris, March 12.—The city of Zurich is to use current from a new hydraulic plant which will be erected upon the Albula River, at a cost of $2,000,000. A considerable amount of hydraulic work will need to be done in order to construct a great reservoir which will hold 350,000 cubic meters. It is estimated that the new plant will give a total of about 22,000 horsepower, and it will be one of the largest in Switzerland, as well as one of the most modern as regards the apparatus which will be installed. The plant lies at a distance of 85 miles from Zurich, and the current will be sent upon a pole line which is worked at 40,000 volts.

At Bordeaux the question of securing the additional supply of current which is needed in the city has come up before the Municipal Council. The report of the lighting company which has the concession for the gas and current supply was presented to the council, and the company asserts that the new stations which it is now erecting near the city will be finished within a reasonable time, so that there will be no further complaints as to its inability to comply with the terms of the concession. A new gas works costing $5,000,000 and an electric plant, estimated at $1,000,000, are now erecting in the suburbs of Bordeaux. At the same time the work of constructing the new lines for the electric current is now going on, and the company expects to be able to furnish electricity from the new electric plant by the middle of the present year. The Municipal Council voted at a recent meeting that the company be allowed up to the end of the year to carry out the terms of the contract.

It is proposed to build a new telephone line from Paris to Macon, and for this purpose the Chamber of Commerce of Macon has already advanced to the state the sum of $25,000 in order to carry out the construction as soon as possible. A new telephone line will also be run in the near future between Dijon and Langres.

Among the new companies which have been formed in France I may mention the Keller-Leloux Company for electro-thermic alloys, capitalized at 3,250,000 francs, with its headquarters at Paris. At Marseilles a lighting and power company, known as the Société Electrique des Bouches-du-Rhone proposes to carry out operations in the Mediterranean region near that city. A new electric automobile company lately formed at Lyons is the Société G. Mariotti et Cie, which intends to construct an electric automobile known as the "Rapid." The Water, Gas and Electric Company is one of the recently organized Lyons firms.

The municipality of Zurich recently voted a credit of 80,000 francs for an electric-tramway line which is to run from the city to the Albisgütli.

The municipal electric and pumping plant of Aichach is using Diesel oil engines, and there are now installed two of these motors, which are furnished by the Augsburg-Nuremberg Machine Company. Of the single-cylinder type, these motors are rated at 80 horsepower and use paraffin oil as fuel. The oil is vaporized in a special form of carbureter. Each of the motors is belted to a direct-current generator designed for 480 volts. When the proposed plant is finally completed there will be 240 horsepower in gas engines installed.

Several new central stations have been erected in Spain within a recent period. At Ezcaray, in the Logroño province, is installed a lighting plant which serves for the town as well as for a number of villages in the neighborhood. At Erandis a new station has been erected by the fusion of two of the leading electric-lighting companies. The city of Saragossa is erecting a co-operative electric plant after the model of the Bilbao station. A. DE C.

Great Britain.

London, March 14.—Owners of private electrical testing laboratories still continue their crusade against the National Physical Laboratory despite the appointment of a committee to inquire into the modus operandi of the institution. Questions, evidently inspired, are continually being put to his majesty's ministers, and one of them this week elicited the figures showing the income of the laboratory from all sources during the last three years. Naturally this shows an upward tendency, and for 1906 the revenue was about $70,000, including the government grant.

The municipalities of Great Britain owning electrical undertakings of one sort or another have for several years openly expressed their dissatisfaction at the periods allowed by the Local Government Board for the repayment of loans, and there is much to be said for their contention. Periods for all sections of plant have a tendency to be reduced, but some good reason should be adduced. For instance, in the case of mains, several cases exist where electric supply cables which have been laid for 16 or 18 years are so good that on inspection it is found the whitewashed covering still remains. Yet the period for the repayment of loans for such plant has in some cases been fixed at 15 years. The latest move has been through the Municipal Electrical Association, which, through the various members of Parliament, has succeeded in getting the president of the Local Government Board to receive a deputation on the subject.

It has been reported that the new London County Council will abandon the electric power bill promoted by its predecessors. No statement has yet been made officially, but if this were to be the case it is not at all improbable that with a strong, progressive government some attempt will be made to secure the appointment of a royal commission and—further delay.

The proposal of the Middlesborough corporation to construct a transporter bridge across the river Tees is now unopposed in Parliament. The principle of the structure is that of the bridge across the river Usk at Newport, which has been described in the Western Electrican. Electrical energy will be supplied from the corporation's generating station.

It is to be regretted that the South Wales Electrical Power Distribution Company, with one of the finest industrial areas in Great Britain from the electric power point of view, has been unable to gather in the necessary capital to carry on the undertaking in a comprehensive manner. With the example of Newcastle and a very similar district the lack of enthusiasm on the part of those financiers responsible for the undertaking, as well as others, is remarkable. A few local sub-stations are to be sold to the local authorities and small companies will be formed to run the main generating stations.

Swansea's telephone tangle has reached a further stage by the holding of a town meeting and the sending out of a circular asking whether subscribers would be willing to pay an additional subscription of $5 yearly. Probably the fact that the circular does not say to whom the extra subscription would be paid is responsible for the poor response. Practically it means that the undertaking will have to be sold to the company.

A bill is now before Parliament asking for permission to install the Dolter surface-contact tramway system in Oxford, and in all likelihood it will be passed. There are now Dolter systems at work in Torquay, Hastings and Yorkshire and another under construction at Folkestone.

It is interesting to note that the assessments of electrical undertakings in London have increased by 87 per cent. in the last five years. G.

Dominion of Canada.

Ottawa, March 23.—The Ottawa Electric Railway Company has made an all-around increase in the wages of its employes. This action was entirely unsolicited and unexpected on the part of the men.

A provisional agreement has been entered into between the Bell Telephone Company and the town of Barrie, Ont., for an exclusive franchise for a further period of five years. Chief among the terms are a cash consideration of $300 a year paid by the company, fixed rentals during the period and a uniform scale of rates throughout the town.

A company is being organized, comprising prominent business men in the province of Prince Edward Island and Halifax, Nova Scotia, to establish interprovincial telephone communication by laying a cable under the Straits of Northumberland. The company will apply to the Dominion government for a charter and subsidy. It is proposed to have the cable adapted for either telephone or telegraph service. W.

Winnipeg, Man., March 23.—The Schaake Machine Works, New Westminster, B. C., is erecting a new plant which will be run entirely by electricity.

The Alberta Power, Light and Supply Company, Vermilion, Sask., has decided to install a telephone system at Vermilion as soon as supplies have been obtained.

The committee appointed by the Edmonton (Alberta) City Council to inquire into the cost of the new electric street railway reports the cost to be $344,000. Of this amount, $49,000 has already been expended in steel rails. Actual construction will cost $224,000, while $71,000 will be expended on paving the streets between the car tracks. R. R. Keely is city engineer. R.

New England.

Boston, March 21.—At a recent meeting of the Worcester (Mass.) Chemical Club Dr. A. W. Ewell exhibited his new ozonizer, in which the shape and size of the electrodes and their distance apart result in an increased yield of ozone. He demonstrated that up to a certain point the yield increased with an added velocity of air through the electrode chamber. For a concentration of two grammes of ozone per cubic meter, the yield is 55 grammes per kilowatt-hour. Dr. D. F. Calhane described Ashcraft's new method for the electrolytic production of metallic sodium. He used fused salt and caustic in separate cells, the molten lead dissolving the sodium in one, which is delivered to the fused caustic in the other, where fused metallic sodium is obtained. By this method metallic sodium can be produced for three or four cents per pound less than by the present method of production.

Owing to the General Electric Company's enlargement of the Stanley plant in Pittsfield, Mass.,

a company has bought some 80 acres of land in that city, which will be divided into 400 building lots, on which double dwellings will be built for the electric company's employes.

The Trumbull Electric Manufacturing Company has broken ground for an additional factory in Plainville, Conn. The new building will be four stories high, 100 feet long, and 50 feet wide.

The Boston Elevated Railway Company has built an electric locomotive, weighing 36 tons, in its shops, and is using it for shifting cars at its Sullivan Square elevated yard. The engine can be used in the subway. It can haul 11 cars, each weighing 33 tons. The company is building another locomotive similar to this.

Henry S. Pritchett, president of the Massachusetts Institute of Technology, is chairman of the building committee of the Franklin Fund, which is to be devoted to the building and maintenance of a trade school at the corner of Berkeley and Appleton streets in Boston. This school will contain an electrical laboratory. The fund was left to the city by Benjamin Franklin, and it matured last year.

The Connecticut Electric Equipment Company of Meriden, Conn., has been incorporated by E. B. Wilcox, A. B. Wilcox and L. T. Fuller of Meriden. It has a capital of $10,000 and it will manufacture and sell electrical machinery for telephone and telegraph equipments.

The Connecticut Legislature is considering a bill calling for the appointment of a joint telephone and railroad commission, to consist of five men appointed by the governor. Senator Judson, who introduced the bill, wishes to restrict the power of the Southern New England Telephone Company.

The Worcester Railways and Investment Company's stockholders' option to exchange their stock for the New England Investment and Security Company's four per cent. preferred stock, expired on March 1st. Up to date, 65,511 shares of the 71,898 shares of the Worcester company's outstanding stock have been deposited. The New England company is a subsidiary of the New York, New Haven and Hartford Railroad Company, which has thus obtained control of the electric railway, which serves Worcester, Mass. B.

New York.

New York City, March 23.—It is officially announced that the Steinway or Forty-second Street tunnel is to be opened for traffic about August 1st. It is now a question whether an injunction restraining the company on account of alleged defects in the franchise will retard the work of getting the tunnel ready for traffic. The Belmont interests have already ordered an equipment of steel cars similar to those operated in the subway.

The bill introduced by Senator Saxe providing for the depression of the New York Central tracks on Eleventh Avenue is meeting with active opposition on the part of New York city citizens, and they will ask for a hearing on the measure.

Supreme Court Justice Newburger has granted permission to the Mechanical Engineers' Library Association to sell its library property at 12 West Thirty-first Street for $120,000. The association bought the property in 1890 from the New York Academy of Medicine for $60,000. The building is useless to the association, now that the library has been removed to the United Engineering Societies' Building.

Mr. R. G. Collins, the civil engineer of the New York Construction Company, builder of the Pennsylvania terminal, who has his residence at Pelham Manor, a distance of 20 miles from New York, has discarded his gasoline car and purchased a Babcock electric. After frequent experiments, Mr. Collins declares that, for limited runs, the electric is far superior to the gasoline machine. During the recent heavy snowfalls he could accomplish the distance quicker with his electric than with a gasoline car. A similar purchase has been made by Mr. Ellsworth Ford of Rye, who uses his car for long-distance riding, coming to Park Row and returning to his residence every day.

The motor fire fighter has come to stay. Speed is the very essence of combating flames, and the showing of motor-driven vehicles in departments wherever tried has made the horse out of the question from a viewpoint of great utility. There are now in use for heads of different departments in the New York Fire Department several motor cars, including gasoline and electrically driven types. A fire fighter now in use does such good service, and goes so fast that all of the chiefs have been forced to get motor cars in order to arrive on the scene of a conflagration in a respectable time. The chassis used is a 30-horsepower air-cooled Knox, suited for warm or cold conditions.

In Brooklyn there has been going on for the last year or so, and is now rapidly nearing completion, a piece of engineering work that nearly rivals the subway in point of tremendous magnitude. It is that of abolishing the grade crossings on the Brighton Beach line of the Brooklyn Rapid Transit system, and the concurrent installation of a four-track service, which is expected to bring Coney Island within 25 minutes of Brooklyn Bridge. The work has comprehended a cost of $2,500,000, the excavation of a mile and a quarter of uncovered subway, and the elevation of an embankment across the Coney Island meadows to Brighton Beach, a distance of five miles. It is not anticipated by the engineers in charge that the four-track service will be in operation before September 1st next, but it is promised that by May 1st the most difficult part of the work will be finished and the embankment portion of the line will be ready on or about June 15th. D. E. P.

Southeastern States.

Charlotte, N. C., March 23.—A public hearing will be held in the United States engineer's office at Savannah, Ga., on April 8th, concerning the construction of a number of power dams across the Savannah River. Concerning the dam at Gregg's Shoals, there is some hitch, on account of an alleged ignorance of the federal laws governing the building of dams across certain navigable streams. The dam at this point is declared to have been so planned that no passage for vessels was left. A protest has been filed against the closing of the river at Gregg's Shoals, and at certain other points where power development was projected. The Savannah River Power Company obtained the right to build a dam at Gregg's Shoals at the last session of Congress, in accordance with the act of Congress of June 21, 1906. Plans for the dam, it is declared, show no provision for locks whereby river craft can pass the point. Other dams authorized by Congress and concerning which similar problems of navigation are connected are: Four dams by the Hugh MacRae Company of Wilmington, N. C., at Hatton's Shoals, Calhoun Falls, Trotter's Shoals, Cherokee Falls; Twin City Power Company dam near Edgefield County, S. C.; dam for same company at Price's Island; J. R. Earle Development Company, near Andersonville Shoals; Anderson (S. C.) Guaranty and Trust Company, near Turner Shoals; also second dam near Middleton Shoals, and a third near McDaniel Shoals.

The Raleigh (N. C.) Electric Company will improve its lines by relaying a large portion of the road with heavier rails, an order for which has been placed.

The House municipal affairs committee of the Tennessee Legislature has recommended the passage of a bill permitting the city of Nashville to issue $350,000 bonds for improving the city electric-light plant. If the bonds are voted, the city will go into the business of furnishing commercial light to the citizens.

W. J. Kincaid, chairman of the board of directors of the Macon, Griffin and Atlanta electric railway, is authority for the statement that work on the road will begin about April 1st.

Americus, Ga., votes this week on a $75,000 municipal improvement bond issue, and also upon the question of a franchise for a street-railway company.

The Georgia Railway and Electric Company of Atlanta will continue the work of laying heavier rails during the present year, and will also build many improvements in the way of sidings, adequate car barns, etc. The directors also approved the purchase of 40 new electric cars for their lines. Several miles of track will be relaid and double-tracked.

The sum of $34,050 has been asked in the budget of expenses of the city of Norfolk, Va., for lighting purposes. A number of new lights were also requested.

A new electric railway is assured for Brunswick, Ga., where two companies made bids for a franchise some weeks ago.

On April 23d the universities of North Carolina and Pennsylvania will debate the question, "Resolved, that the street railways in the United States should be owned and operated by the municipalities."

The Southern Power Company has let the contract for a sub-station at Gastonia, N. C. The transformer house will be two stories, 55 by 30 feet. J. D. Ford of Charlotte, N. C., has the contract for the building.

The Chattanooga Railway Company may build an electric railway up Lookout Mountain. President John Graham of Philadelphia has signified the company's willingness to undertake the work.

The Twin-City Electric and Construction Company, Winston, N. C., has been incorporated with $25,000 authorized capital by E. G. Couch, S. L. Blackburn and A. H. Galloway, to do electrical construction and handle supplies. L.

Michigan.

Grand Rapids, March 23.—After declaring the usual quarterly dividend of 1¼ per cent. the directors of the Detroit United Railway Company discussed the question of securing more power for the handling of the cars in the city. No definite action was taken. After luncheon at the Detroit Club, President J. C. Hutchins, H. A. Everett and W. E. Moore took the president's private car and went out over the newly acquired Detroit, Ypsilanti, Ann Arbor and Jackson, now known as the Detroit, Jackson and Chicago.

The Consolidated Milling, Lighting and Power Company of Clare has taken over the Clare Electric Light Company and the Callam & Cornwell plant. A. J. Doherty is at the head of the new company. The Clare Electric Light Company has been in operation since 1895. Callam & Cornwell established their plant on the river in 1900, removing the mill to the city in 1903, and establishing the electric motor power. The dam will be improved. The new company has made a proposition to the city to operate the pumps at the waterworks plant.

When the new Wealthy Avenue car barn is completed the Grand Rapids Railway Company will have a clubhouse for its employes as complete as anything in the city. On the west side of the car barn will be sleeping quarters for 20 men, a restaurant, reading room, club room, baths and almost everything which will add to the comfort of the conductors and motormen while off duty.

Marquette's municipal lighting plant is a success, according to the annual report of the commission under whose auspices the institution is conducted. This report shows that during the year ended March 13th last, a business amounting to $74,335 was done. About $20,000 of this is credited to the shop account, on which no profit is derived, all work of this nature being done at actual cost. The total income from electric current was $50,087. There was expended on new construction nearly $10,000, $3,210 more on interest account, and, after allowing for depreciation, it is said, there is shown a net revenue of $29,136 to the credit of the plant. The commission has on hand cash to the amount of $30,310, as against $14,562 a year ago, or about one-half the estimated cost of the proposed new plant to be built this year and which will enable the city to do a considerably larger light and power business. The secret of success of this municipal enterprise is, first, that the plant is operated by waterpower, and, second, that its management is kept out of politics. The rate charged householders is seven cents and business places five cents per kilowatt-hour.

It is known that electricity can be purchased of power companies at Lansing for less than it can be made by the city, and it will be necessary to purchase additional machinery at a cost of about $27,000 to meet the increasing demand upon the municipal plant if electricity is not purchased of a power company. It is thought that, in addition to the present capacity of the city's plant, which is about 1,200 kilowatts, it will be necessary to furnish 300 kilowatts to take care of next winter's demand. The board is not certain, however, as to whether it can legally buy electricity of an outside company, and the matter has been referred to City Attorney Hood for an opinion.

The Commonwealth Power Company, which recently completed a dam at Lyons, is endeavoring to make contracts for lighting Mason and Grand Ledge, and also offers to sell power to Lansing for electric light. L. W. B.

Indiana.

Indianapolis, March 23.—The trustees of the Crawfordsville Electric Light Company have increased the rate from $60 to $66 per arc light. The plant belongs to the city, and the reason given for an increase is that the plant is liable to serious and unforeseen accidents which may partially or wholly disable the service and require the expenditure of a large sum of money, and a sinking fund should be established for impairments and displacements. The trustees also propose to adopt the following schedule for commercial use: For the first 50 kilowatts, 12½ cents per kilowatt; for the next 100 kilowatts, 10 cents per kilowatt; for the next 200 kilowatts, seven cents per kilowatt, and for all current in excess of 350 kilowatts per month, five cents per kilowatt.

A committee appointed by the City Council of Greenfield has reported the municipal electric-light plant worn out; that its capacity is too small, and its engines and machinery have seen their day. Since it was installed it has paid for itself, and has furnished street and other public light. Notwithstanding this, there is now only $4,000 in the electric-light fund with which to build a $50,000 plant. Upon the report of the committee the council concluded to communicate with manufacturers of electric-light machinery with a view of inducing some company to put in a new plant on the installment plan, the city making an advance payment, and permitting the plant to work out its own indebtedness, as was done with the present wornout plant.

President Hastings of the Indianapolis Gas Company said the Indiana Legislature erred in passing the 60-cent gas bill, and declared that the measure can never be enforced in Indianapolis.

The quartermaster-general at Washington has approved the electric-light plans for Fort Benjamin Harrison, near Indianapolis. The buildings contain 17 acres of floor, and over a thousand acres of ground to be lighted. The appropriation for lighting is not available until July 1st, but it is proposed to advertise for the furnishing of current at once.

Ohio and Indiana capitalists have organized a $6,000,000 company at Toledo to build an electric railroad from Toledo to St. Louis, via Fort Wayne, Muncie, Indianapolis, Terre Haute and Brazil, traversing two-thirds the length of Indiana. C. D. Whitney, former general traffic manager of the

Clover Leaf Railroad, is president of the company. The new company has taken over an electric power plant at Miami, and this will furnish power for the first section.

The Murdock syndicate, which recently bought extensive electric properties in Northern Indiana, announces that it will build an electric railway from Laporte to Logansport, a distance of 60 miles, this summer. This will assure the connection of Indianapolis and Chicago by trolley. S. S.

Illinois.

Peoria, March 23.—The Morton Light, Heat and Power Company, which has recently been incorporated and succeeded Beyer Bros., has elected a board of directors consisting of M. S. Beyer, Henry Beyer and W. R. Lackland.

The Monmouth Coal Company will install electric machinery throughout its coal mine at Brereton. The cost is estimated at $16,000.

Bids for grading the interurban road between Springfield and Jacksonville were opened this week. The material has been ordered and the estimate is 100,000 ties, 3,500 tons of rails, 1,200 kegs of spikes, 200 kegs of bolts, 10,200 angle bars, 18 switches, 13,000 fence posts and 52,000 rods of wire. The grade will be the best that the Illinois Traction Company has. The heaviest grade will be five-tenths of one per cent. The contract calls for the finishing of the grade by August 1st. The road will be called the Illinois Western division of the Illinois Traction Company. The intention is to have the road finished and operating by October 1st to accommodate the state fair crowds.

The Illinois Railroad and Warehouse Commission has made a detailed report for the year ended January 30th. The commission calls attention to the fact that the increase in mileage of electric lines does not include the street railways, as the latter are exempt from the jurisdiction of the commission, but only to interurban and elevated railways. The total mileage of surface and elevated railways was 1,187.43, an increase for the year of 104.63 miles.

In connection with street railways being exempt from the commission the report says: "It would seem to be just and necessary that a public utility enjoying special privileges by courtesy of the state and municipalities should be required to submit some kind of a statement of its business to some department of the state for the information of the people who invest in their securities.

While excavating for the tracks of the Illinois Traction Company's extension into Morgan County from Springfield the workmen have dug up many walnut ties that were used in the construction of the first railroad built west of the Alleghany Mountains. It was built in 1837 from Meredosia to Jacksonville and with state aid. The rails were flat strips laid on long wood stringers. The ties dug up were in a fair state of preservation.

General Manager Emil G. Schmidt of the Utilities Company of Springfield has given the Young Men's Christian Association of that city a gift of $2,500 and a gift of $500 for every $4,500 raised before tonight. This is to complete the building the Young Men's Christian Association has commenced. V. N.

Northwestern States.

Minneapolis, March 23.—M. W. Savage of the International Stock Food Company, Minneapolis, is heavily interested in the Minneapolis, Rochester and Dubuque Electric Traction Company, which is to build an electric line from Minneapolis to Dubuque. The company has organized with Mr. Savage as president, W. D. Boutell of Minneapolis, vice-president, and William Peyton Mason, secretary and general manager.

Options have been secured nine miles above Anoka, Minn., on the Rum River for a dam and power plant, and surveyors are at work there. It is thought that about 12,000 horsepower can be developed. The Twin City Rapid Transit Company is believed to be back of the project.

Charles Webster has announced that he will apply to the Minneapolis City Council for a franchise to furnish electric light and power in Minneapolis.

The Western Gas and Light Company, which has a power plant at Apple River Falls, Wis., is planning to build a sub-station at Stillwater, Minn., where 600 horsepower will be developed.

The Independent Light and Power Company of Davenport, Iowa, has purchased a site and will begin work shortly on its new power plant.

It has been voted to construct a municipal electric-light plant at La Crescent, Minn.

An election will be held at Sioux Falls, S. D., April 16th, to vote a street-car franchise to F. M. Mills of Benton Harbor, Mich., and his associates.

Jacob Heim proposes to put in an electric-light and power plant at Sauk Rapids, Minn.

The City Council at Superior, Wis., has ordered Owen Ford, engineer, of St. Louis, to prepare plans for a new municipal electric-light plant.

The Public Service Company of St. Cloud, Minn., has accepted plans for enlarging its plant at a cost of $75,000.

Webster Merrifield of Grand Forks, N. D., is promoting a company which will construct a street-car system in that city and East Grand Forks, Minn. The line may also be extended to Crookston, Minn. R.

PERSONAL.

William Barclay Parsons, chief engineer of the New York Rapid Transit Commission, has been engaged as chief consulting engineer for the new subway in Cambridge, Mass.

Mr. John Gavey, C. E., engineer-in-chief to the General Postoffice of England, will shortly be retiring under the age limit. Mr. Gavey is to be entertained at dinner by a few of his personal friends as a mark of esteem.

William H. Brown of Springfield, Ill., has been named to succeed J. M. Robb as secretary and treasurer of the Peoria Gas and Electric Company. Mr. Brown is secretary and treasurer of the Springfield Light, Heat and Power Company.

James M. Thurgood, for more than 20 years local manager for the Western Union Telegraph Company at Vincennes, Ind., committed suicide on March 21st. Mr. Thurgood balanced his books and left a letter denying that he was short in his accounts.

Ralph D. Mershon of New York city, the well-known electrical engineer recently in England to give advice in connection with the proposed hydro-electric installation to be erected by the Victoria Falls Power Company in South Africa, was entertained while in London by the Marquis of Winchester, a director of the company.

Charles E. Phelps, Jr., chief engineer of the Electrical Department of Baltimore, Md., was in Boston recently, to explain his city's electric conduit system to the legislative committee on mercantile affairs, which held a hearing on the petition of Cambridge, Mass., for authority to establish public-service conduits under the streets.

Prof. Gaetano Lanza, head of the Massachusetts Institute of Technology's department of mechanical engineering, has received a decoration in the Italian order of SS. Mauricio and Lazarus, on account of his achievements as a scholar and scientific writer. Professor Lanza was born in Boston in 1848, his father being a native of Palermo, Italy.

Robert C. Shaal, formerly with the General Storage Battery Company of New York, has accepted the position of sales engineer of the Bliss Electric Car Lighting Company, as assistant to the vice-president, Col. John T. Dickinson, with headquarters at the company's New York office, Night and Day Bank Building, Fifth Avenue and Forty-fourth Street.

John Craig Hammond of New York and Denver, formerly of Chicago, for several years connected with the electrical interests of H. L. Doherty, and one of the brightest masters of publicity in the business, has been appointed press representative of the New York Central Railroad lines, with headquarters in New York. The railroad people are to be congratulated on securing Mr. Hammond's services.

A deputation from the city of Brantford, Ont., has waited upon the Dominion government to present a plan for the erection of a memorial in that city in honor of its former citizen, Prof. Alexander Graham Bell, inventor of the telephone, which was first operated in that city, it is said. It is proposed to purchase the Bell homestead as a public property and to erect thereon a monument, the whole to cost about $40,000. The citizens of Brantford have already subscribed upward of $15,000, and the Ontario government will grant a sum of money. The Dominion government will give $10,000.

ELECTRIC LIGHTING.

The Union Light and Ice Company of Carmen, Okla., has been incorporated for $25,000.

The Palisade (Colo.) Light, Heat and Power Company has been incorporated for $50,000.

R. A. Talbott of Rock Valley, Iowa, has made application for an electric-lighting franchise there.

The Rockport (Texas) Ice and Light Company has been incorporated with a capital stock of $25,000.

The village of Sherburne, N. Y., will issue $15,000 in bonds for the construction of a municipal lighting plant.

R. A. Bushnell of Wessington Springs, S. D., has been granted a franchise for an electric-light plant to be erected at that place.

The Hillsboro (Ill.) Electric Light and Power Company has made a proposition to furnish the village of Irving, Ill., with electric light and power.

The Beaver River Light and Power Company of Beaver Falls, N. Y., with a capital stock of $40,000, has been incorporated under the laws of the state of New York. James P. Lewis, a prominent paper and pulp manufacturer of Beaver Falls, and the president of the J. P. Lewis Company, is the promoter of the new corporation. The incorporation papers give the right to operate in the villages of Lowville, Beaver Falls, Croghan and Castorland, as well as the towns of Lowville, New Bremen, Croghan and Denmark.

A receivership for the People's Gas and Electric Light Company of Xenia, Ohio, an Ohio corporation capitalized at $175,000, was recently asked in the United States Circuit Court at Cincinnati, Ohio, by Evelyn Bird of Chicago, a holder of bonds of the Xenia company.

ELECTRIC RAILWAYS.

Clinton H. Balleu has been granted a franchise to operate an electric railway at Princeton, Mo.

Minot, N. D., is discussing an electric railway from the Burlington coal mines to make Minot a manufacturing town.

The San Bernardino (Cal.) Valley Traction Company has issued $1,000,000 in bonds for the purpose of making extensions.

The Henderson (Ky.) Traction Company has been incorporated with a capital stock of $150,000 by Walter Schmidt of Cincinnati, J. W. Garrison and others.

At a mass meeting of business interests in Little Rock, Ark., the plan to raise funds to help finance the Little Rock and Hot Springs electric railway was discussed, and as a result $31,000 was subscribed.

Columbia City, Ind., will vote $30,000 to the Warsaw-Fort Wayne electric railway. Subsidies will be asked at Pierceton, $12,000; Larwin, $10,000; Corsse, $12,000, and Arcola, $9,000. It is said that all will be voted with little opposition.

Walter L. Eckhouse, chief engineer of the American Engineering Company, with headquarters at Indianapolis, is in Terrell, Texas, with a party of 11 surveyors, making a survey of the route for the proposed interurban from Dallas to Greenville.

The Kentucky Central Railroad Traction Company of Elizabethtown, Ky., has completed the survey of the proposed electric line from West Point to Elizabethtown, Ky., a distance of 22 miles. The road will be completed by the close of the present year.

The Tekoa-Saint Maries River Railroad Company will extend from Tekoa, Wash., south of Spokane, to Indian Creek, and will be in operation, it is said, in time to move the season's crop. The line will be ultimately extended to the timber belts of the St. Maries River in Idaho.

A company has been organized at Pittsburg, Kan., to build an electric railway from Girard to Mulberry through the coal camps. The company has organized under the name of the Girard Electric Coal Belt Railway Company. James A. McFarland is president, and J. A. Wayland, vice-president.

The first accident in connection with the Philadelphia new elevated electric railway occurred a few days ago while a train, which was running at a high rate of speed through the subway, ran beyond the end of the tracks and plowed into a pile of material for use in the subway. Comparatively little damage was done.

The Spokane and Inland Electric Railway Company will build 200 miles of line south of Spokane during the coming year. The main line from Spokane to Colfax, 80 miles, and branch lines to Moscow and Lewiston are included. Projected lines run from near Colfax to Snake River to connect with the line from Walla Walla north through Dayton.

The Prairie State Traction Company was recently organized at Whitehall, Ill. The company will construct an electric line connecting the following towns: Scottsville, Virden, Girard, Whitehall, Roodhouse and Athensville. The country through which it will pass has rich coal deposits. A. P. Brought of Manchester and E. S. Greenleaf of Jacksonville, Ill., are the incorporators.

The Okanogan electric railway, projected by A. M. Dewey of Spokane, Wash., which was to be built from Nighthawk to Brewster, Wash., is being surveyed from Nighthawk via Loomis, Fish Lake, Johnson Creek Valley, across the government's Okanogan irrigation project to the new town of Omak, on the Okanogan River, across the latter, through Omak Pass, on the south half of the Colville reserve, to the mouth of the Spokane River, thence on to a terminus in Spokane.

The Terre Haute, Indianapolis and Eastern Traction Company, with an authorized issue of $25,000,000 worth of stock and $10,000,000 worth of bonds, recently filed articles of incorporation in the state of Indiana. This is the holding company toward which the plans of the Philadelphia syndicate, represented in Indianapolis by Hugh J. McGowan, have been shaping for nearly two years. The company may acquire by purchase or lease all the Indiana syndicate lines. These include the Indianapolis and Northwestern, the Indianapolis and Western, Indianapolis Coal Traction (Plainfield line), the Indianapolis and Martinsville, the Indianapolis

and Eastern and the Richmond Street and Interurban Company. The new company will control 303 miles of traction line in operation.

If two bills recently brought before the Illinois Legislature are enacted the overhead trolley will have to be abolished to give place to underground power and elevated roads will have to abandon the third rail. The anti-third rail bill would compel the Chicago elevated roads and the Aurora surface road to change their systems, and the trolleys bill would make all Chicago street cars use the underground system. If passed the act will become operative as to new roads July 1st next, giving all present lines until July 1, 1909, to change their systems.

Plans have for some time past been under consideration for the future introduction of electric traction for the Alpine railways. For the section of line on the Aalberg Railway between Innsbruck and Bregenz, two large hydraulic powers have been acquired on the Ache in the Oetztal and on the River Inn, at Landeck, of which the first will probably be selected for operation. In addition to this, supplementary power may possibly be obtained in the Vorarlberg district. In the northern districts of the Alps many sources of waterpower are being surveyed.

POWER TRANSMISSION.

Undermined by hitherto undiscovered springs, the new $50,000 power house of the Upper Iowa Power Company and the concrete dam adjoining it sank into the Upper Iowa River near Decorah, Iowa, on March 23d, and became almost a total loss.

A decision by Judge Albert O. Marshall of the Will County Court on March 25th gives the Sanitary District of Chicago the right to condemn property of the Economy Light and Power Company along the Drainage Canal at Joliet. The drainage trustees are empowered by the ruling to proceed with the condemnation of 130 acres of land, purchased by the Economy Light and Power Company in order to take advantage of the waterpower furnished by the canal. President McCormick of the Sanitary District stated that he did not believe the land was worth more than $20,000. The company, however, valued its waterpower rights at $3,000,000.

There are a number of waterpower projects afoot in the state of Utah according to some of the applications filed recently with the state engineer. F. W. C. Hathenbreuck and Sidney Bamberger want 64 second-feet (cubic) of water, which will be used to develop 4,000 horsepower, the water to be taken from the Green River in Wasatch County to furnish power and electric lighting in Park City, Brigham, Salt Lake and other places. They also desire 26 second-feet of water, to be taken from the same river at a different place, to develop 800 horsepower, the purpose being to drive stamp mills and mining machinery in the Wasatch County mines. Willard Young and Frank C. Kelsey of Salt Lake want 300 second-feet of water from the Weber River in Morgan County, the diverting apparatus to consist of a canal and flume 3,500 feet and 15,000 feet long, respectively. This will also generate electric power. Samuel R. Bennion and Charles S. Carter of Vernal desire 55 second-feet of water from the Green River in Uintah County, the length of the diverting channel to be 5,000 feet. The water will be used for electric lighting and propelling machinery.

PUBLICATIONS

The National Electric Light Association, 29 West Thirty-ninth Street, New York city, has issued a new list of members of the association.

The January edition of the Iowa Engineer, published by the engineering departments of the Iowa State College of Ames, Iowa, is devoted entirely to the proceedings of the third annual convention of the Iowa Association of Cement Users, held at Ames in January.

The Trumbull Electric Manufacturing Company of Plainville, Conn., is sending out a series of monthly calendars on "Sir Circle T," which it calls "the knight of the perfect switch." A return postal filled out and sent to the company will insure the receipt of the calendars for each month.

A valuable little booklet entitled "Electricity" has been issued by the Portland Railway, Light and Power Company of Portland, Ore., in which are given instructions by which customers may read and test their own meters and check their bills. There is also general information concerning the furnishing of current for light and power. The instructions are clearly stated and enable customers to maintain personal supervision over the amount of current consumed.

Catalogue No. 54 of "The Standard" direct-current fans, has recently been issued by the Robbins & Myers Company of Springfield, Ohio. The styles listed include ceiling, desk, bracket, oscillating and exhaust fans. The manufacturer states that the fans are carefully designed with reference to highest possible economy. All the fans described are made with special tools and gauges, and should any part wear out or be broken, it can be identified by the serial number on the fan motor. The catalogue is well printed, in two colors.

"Slidolite" is the title of a folder recently issued by the Slidolite Company, 88-92 West Jackson Boulevard, Chicago. The slidolite is a device which enables the user to put a light, as an incandescent electric lamp, where it is most needed. The adjustment is made by simultaneously swinging the arm and sliding the light to the position desired. The device may be attached to ceilings of any height. It can be furnished in single ceiling, double ceiling, wall-bracket or partition-bracket forms.

The Norton Company of Worcester, Mass., manufacturer of Norton alundum grinding wheels, has issued a neat little booklet on "Alundum, Its Invention and Use." The booklet refers to alundum as the hardest and sharpest abrasive. It notes that before the invention of the electric furnace, artificial abrasives suitable for grinding-wheels were unknown. The company has during the last few years been operating an electric-furnace plant at Niagara Falls, N. Y., in which it has developed and brought the abrasive mentioned. The invention of alundum is one of the latest of the electrochemical inventions which have made Niagara Falls the center of electrochemical industry in the country. The necessary requisites for an efficient abrasive for grinding-wheels are given as: Sharpeners, hardeners, right temper, uniformity and abundant supply.

The Buckeye Electric Company of Cleveland, Ohio, has recently issued bulletins Nos. 3, 4 and 5. Bulletin No. 3 treats of the Gem metallized, 50-watt lamp. The highest efficiency of this lamp is 2.5 watts per candle. These lamps are made to operate on voltages from 100 to 130. In bulletin No. 4 appears a description of the Gem metallized, high-candlepower and Prismo, lamps and units. Several diagrams are given showing the curves of candlepower distribution of Gem units with different types of reflectors. The tantalum lamp is very fully described and illustrated in bulletin No. 5. These lamps operate at two watts per candle. The efficiency often reaches as low a value as 0.7 watt per candle at a point below the lamp when used with a concentrating Holophane reflector. The company does not recommend the use of tantalum lamps on alternating current.

The Kuhlman Electric Company of Elkhart, Ind., has just issued booklet No. 19, containing "Suggestions Pertaining to Selection and Care of Transformers," which will prove of interest to central-station managers. Complete duplicate electrical specifications of a five-kilowatt transformer are given on pages 4 and 5. The following rules regarding the selection of transformers for power service are here in part quoted: "1. For induction motors, whether single, two or three-phase, in sizes of five horsepower or less, transformer equipment should be based on 1,500 watts per horsepower of motor. 2. For motors of single, two or three-phase, larger than five horsepower where used only 10 to 12 hours a day, transformer equipment should be based on 1,000 watts per horsepower of motor. 3. For induction motors of one, two or three-phase, larger than five horsepower, where required for service 24 hours a day, the equipment should be based on 1,200 watts per horsepower of motor." A facsimile of the company's guarantee on every transformer shipped appears in the booklet.

SOCIETIES AND SCHOOLS.

The British Institution of Civil Engineers has arranged to hold its fourth triennial engineering conference in London on June 19th, 20th and 21st. In all there are seven sections, including an electrical one, of which Col. R. E. Crompton is chairman. The vice-chairmen are Prof. J. A. Ewing, F. R. S., Mr. J. Gavey and Mr. W. M. Mordey.

The list of questions for the 1907 "Question Box," to be presented at the next convention of the National Electric Light Association, has been issued. The questions have been carefully classified and are very practical. They cover a variety of technical subjects and such practical topics as central-station "management," "advertising," "contracts and rates," etc. Answers to the questions are now in demand by Paul Lüpke, 222 East State Street, Trenton, N. J., who is the capable editor of the Question Box.

The fifth annual convention of the Universal Craftsmen Council of Engineers will be held at the Masonic Temple, Chicago, on August 6-10, 1907. A trades exhibit will be held in connection with the convention in the drill hall of the building. Plans have been made to entertain visitors, including a moonlight trip on Lake Michigan. Requests for exhibit spaces should be made to the secretary, F. Elmo Simpson, giving the number of booth selected. The committee on exhibits consists of Alfred Johnson, S. Jones and William Leonard.

At its recent quarterly meeting the Massachusetts Institute of Technology Corporation elected three new alumni members from the Alumni Association's five candidates. They are George W. Kittridge, of the class of 1877, of Cincinnati, Ohio; Frank G. Stantial of Everett, Mass., class of 1879, and George E. Hale, director of the Carnegie Institution's solar observatory at Mt. Wilson, Cal., class of 1890. The alumni now have 12 members in the corporation. The corporation will take no action on the presidency or site until its June meeting.

MISCELLANEOUS.

The American Railway Insurance Company of Cleveland, organized by the traction interests to to carry their risks, will not begin business until some time next month, as its $500,000 of capital and surplus is not to be fully paid until April 1st. Henry N. Staats, its manager, reports pledges from 28 traction companies to place their insurance with the new concern, and negotiations pending with 16 more.

By the co-operation of the Household Economies Division of the Dubuque Woman's Club and the Union Electric Company of Dubuque, Mrs. F. Violet Sanborn, lecturer and writer on domestic science, will give a series of lectures on "The Science of Housekeeping" at 438 Main Street, Dubuque, Iowa, on the evening of April 1st. At the first lecture there will be a reception and a programme of orchestral music.

The American Railway Engineering and Maintenance of Way Association has adopted a committee report which recommends a certain plan for determining the impact strain upon bridges when hit by moving trains at various rates of speed. The testing apparatus was designed by Prof. F. E. Turneaure, dean of the college of engineering of the University of Wisconsin. Railroads throughout the country have volunteered financial support to a series of tests which are to be made and which will result, it is believed, in greater safety in train operation.

TRADE NEWS.

The Eagan-Farry Electrical Company of Dallas, Texas, has been incorporated with a capital stock of $15,000.

The Western Electric Supply Company of El Paso, Texas, has been incorporated with a capital stock of $100,000.

The new branch office of the Allis-Chalmers Company in New Orleans is located at 316 Godchaux Building. The representatives of the company will welcome visitors at this location.

John Nangle, formerly salesman with the Western Electric Company, Chicago, has been appointed manager of the branch office at 83 West Jackson Boulevard, Chicago, recently established by the Phœnix Electric Company of Mansfield, Ohio. A full stock of motors and dynamos will be carried at the Chicago salesroom of the company.

At the office of the supervising architect, Treasury Department, Washington, D. C., sealed proposals will be received until April 10th for the installation of an electric passenger elevator in the postoffice, courthouse and custom house at Superior, Wis., in accordance with the drawings and specification, copies of which may be obtained at the above-named office, or at the office of Messrs. Barber & Barber, at Superior.

Frank B. Cook of Chicago announces that a final decision has been awarded in his favor in two of the interference suits on self-soldering protectors which have been pending for a long time. The cases came up for final hearing at Washington on February 18th, and on March 4th Mr. Cook received the decisions. In view of the history of this Patent Office interference, Mr. Cook feels somewhat elated at this final decision in his favor.

The Western Wire Sales Company, incorporated under the laws of the state of Illinois, has taken over the business, good-will, assets, agencies, etc., of J. Allen Haines, Inc., 324 Dearborn Street. The offices remain in the same place. In addition to the agencies taken over, this company has added several new agencies and represents in the West one of the large eastern manufacturers of german-silver, nickel wire, resistance wire, etc., and the Tipless Lamp Company, New York city. The Western Wire Sales Company is publishing a weekly market letter, which will be sent regularly to any person who may desire it. This letter aims to give information on copper, the copper market, new articles of interest to those connected with the electrical trade which have been put on the market, etc.

The Brilliant Electric Company of Cleveland, Ohio, announces that ground has been broken at Conneaut, Ohio, where the company will erect one of the best equipped lamp factories in the country. The building contract has been let to the Moore Engineering Company of Cleveland for a $50,000 structure, the owner to expend at least a similar amount in equipment. The company's business has progressed so rapidly that it is at present unable to wait for the completion of the new factory at Conneaut; consequently it will vacate its general offices in the present factory building at 1134-1136 Chestnut Avenue, N. E., Cleveland, in order to give

the factory additional space for manufacturing purposes. After April 1st, the company's general offices will be located at 403 and 404 Electric Building, Cleveland. The officers of the Brilliant Electric Company are: President, A. B. Foster; vice-president, M. H. Mason; secretary, E. J. Kulas; treasurer, I. N. Pennock.

To provide for its increasing business, the Benjamin Electric Manufacturing Company, 42 West Jackson Boulevard, Chicago, has enlisted the services of both its president and vice-president in the management of its affairs. R. B. Benjamin, president, who has heretofore had entire charge, will devote his time principally to the manufacturing department, and to the development of the new devices which the company is putting on the market. W. D. Steele, vice-president, who has lately taken his position at the company's headquarters in Chicago, will have charge of the commercial department. Mr. Steele has had a wide experience in electrical engineering, especially in electric lighting. He was at one time in the engineering department of the Brush Electric Company, was later city electrician of Detroit, Mich., and superintendent of the electric-light plant. For the last seven years he has been connected with the New York office of Westinghouse, Church, Kerr & Co.

The Gregory Electric Company has recently added Mr. E. H. Nagelstock to the personnel of its commercial and engineering staff. Mr. Nagelstock has been connected with the sales department of the General Electric Company, New York city, and previously had considerable experience at the works of the General Electric Company at Schenectady, in the testing and engineering departments, and was closely identified with technical matters relating to the manufacture of apparatus to meet the requirements of the National Board of Underwriters. Mr. Nagelstock is a graduate of the Armour Institute of Technology, class of '98. His first practical experience consisted in running an electric-light and power plant for Armour & Co. at the Union Stock Yards, Chicago. During the Spanish-American war he was searchlight operator on the U. S. S. Oregon. In his various positions Mr. Nagelstock has made many valuable acquaintances. He will represent the Gregory Electric Company in Chicago and vicinity.

BUSINESS.

A Corliss cross-compound non-condensing engine, built by Allis-Chalmers Company, will be installed in the Roby (Ind.) plant of the Western Glucose Company, to drive an 800-kilowatt alternating-current generator furnishing power for the plant. Five vertical induction motors, of 75 horsepower each, will be connected to special apparatus used in the manufacture of glucose, and a line of standard induction motors will be installed for operating the rest of the machinery in the works. A 50-kilowatt synchronous motor-generator set will carry the lighting load for the plant. All of the equipment will be built by Allis-Chalmers Company.

The increasing trade of the mechanical department of the Minneapolis Steel and Machinery Company, Minneapolis, Minn., has made it imperative to add another large building of steel and brick construction to the already large plant. It was only a few months ago that the company had to double the capacity of its foundry. When the new building is completed, the company will have a total of over 12 acres of floor space within a yard area of over 20 acres. Minneapolis men have thus given to that city an enterprise which is adding a new chapter to Minneapolis' fame in all parts of the country, where men think of suction gas producers and gas engines, steam engines or steel construction on a large scale. In the short period of a year, since the company secured the right from Germany to build the Muensel gas engine and suction gas producer, it has installed over 30 plants and has orders in the shops for a great many more. The demand for this modern power plant has demonstrated beyond a doubt that the power users of the United States are glad to install a gas power plant which has passed the experimental stage and is ready for work from the start.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 19, 1907.

847,305. Telephone Set. George F. Atwood, East Orange, N. J., assignor to the Western Electric Company, Chicago, Ill. Application filed March 12, 1906.

In a subscriber's telephone set are combined a rocking member adapted to receive one end of the telephone, a latch for the other end of the telephone and guides adapted to direct the telephone into engagement with the latch.

847,310. Thermo-electric Annunciator. Severin O. Bestul, Iola, Wis. Application filed October 12, 1906.

In the apparatus described are a pivoted lever, a carrier plate adjustably connected to the lever, a spring acting on the plate and lever, an expansion bar anchored at one end and connected at its other end to the plate and controlling the movements thereof, and an electric circuit arranged to be opened and closed by movements of the plate, the circuit including a battery and an electrically actuated bell.

847,316. Telephone System. Charles L. Carr and Thaddeus P. Carr, Yellow Springs, Ohio. Application filed October 10, 1904.

In a controlling instrument for party line telephones are a controlling member rotatable in one direction only, provided with selective means to close the signaling circuit and having a part which closes the talking circuit only when the member is in normal position, and an electromagnet in the signaling circuit provided with means for closing the talking and signaling circuits, the part serving to open the talking and signaling circuits when the controlling member returns to normal position.

847,337. Electrical Rail Bond. Alonzo F. Hooton, Greenfield, Ind. Application filed May 24, 1906.

The rail bond includes a pair of contact plates having each a curved portion to which is attached a flange composed of a number of plates and a loop attached to the plates of both of the flanges.

847,355. Signaling Apparatus for Telephones. August A. Monson, Minneapolis, Minn. Application filed March 31, 1906.

A sub-station calling and signaling device comprises a revoluble disk having a notched periphery, a locking lever having one end arranged to engage the disk and provided at its opposite end with a projecting arm, and a receiver hook arranged to engage the arm when depressed and lock the disk from movement.

847,356. Automatic Telephone Switchboard. August A. Monson, Minneapolis, Minn. Application filed April 2, 1906.

In an automatic central telephone exchange mechanism there is a series of independent contacts—one contact for each sub-station, an independent electromagnet controlling the movement of each contact, a calling circuit having a multiple connection with all of the electromagnets and means for breaking the multiple circuit when any one electromagnet is energized, thereby preventing the energizing of any of the remaining electromagnets.

847,366. Candy Spinning Machine. Ralph E. Pollack, Syracuse, N. Y. Application filed June 13, 1906.

An electric heater band is clamped to the bottom and top plates of the machine and surrounding the chamber formed by the plates.

847,367. Telephone Switch Operating Mechanism. Frank M. Potter, Jr., Rome, N. Y. Application filed May 28, 1906.

Combined with a telephone switch are a rock shaft having a radially extended arm for actuating the switch, a pivoted telephone supporting hook constructed and arranged to engage either end of the shaft and turn it in the same direction, and supports for the hook at both sides of the box, to either of which the hook may be connected.

847,372. Lightning Arrester. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed February 13, 1903.

In combination with the electrodes of the lightning arrester are means for establishing a low-resistance electrical connection on the passage of an arc between the electrodes and for disestablishing the connection on the cessation of the arc.

847,385. Telephone Trunking System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 1, 1902.

In connection with the trunk circuit are a guard signal at the incoming end of the trunk, a relay actuated over the tip side only of the outgoing end of the trunk circuit when a connection is established at the end to place the signal in condition to operate, and a second relay at the incoming end actuated by current over a portion of the talking circuit when a connection is established at the called line to render the signal inoperative.

847,395. Light-transmitting and Light-diffusing Object. Ernest Böhm, London, England. Application filed April 30, 1906.

The inventor shows an incandescent electric-light bulb having on its surface an integral rib comprising numerous bulbous irregularities on its outer surface which form separate lenses. (See cut on next page.)

847,424. Measuring Apparatus for Electricity. Eduardo Mier y Miura, Madrid, Spain. Application filed December 12, 1904.

In the apparatus are two concentric upright tubes constructed to receive isolated bodies of electrolyte, tubular electrodes within the space between the tubes, a pair of upright indicating tubes, connections between the interior of the first-named tubes and the indicating tubes whereby the electrolyte occupies the latter also, and a scale associated with the indicating tubes.

847,449. Transmitter Front. Alfred H. Weiss, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 2, 1907.

The transmitter front has a folded portion, means for securing the mouthpiece thereto, and a shoulder formed by the folded portion against which the mouthpiece abuts.

847,451. Means for Turning and Arranging Cancaps. John T. Wilmore, Denver, Colo. Application filed August 7, 1905.

In the apparatus described are magnet-carrying devices mounted exteriorly on a cylindrical can-cap-containing receptacle.

847,453. Ice Remover. Gerald P. Ayers, Chicago, Ill. Application filed April 30, 1906.

In combination with a truck of a third-rail electric car is a power-operated hammer carried on the truck directly above the third rail and adapted to break ice from the rail.

847,461. Telephone Call Meter. Charles T. Bradshaw, Philadelphia, Pa. Application filed September 27, 1904.

In a registering device for telephones are a register at the subscriber's station, electromagnetic means for actuating the register from the central station, and means controlled from the subscriber's station for locking the actuating means when the telephone is not in use.

847,479. System for Electrically Releasing Drawers in Cash Registers, Etc. Alfred G. Jackson, Brisbane, Queensland, Australia. Application filed May 9, 1906.

In a cash register in combination with a cash drawer and electromagnetic locking devices therefor are a circuit including a source of electric energy for operating the electromagnetic devices, an initial key, a normally open switch in the circuit arranged to be closed by the movement of the initial key, an operating element and a second normally open switch on said circuit adapted to be closed by the operating element.

847,520. Circuit-breaker. Edwin H. Smythe and Eastman A. Burrows, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed April 22, 1905.

In a switch are combined with a base and a contact terminal projecting therefrom a pair of switcharms adapted to engage opposite sides of the terminal, and a third switcharm adapted to engage the face of the terminal. (See cut on next page.)

847,535. Punching Machine. Jan Wytman, Avalon, Pa. Application filed March 10, 1906.

An electric circuit is controlled by an index pin in the machine co-operating with a templet support. There is also a pin-withdrawing magnet provided with a switch.

847,540. Electric Meter. Claude W. Atkinson, Beckenham, England. Application filed December 29, 1904.

An electrolytic meter comprises a cell containing the electrolyte and one stationary electrode, a float carrying the other electrode, two electrical contacts adapted to be closed by the float at its upper and lower positions, an electromagnetic relay adapted to be operated by a current controlled by the contacts, and a reversing switch adapted to reverse the polarity of the electrolytic cell in combination with an integrating mechanism operated by the electromagnetic relay.

847,543. Thermally Operated Apparatus. Emile Batault, Geneva, Switzerland. Application filed May 14, 1902.

A thermally operated apparatus has in combination a resilient arc or bow and a chord connecting the ends of the arc or bow and holding it under tension, the chord passing two or more times between the ends of the arc or bow.

847,555. Adjusting Device for Relays. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 5, 1906.

Combined with an electromagnet having an armature are a U-shaped bridge piece, a pliable tongue secured at one end to the yoke portion of the bridge-piece and a coiled retractile spring connecting the armature with the other end of the tongue.

847,566. Adjustable Support for Vapor Lamps. Stanwood E. Flichtner, Englewood, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed July 28, 1904.

In a printing apparatus are a vapor electric-lighting apparatus mounted upon a plate, a hinge at one end of the plate, a hinged support at the oposite end thereof, and means whereby the plate can be moved to an inclined position either above or below its normal operating position.

847,595. Speed-timing Device for Vehicles. Alden L. McMurtry, New York, N. Y. Application filed June 8, 1904.

In the device an electric circuit is automatically completed by a latch when released from a pivoted trigger-arm.

847,597. Governor. Peter Onsum, Jackson, Tenn., and Henry R. Dohren, Champaign, Ill. Application filed January 12, 1906.

Magnets are secured to a rotatable wheel in the governor. A disk is rotatably mounted by close proximity to the magnets and is adapted to be affected thereby.

847,610. Marking Apparatus. Edwin M. Schantz, Zimmerman, Ohio. Application filed March 10, 1906.

In the apparatus described are electric lamps defining the graduations on a scale and supplementary sets of contact pieces. The device is used for marking subdivided spaces on lumber.

847,624. Electrical Measuring Instrument. Thomas W. Varley, New York, N. Y. Application filed September 8, 1905.

In the apparatus there are a substantially constant magnet for creating a substantially uniform field of force in a radial direction, a stationary coil adapted to shift the lines of force of the constant magnetic field and a movable coil in the magnetic field normally in a balanced condition relative thereto but becoming unbalanced when the magnetic field is shifted.

847,656. Telephone Relay. Dilpert S. Dickert, Salt Lake City, Utah. Application filed May 22, 1906.

In a relay for telephone lines are two inductor coils, two transmitting devices, magnetically controlled means operatively connected therewith and two independent

electromagnetic means included in closed circuits with the secondaries of the induction coils.

847,663. Speed-controlling Device for Electric Motors. Thaddeus W. Heermans, Chicago, Ill. Application filed November 17, 1906.

A speed-controlling apparatus for shunt-wound electric motors comprises two rheostats connected in parallel in the shunt field of the motor, the arm of one of which is automatically operated, and manually operable means for operating the arm of the other rheostat.

847,691. Telephone Attachment. Alcorn Rector, New York, N. Y., assignor to himself, Daniel O. Sprague and Arthur P. Smith, New York, N. Y. Application filed November 24, 1906.

Combined with the receiver are a ring interposed between the earpiece and the body of the receiver, a cup having an earpiece and a sound-tube leading from within the ring to the cup.

847,701. Trolley and Crossover. Fredrich Schmunk and Paul B. Schmunk, Beaver Falls, Pa. Application filed July 10, 1906.

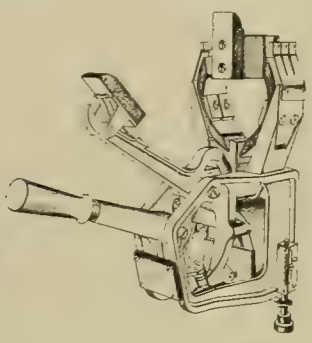
Details are described.

847,740. Means for Producing Expression Marks on Music Record Sheets. Benjamin S. Dean, San Francisco, Cal. Application filed February 21, 1906.

In the device electromagnets are employed to operate beams connecting pivoted hammers provided for a number of record sheets. There are electric circuit-closing devices for the electromagnets.

847,741. Electric Hammer. Winfield A. Denny, Anderson, Ind., assignor of one-third to Benjamin D. Emmanuel and one-third to Clement W. Hooven, Anderson, Ind. Application filed July 26, 1906.

NO. 847,395.—LIGHTING GLOBE.



NO. 847,520.—CIRCUIT BREAKER.

Combined with a pair of solenoids or the like are parallel cores, a rigid connection between the cores and a hammer connected with the rigid connection so as to move therewith.

847,743. Current Controller. Richard Duckworth, Preston, England. Application filed January 3, 1906.

A current-controlling device for electric-railway companies, a feeder, a sectional slipper rail normally out of electric contact with the feeder, yielding terminals for the slipper rail and feeder, a contact plate movable in a manner to make and break a circuit between the terminals, and yielding means, operated by the passage of a portion of the car, for imparting movement to the contact plate.

847,746. Electrical Welding Apparatus. Thomas A. Edison, Orange, N. J. Application filed July 21, 1904.

Apparatus for welding metallic articles contiguous to a seam thereon comprises a fixed article support, a carbon operatively mounted in the proper relation to establish an arc between the carbon and the article, and means for automatically causing the carbon to move along a closed non-circular path.

847,750. Sliding Jack Switch. George F. Espy, Union Furnace, Pa. Application filed November 23, 1906.

The switch has a base comprising stationary and movable portions, a connector provided with separated contact members and carried by one of the base portions, pairs of co-operating contacts carried by the other base portion and means for bringing the connector into engagement with any pair of contacts by actuating the movable base portion. The switch is adapted to connect a transmitter successively into circuit with different telegraphic circuits.

847,777. Telephonic Repeating Circuit and Apparatus. Fernand Emile de Faucheux d'Humy, Englewood, N. J. Application filed June 26, 1906.

In a reciprocal telephonic repeating system are combined with telephone-line sections, repeating relays, each inductively responsive to currents originated in its respective line section and unresponsive to currents produced by it in the other line section. (See cut.)

847,794. Electrical Apparatus. Charles N. Lord, Santa Fe, N. M. Application filed March 7, 1906.

Combined with a source of electrical supply are one or more dry battery cells, lead-wires extending therefrom through the handle, metallic sockets in which the lead-wires terminate and carbon or like elements inserted in the metallic sockets and projecting beyond the handle.

847,816. Adjustable Miter-box for Commutator Brushes. Walter S. Pollard, Philadelphia, Pa. Application filed August 26, 1905.

The device has a work-seat in the base and fixed and movable sides in proximity to the work-seat.

847,842. Telephone Receiver. Louis Steinberger, New York, N. Y. Application filed August 4, 1904.

In the receiver are a metallic casing provided with an enlarged end having mutilations disposed internally thereof, a member of insulating material encircled by the casing and provided with an enlarged end having portions extending into the mutilations and magnetic mechanism supported in proximity to the diaphragm by the member of insulating material.

847,851. Revolving Mercury Dip Current Interrupter. Francis M. C. Usher, Fulton, Ky., and Consuelo A. Sloane, Merrifield, Va. Application filed September 19, 1905.

In a current interrupter are combined with revolving contact needles conducting devices having a different center of revolution from that of the needles whereby the needles are revolved, and means borne by the devices and arranged to conductively and alternately connect the ends of the needles and the conducting devices.

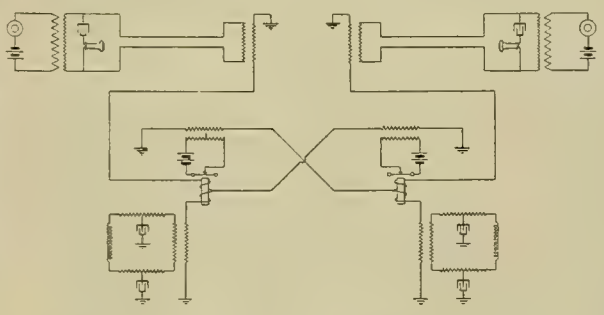
847,872. Hair Drier. Isabell Allen, Kansas City, Mo., and George Hanlon, Shawneetown, Ill. Application filed June 12, 1906.

An elongated electric-light bulb extends through the hollow back of a comb detachably arranged on one end of the handle of the drier. Electrical connections extend through the handle to the bulb. Means are provided to send a current of air about the comb-lamp and thence to the hair being dried.

847,876. Spark-timing Device for Ignition Systems. Vincent G. Apple, Dayton, Ohio. Application filed November 9, 1903.

The device embraces circuit-controlling means, including a rotating conductor and a carrier for the conductor rotatively adjustable on the shaft to be driven.

847,877. Electric Current Interrupting and Varying Apparatus. Emile Bachelet, New York, N. Y. Application filed January 9, 1906.



NO. 847,777.—TELEPHONE REPEATING CIRCUIT.

Combined are an interrupter, an electroreceptive device, a frequency varying switch interposed in the circuit between the interrupter and the receptive device, and provided with a series of contacts whereby the number of interruptions produced by the interrupter can be changed or amplified between the interrupter and receptive device by shifting the switch.

847,894. Sparking Device for Internal Combustion Engines. Edward F. Bradley, Tufnell Park, England. Application filed February 2, 1906.

Combined with an induction coil, a circuit-maker and breaker and a battery are a stationary contact and a spring-plate having a contact included in circuit with all the aforesaid parts; a condenser bridged between the spring-plate and the contact, an electromagnet arranged in shunt circuit with the coil and the contact, a pivoted armature for the core of the induction coil having its free-end portion arranged between the two pole-pieces of the electromagnet, and a hook carried by the armature and engaging with the free-end portion of the spring-plate.

847,905. Electric Signal System. Eugenio Chouteau, Jr., St. Louis, Mo. Application filed October 24, 1906.

A sensitive electric alarm and an insensitive electric alarm are carried by a number of locomotives on the track. A powerful battery is mounted on each locomotive for energizing the insensitive bell of the other locomotive, and a weaker battery is placed in each locomotive to energize the sensitive bell of the other locomotive. Each locomotive is provided with a switch and connections for establishing communication between the weaker battery of one engine and the sensitive bell of the other. The switch is further provided with connections for establishing communication from the powerful battery of one engine to the sensitive bell of the other.

847,921. Omnigraph. James W. Earles, Fort Hancock, N. J. Application filed January 24, 1907.

In an omnigraph are combined a flat arcuate metal plate provided on its inner edge with a series of projections corresponding to the characters of a telegraphic alphabet, a key pivoted for horizontal movement and adapted to connect at one end with the projections, a sounder and electrical connections between the key, plate and sounder.

847,925. Switch. Alfred L. Eustice, Chicago, Ill. Application filed August 15, 1906.

In the switch is included a solenoid having the core operative in the path of a locking lever. A circuit energizes the solenoid to project the core in contact with the lever for operating the latter to release a movable member. There are also time-controlled means to close the solenoid circuit to operate the core of the solenoid at a predetermined time.

847,935. Electrical Grounding Device. John F. Golding, Washington, D. C., assignor to the Monolith Steel Company, Inc., a corporation of Virginia. Application filed November 18, 1905.

In this device are combined a grooved driving bar and an electric conductor looped at its middle and having its ends secured in the grooves of the bar.

847,937. Insulated Rail Joint. George L. Hall, New York, N. Y., assignor to the National Railway Materials Company, New York, N. Y. Application filed October 22, 1906.

Details are described.

847,939. Combined Pull and Key Socket. John H. Hanson, Chicago, Ill. Application filed July 16, 1906.

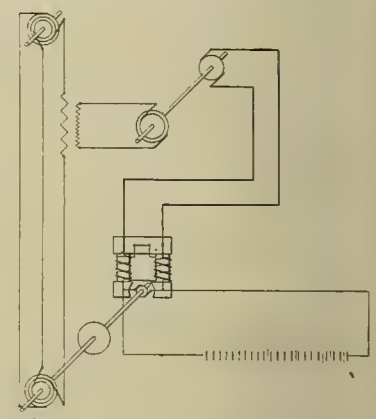
In a lamp socket is a socket shell having therein a cord-guiding aperture and a contact head within the shell. A conducting spring constantly coacts with the contact head to snap it and to hold it in predetermined positions.

847,974. Alternating-current Plant Combined with Storage Battery. Ludwig Schroder and Adolph Müller, Berlin, Germany. Original application filed October 7, 1904. Divided and this application filed July 14, 1905.

Combined with a direct-current generator provided with two field windings in opposition to each other are a storage battery supplied by the direct-current generator and connected with one of the field windings for energizing the latter, a separate generator connected mechanically with the direct-current generator, and electric mechanism controllable by the separate generator and connected with the other of the field windings. (See cut.)

847,981. Thermostat. Peabody A. Brown, Denver, Colo. Application filed December 8, 1905.

In this thermostat there is a bar, a support to which one extremity of the bar is fixed, electrical contacts located on opposite sides of the bar and distinct circuits in which the respective contacts are located. The bar is composed of two plates of material possessing the properties of expansion and contraction in unequal degrees and is provided with an auxiliary member fixed to it at one extremity, the auxiliary member being located on the side of the bar toward the cold contact and being also composed of two plates of material possessing the properties of expansion and contraction in unequal degrees.



NO. 847,974.—ALTERNATING-CURRENT PLANT COMBINED WITH STORAGE BATTERY.

847,984. Telephone Trunking System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 25, 1902.

Combined with a trunk line extending between different switchboard sections are a cord circuit adapted to be connected with the trunk at its outgoing end, and a called subscriber's line with which the trunk is adapted to connect at its incoming end, a supervisory relay associated with the cord circuit and a trunk relay associated with the incoming end of the trunk line, the relays being in series with the two limbs of the trunk line in parallel, and having their circuit controlled by the position of the called subscriber's receiver hook.

847,989. Trolley Wire Crossing. James N. Hayes, St. Louis, Mo. Application filed January 29, 1906.

The device comprises a crossing made of two sections with inclined surfaces formed on each of the sections.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 25, 1907:

423,897. Constant-current motor. W. Baxter, Jr., Baltimore, Md.
423,901, 423,902 and 423,903. Multiplex Synchronous Telegraph. R. G. Brown, Brooklyn, N. Y.
423,909. Regulator for Dynamos. H. W. Cooley, Boston, Mass.
423,956. Electric Forging Machine. R. Ross, Vergennes, Vt.
423,966. Method of Electric Soldering, Cementing, Etc. E. Thomson, Lynn, Mass.
423,967. Apparatus for Electric Soldering and Cementing. E. Thomson, Lynn, Mass.
423,975. Controller for Electric Motors. M. J. Wightman, Lynn, Mass.
423,991. Dynamo-electric Machine. S. Z. DeFerranti, Hampstead, County of Middlesex, England.
424,006. Telegraphy. C. Langdon-Davies, London, England.
424,036. Electromagnetic Motor. N. Tesla, New York, N. Y.
424,047. Electric Radiator. H. E. Butterfield and W. Mitchell, Waterville, Me.
424,057. Underground Conduit for Electric Wires or Cables. C. G. Gilman, Eldora, Iowa.
424,065. Dynamo-electric Machine. C. D. Jenney, Indianapolis, Ind.
424,070. Electric Locomotive. G. W. Mansfield, Boston, Mass.
424,082. Electric Railway. W. Thompson, Meriden, Conn.
424,152. Secondary Battery. H. H. Wardwell, Lake Village, N. H.
424,206. Electric-railway Car. R. M. Hunter, Philadelphia, Pa.
424,207. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
424,209. Quadruplex Relay. F. W. Jones, New York, N. Y.
424,219. Electric Alarm for Letter Boxes. W. G. Reed, Toronto, Canada.
424,268. Electromagnetic Watch-clock. R. B. Carr, Boston, Mass.
424,295. Electric Stop-motion for Knitting Machines. J. P. Haslan, Wilmington, Del.
424,298. Electric Railway. J. C. Henry, Kansas City, Mo.

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Alternating-current Motors for Machine Tools and Cranes in a Modern Machine Shop.

One of the many instances which show a tendency toward the use of alternating-current motors, both variable and constant-speed, in shops and factories, is the moderate sized and busy plant of Chalmers & Williams, in Chicago Heights, Ill. Here are manufactured engines, pumps and mining machinery. The nature of the business requires a large variety of machines, and the services of two large and several small cranes are in constant demand. All these are electrically driven, and the company is getting entire satisfaction from its installation.

That electric drive will be the method of power transmission in general use in good shops and factories of the future is no longer a question. The disadvantages of long lines of shafting and belts were realized long before electricity offered a solution of the problem. The rope-drive is still used to good advantage in a few simple cases of direct transmission of large units of power. Compressed air is employed to a limited extent for the operation of drills, hammers, chisels, calking tools and the like and for cleaning filings, chips and dirt out of machines in the course of manufacture. Hydraulic transmission has been and is still used for certain special tools, such as large riveters, flanging machines and heavy jib cranes. But for general use and to meet the requirements of economy and convenience electricity is undoubtedly the best power-transmitting agent.

The only question remaining is, what system of electric-drive to install. A prominent central-station man recently said: "We all run across cases where business is lost because we cannot secure alternating-current motors that will do the work as satisfactorily as the direct-current motor, the margin between the cost of the operation of a private plant and central-station service being so small that in order to secure the best results from machinery the manufacturer often decides to install his own plant and direct-current motors with a resulting loss to the central-station company. If we can secure motors that will do the work asked for by the customer we will help our own cause materially."

The last few years have seen a large increase in the use of alternating-current motors in connection with factory work. This has been largely due to the decreased cost of these motors, the prices now approximating closely the prices of direct-current motors of similar sizes and speeds. Excepting on tools and machinery requiring variable speeds, the alternating-current motor is usually considered preferable, owing to its overload characteristics, simplicity and safety. This motor, having been developed to a point where it can be guaranteed as reliable in ordinary work, only further development for variable-speed is now awaited; and such developments are being rapidly made by the various manufacturers.

It is the purpose of this article to describe briefly a moderate sized, prosperous and well-managed manufacturing establishment where alternating-current is used exclusively for driving some 50 machines of large and small size and for operating cranes, as well as doing the shop lighting. The plant referred to is that of Chalmers & Williams, mentioned above, at Chicago Heights, Ill. The machines and tools are all driven by constant-speed two-phase alternating-current Westinghouse type CCL induction motors and the cranes are operated by Westinghouse motors built for variable speed.

Of the accompanying illustrations, Fig. 1 shows a 42-inch double-head Fifield lathe driven by two 10-horsepower 850-revolution motors. The motors are direct-geared to the machine. Attention should be called to the mounting of the auto-starter in this unit, the arrangement being especially convenient for the operator.

Fig. 2 shows the two large overhead traveling cranes used in the plant, each of 20 tons capacity. Each of these cranes is supplied with three motors, one for the hoist, one for the bridge travel and one for the trolley travel. All these motors are of the variable-speed type, with resistances introduced in the rotor for controlling the speed. The controllers are stationed in the cabs. The motors are two-phase, 60-cycle, 200-volts. Mr. David G. Smith, superintendent of the plant, says that the operation of these cranes is entirely satisfactory, which is also true of the machine-tool drive.

The first crane in the picture is made by the Whiting Foundry and Equipment Company of Harvey, Ill. The second one is made by Pawling & Harnischfeger, Milwaukee, Wis. The engine stand being hoisted by the first crane is part of a complete engine being built by Chalmers & Williams to go into the new Commercial National Bank Building, Chicago. The latter building will have four of these engines. The rear crane is hoisting the crank shaft of one of the engines.

In Fig. 3 is shown a No. 2½ Niles horizontal boring machine driven by a five-horsepower 850-revolution motor. This motor is reversible, a reversing auto-starter being employed. The auto-

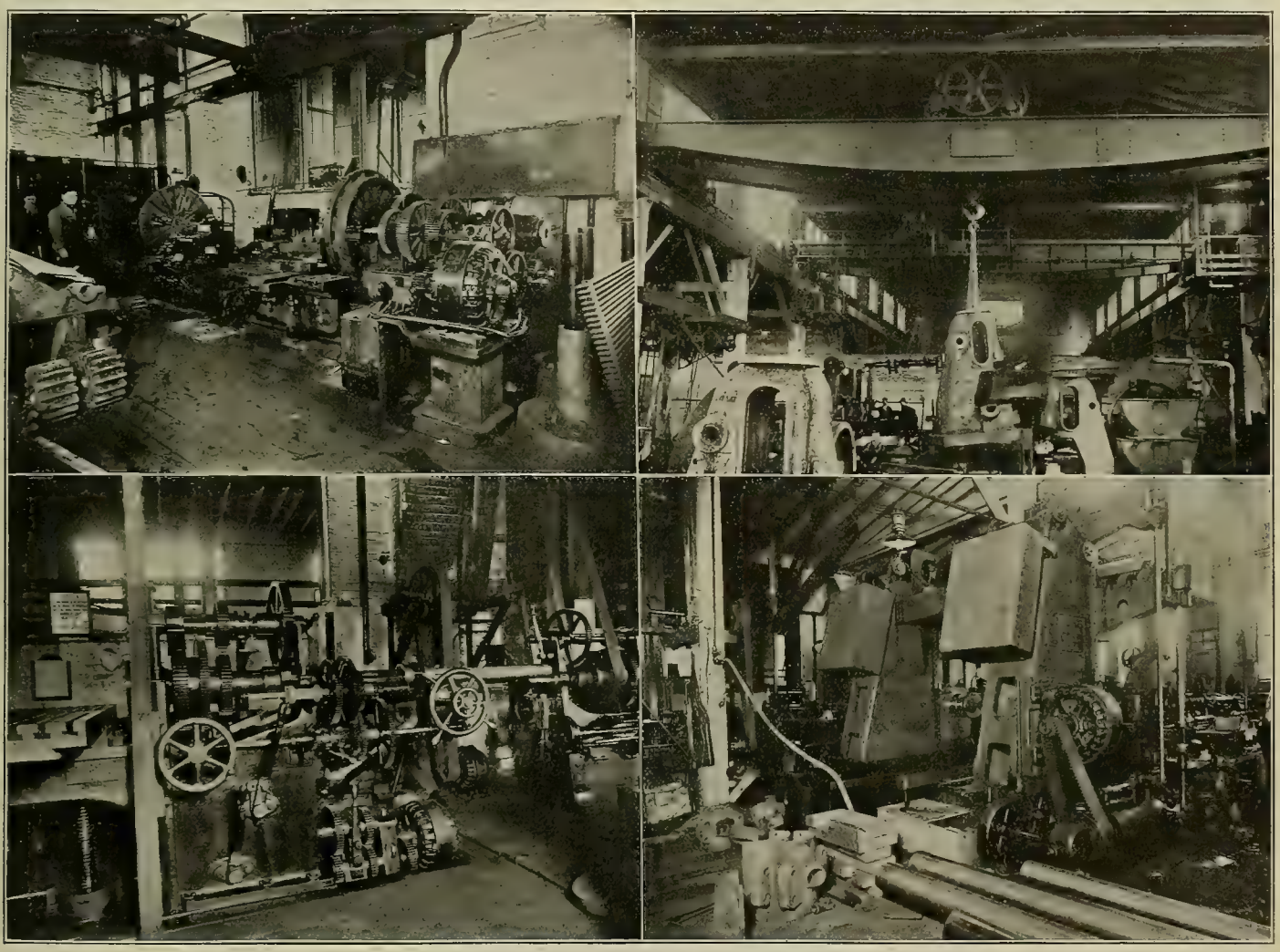


Fig. 1. 42-inch Double-head Lathe with two Motors.
Fig. 2. Overhead Traveling Cranes.
Fig. 3. Horizontal Boring Machine.
Fig. 4. Four-spindle Milling Machine.

ALTERNATING-CURRENT MOTORS FOR MACHINE TOOLS AND CRANES IN A MODERN MACHINE SHOP.

starter is located back of the machine in a convenient place for the operator.

Fig 4 shows a Beaman & Smith 48-inch by 12-foot four-spindle milling machine. It is chain driven by a 30-horsepower 840-revolution motor. This is a very heavy machine. The chain drive is clearly shown in the picture.

An excellent view of a modern electric drive is given in Fig 5. The picture shows a heavy 52-inch Fifield lathe driven by a 15-horsepower 850-revolution two-phase 60-cycle CCL induction motor. The motor is compactly geared to the machine, as clearly shown in the picture.

A 10-foot boring and turning mill made by the Pond Machine Tool Company is shown in operation in Fig. 6. This machine is driven by a 20-horse-power 840-revolution motor. A five-horse-power 850-revolution motor is mounted on top of the tool for lowering and raising the cross rail and cross head. The main driving motor is located on the floor and drives the machine through a Morse silent-chain drive. Quite a number of these chain drives are used and are found very convenient in meeting the various conditions incident to locating the machines. This motor is a constant-speed machine, variable speed being obtained through a nest of gears.

The company maintains its own generating plant, an interior view of the engine and generator room being given in Fig. 7. The plant is neat and simple. It consists of two 120-kilowatt two-phase 60-cycle generators direct-belted to two vertical Allis engines. The generators are separately excited, the exciters being belt-driven from the generator shafts. The farther generator in the picture is of Bullock make and the nearer one is a Westinghouse machine.

The switchboard, shown at the right in Fig. 7, is of white Italian marble and contains the usual instruments and switches, of Westinghouse make. The entire system is two-phase, 60 cycles, 200 volts.

Lighting of the various shops and buildings is done by alternating-current arcs and incandescent lamps, all on single phase. For the incandescent lighting, transformers are installed to reduce the current from 200 to 110 volts. The arc lamps, some of which can be seen in Figs. 4, 6 and 7, are 110-volt multiple alternating-current and are installed on 200-volt single-phase circuits, compensators being used to obtain 110 volts.

The general plant is made up of the following: Main machine shop, foundry, blacksmith shop, woodworking and pattern shop, tool-making shop, and warehouse.

The woodworking and pattern shop is driven by a 40-horsepower motor, the blacksmith shop by one of 30-horsepower, and the tool-making shop by a 20-horsepower machine.

Any part of the Chalmers & Williams plant presents typical examples of what can be done in factories of moderate size, as well as large ones, with alternating-current motors. Aside from the machines shown in the pictures, which were selected as typical, the plant contains drilling machines of various kinds, grinders, emery wheels, tumbling barrels, blowers, etc., all of which are motor driven. There are in the entire plant about 50 motors in sizes ranging from one-half horsepower to 50 horsepower.

The economy of induction motors is indicated by Superintendent Smith's remark that no repairs have been necessary on any of the motors since their installation, some of them nearly two years ago.

Standard Specification for Coal.

Some years ago Mr. J. E. Woodwell, inspector of electric-light plants for the United States Treasury Department, caused to be put into effect a plan of purchasing coal for the electric plants under his supervision upon a heat-unit basis, the quality of the coal being determined by proximate analysis and calorimeter tests. The calorimeter apparatus which has been used in this work for over six years was made expressly for the government by Mr. Henry J. Williams, coal expert, of Boston. Step by step the work has been developed as the result of experience with actual contracts and a study of similar methods as used by the Interborough Rapid Transit Company of New York, the Fuel Engineering Company of Chicago, the United Gas Improvement Company of Philadelphia and others. Finally, a standard "Specification and Proposal for Coal" was evolved as the result of the joint efforts of Mr. Woodwell, Mr. E. D. Randall of the Geological Survey and Mr. S. S. Voorhees, engineer of tests of the Treasury Department.

This specification has been issued recently in printed form and is of much interest to owners and managers of steam-raising plants. It is intended to give a clear description of the coal desired by the government, and to secure a definite statement of the quality of coal offered by the bidder, with a view to using such statement as a basis for payment in connection with the stated price per ton.

What is desired is not necessarily the cheapest or the highest grade of coal per se, but the coal which will insure the greatest net economy in plant operation. In view of these facts, the description of the coal inserted by the government in the specification should receive careful consideration, as the boiler and furnace conditions require. It is not expected that all deliveries will be absolutely uniform or agree exactly with the standard established by the contractor, but it is necessary that all deliveries should be within the limits set by the government.

The limits are wide enough to permit the use of the output of any mine or group of mines, provided proper care is exercised in mining and picking out slate, bone, etc. With these points in mind, it is only necessary for the bidder to select coal for each proposal which will meet the description given, and permit deliveries within the limits set. The standard established by the contractor should be such as to require the least corrections for variation in heat units and ash from values established.

It is believed that the enforcement of the provisions of the specification will operate equitably both with respect to the government and to the contractor and will guarantee adequate protection to each. Many coal dealers have already signified their willingness to furnish coal on this basis and have commended as well as indorsed the method.

The application of this system will not only enable the award of a contract to be made in an equitable manner, but will also remove many of the usual causes for dispute as to the character and quality of the coal subsequently delivered, and provide a satisfactory basis for the correction of payments for differences in quality in favor of the party in whose interest it is due.

The system of sampling, analyzing and testing coal delivered under the government contracts will be under the supervision of the fuel testing division of the Geological Survey in order to insure reliability and impartiality.

The heating value expressed in British thermal units of coal containing approximately the same percentage of ash is essentially a direct measure of the actual value to the purchaser, and for this reason the specification provides for an adjustment of payment in direct proportion to the variation in heat units in the coal as received. As the coal is weighed when delivered and the payments are based also upon the price per ton, it is necessary to determine the heating value of the coal in the condition in which it is received containing whatever moisture may be present at the time.

A further correction in payment will be made for variation of the ash in dry coal in order to take account of the cost of handling additional fuel and ash and its effect on the capacity of the boiler and furnace.

In the specification (which is a printed form of five pages) the government gives a description of the coal desired, determined by boiler and furnace equipment, operating conditions and the local market. Coals must not contain more than certain percentages (written in) of ash, volatile matter, sulphur and dust, the last named being considered as all coal which will pass through a one-eighth-inch round-hole screen.

The process of sampling is described in the specification. Immediately on receipt the sample will be analyzed and tested by the government, following the method adopted by the American Chemical Society and using a bomb calorimeter.

A contract entered into under the terms of the specification shall not be binding if, as the result of a practical service test of reasonable duration, the coal fails to give satisfactory results due to excessive clinkering or to a prohibitive amount of smoke.

Coal containing percentages of volatile matter, sulphur and dust higher than the limits indicated,

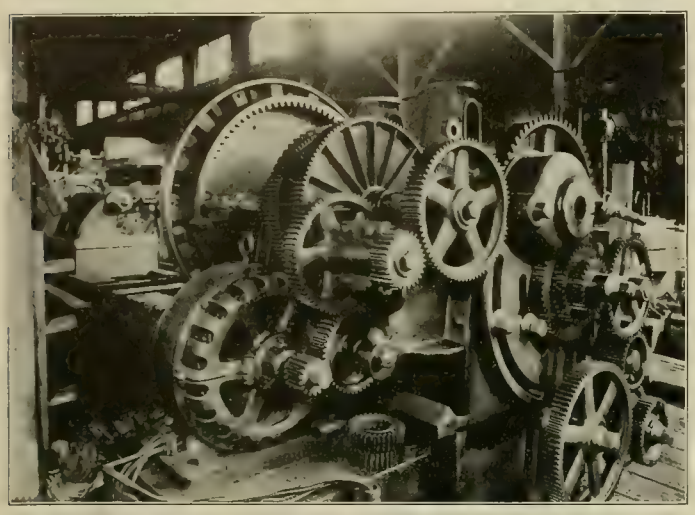


Fig 5. 52-inch Lathe Direct Driven

Fig. 7. Generating Plant.

ALTERATING-MOTOR DRIVE IN A MODERN MACHINE SHOP.

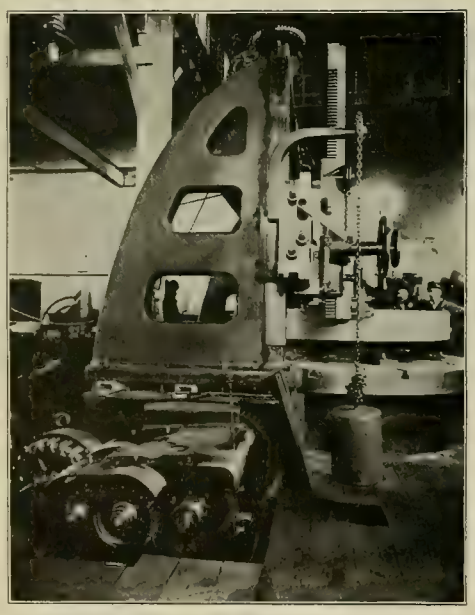


FIG. 6. ELECTRICALLY DRIVEN BORING AND TURNING MILL IN A MODERN MACHINE SHOP.

and coal containing a percentage of ash in excess of the maximum limits indicated in a table which is given, will be subject to rejection.

In the proposal accompanying the specification the bidder offers coal at a certain number of British thermal units in coal as delivered and a certain percentage of ash, and for a certain price. Thereupon the specification gives the following stipulations for price and payment:

"Payment will be made on the basis of the price named in the proposal for the coal specified therein, corrected for variations in heating value and ash, as shown by analysis, above and below the standard established by contractor in this proposal. For example, if the coal contains two per cent., more or less, British thermal units than the established standard, the price will be increased or decreased two per cent. accordingly.

"The price will also be further corrected for the percentages of ash. For all coal which by analysis contains less ash than that established in this proposal a premium of one cent per ton for each whole per cent. less ash will be paid. An increase in the ash content of two per cent. over the standard established by contractor will be tolerated without exacting a penalty for the excess of ash. When such excess exceeds two per cent. above the standard established, deductions will be made from price paid per ton in accordance with the following table."

This table need not be given here. It provides for percentages of ash (as established in proposal) ranging from 5 to 18, and for cents per ton to be deducted ranging from 2 to 35. If, for instance, coal having a declared 10 per cent. of ash is tendered, it may run up to 12 per cent. without deduction from contract price. But if any shipment prove to have 15 per cent. of ash on test, 7 cents a ton is deducted. A graduated scale gives the deductions to be made at various percentages of ash. The maximum limits for ash run from 12 per cent. for coal declared as 5 per cent. ash to 22 per cent. for 18 per cent. ash.

Magnetic-shunt Dynamo Regulation.

A new method of dynamo regulation has been patented in France by Charles Parsons. It relates to the shunt magnetic field regulation of dynamos, and it is used instead of the usual method of regulating the field as the load rises by means of

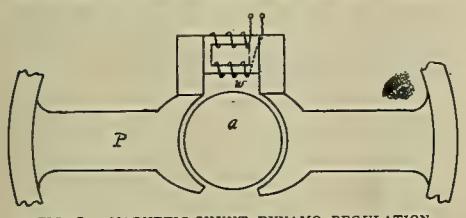


FIG. 1. MAGNETIC-SHUNT DYNAMO REGULATION.

a rheostat. It is found that when the iron of a magnetic circuit is submitted to a magnetic flux of alternating character superposed upon a continuous flux, the permeability of the iron is lowered, or the magnetic resistance is seemingly increased. This principle is used for regulating the field, as here shown, and the invention consists in the use of a magnetic shunt, which can be given an alternating magnetomotive force and which bridges the

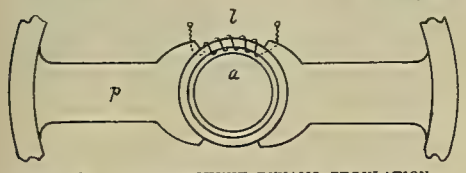


FIG. 2. MAGNETIC-SHUNT DYNAMO REGULATION.

field poles. The amount of the shunt is regulated at will by varying the current.

In Fig. 1 the pole pieces (P) are provided with extension blocks (K), between which is placed the magnetic shunt (l), this carrying a winding (w) traversed by an alternating current. Fig. 2 shows another arrangement, in which a laminated iron ring is mounted inside the field, the latter being bored out so as to receive it. Alternating current passes in the winding which the ring carries upon it. The passage of the alternating current through the winding placed on the shunt has the effect of lowering the number of lines of force going through the shunt, and therefore of increasing the number of lines which are cut by the conductors of the armature, this giving an increase in the electromotive force.

A number of methods can be naturally used in order to carry out the same idea, and any kind of laminated iron magnetic piece is employed, provided it forms a shunt between the pole pieces of the field, and that the winding is traversed by alternating or polyphase currents. The magnetic shunt can be used either with or without an air gap between them and the poles, and this air gap can be employed to give a regulation of the machine so as to satisfy the different working conditions. Multipolar generators can also be equipped in the same way.

In like manner, in an alternator the field magnets of the exciter or the main field magnets, or both of these, can be thus arranged with magnetic shunts, and the main alternating current of the machine can be passed in them, or a shunt circuit from the main line, either transformed in voltage or not. This has the effect that, as the load on the machine increases, the magnetic resistance of the field poles also increases and a greater number of lines of force pass through the armature. Thus, even with a low power factor, the voltage can be kept constant or even increased. It is found by the inventor in practice that where such a device is applied to the poles of an exciter, the inductive drop in the winding surrounding the magnetic shunt is very small, while the drop is considerable when the device is applied to the main field poles of the alternator.

Villard's Theory of the Aurora.[1]

By William R. Blair.

In his "Essai de Théorie de l'Aurore Boréale,"[2] M. P. Villard desires especially to account for the movements of the aurora and the various forms in which it appears. He assumes that the auroral light is due to the motion of cathode rays under

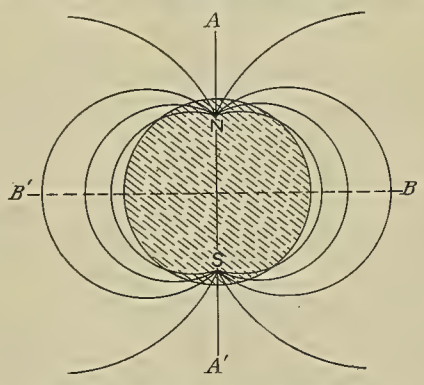


FIG. 1. THE EARTH'S MAGNETIC FIELD

the influence of the earth's magnetic field, and he argues that these rays are of terrestrial origin. The auroral arch, auroral draperies and dance of the rays, as usually defined, are the peculiarities to be explained.

The earth's magnetic field is conceived to be similar to that existing between the poles of a Ruhmkorff electromagnet (the coils being in line with each other). Using such a magnet and the theory, already developed, of how a cathode particle moves in a magnetic field, experiments were devised and carried out for the reproduction of the auroral phenomena on a small scale in an evacuated bulb. Electrodes were sealed in the bulb; the negative electrode was especially devised for projecting into the field of the magnet, in a suitable direction, a small bundle of cathode rays. Photographs of these reproductions were obtained.

The first three of the accompanying diagrams and their descriptions serve as a review of the

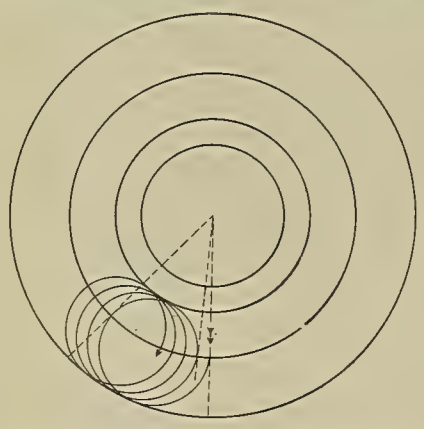


FIG. 2. PATH FOLLOWED BY A CATHODE PARTICLE.

effects of a magnetic field on the motion of projected cathode particles. The fourth serves as a basis for the explanation of the forms and movements of the aurora.

1. From the Monthly Weather Review, Weather Bureau, United States Government. The author is assistant physicist of the Bureau, and the contribution is dated January 18, 1907.

2. Annales de Chimie et de Physique, September, 1906.

Fig. 1 represents the earth's magnetic field. (A A') is the magnetic axis, (N) and (S) the poles. This field is such that the distribution of magnetic force in a plane through (B B') and perpendicular to (A A') is symmetric with respect to the point at which the plane cuts the axis.

Fig. 2 shows the path followed by a cathode particle projected vertically into the earth's field in this equatorial plane; i. e., at right angles to the line of force. The curve traced is an epitrochoid.

Fig. 3 illustrates the motion of an electron in a uniform magnetic field. Its path is a helix lying lengthwise in the direction of the field. In this case the electron entered the field in a direction other than at right angles to the lines of force.

The more general case in which the magnetic

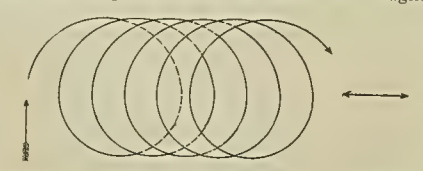


FIG. 3. MOTION OF AN ELECTRON IN A UNIFORM MAGNETIC FIELD.

field is not uniform, but, like that of the earth, has converging lines of force, cannot be readily represented by means of a diagram. It will be explained by the use of Figs. 2 and 3. The electron is projected into the magnetic field at an angle to the equatorial plane, and consequently its path is a combination of the helical and epitrochoidal paths with this additional feature. In the increasing field the successive spires of the helix, according to Villard, decrease in diameter and in forward velocity, this forward velocity becoming zero and then negative. With the increase in velocity in the negative direction the diameters of the spires increase. The electron is thus a prisoner of the magnetic field traveling back and forth between the poles but never reaching either one.

The zigzag path of a cloud of electrons, distorted to fit a plane surface, is shown in Fig. 4. Imagine this figure on the surface of a sphere. The lines marked north pole and south pole become points. The reinforced parts, due to the overlapping of the paths, occur along magnetic meridians and the turning points of these paths lie on magnetic parallels.

In the glass bulb in which the artificial aurora was produced it was found that where the paths

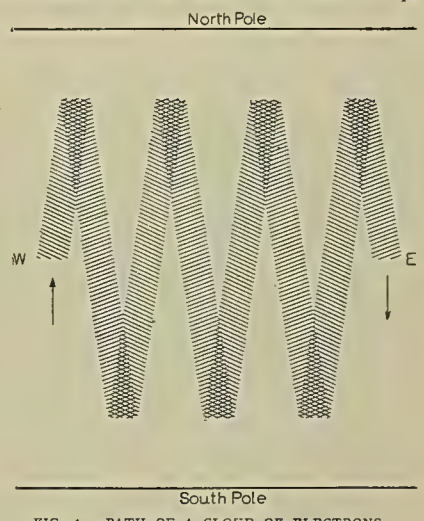


FIG. 4. PATH OF A CLOUD OF ELECTRONS.

overlapped the light was decidedly more intense. These regions correspond to the auroral rays, which are observed to be parallel to a free magnetic needle. Since these rays terminate on the same magnetic parallel, we have the auroral arch. If the distance between homologous points of two neighboring rays is greater than the width of a ray, we have the fan-shaped aurora; if less, the auroral drapery. The aurora in the north must always be accompanied by one in the south.

The general motion of a cloud of electrons is from west to east (consider Fig. 2). The rate of this easterly motion is, for a given magnetic field, a function of the intensity of the electric field, i. e., of the velocity of the electrons. Corresponding to variations of the electric field we shall have, consequently, the rotation of the aurora, to the west in an increasing field, to the east in a decreasing field. Since the distance from the poles of the turning points in the paths of the electrons is a function of the magnetic field strength, variations in this field will cause the north and south motions, the dancing of the rays. This motion will be away from the pole in an increasing field and toward it when the field is decreasing. The artificial dance of the rays was produced by bringing a small bar of iron near one of the poles of the Ruhmkorff magnet, thus causing variations in the field strength.

The chief argument for terrestrial as opposed

to solar origin of the cathode rays is the fact that auroras, at altitudes of some hundreds of kilometers from the earth, are sometimes seen as far south as the equator. Admitting that electrons can get away from the sun, those that reach the earth must approach and recede along the almost vertical magnetic lines in the immediate vicinity of the poles of the earth's field, producing an aurora which if visible at all in the lower latitudes would necessarily occur at very high altitudes. The supposed source of the electrons is a cloud under the influence of solar radiation. Other possible sources are mentioned. Since these can occur only on that side of the earth next to the sun, and since the comparatively feeble light of the aurora is not visible until after sunset, more and brighter auroras are seen just after dark than later in the night, the easterly auroral rays being always feebler than those toward the west.

The Engineering Societies Building in New York City.

As announced previously in the Western Electrician, the dedicatory exercises of the new Engineering Societies Building, 29-33 West Thirty-ninth Street, between Fifth and Sixth avenues, New York city, will be held on April 16th, 17th, 18th and 19th. The Western Electrician is pleased to be able to present to its readers this week a brief description of the building.

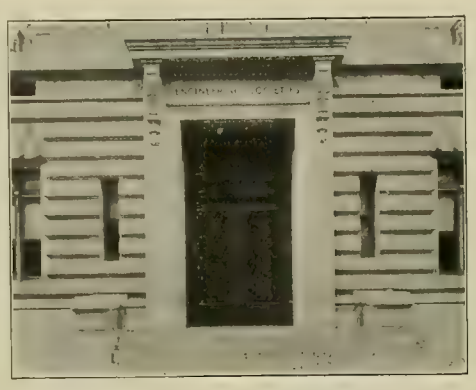
The edifice, which is 13½ stories high above the sidewalk, utilizes 115 feet of the 125 feet frontage and 90 feet of the 100 feet depth. It is a handsome structure of stone, steel and light-yellow brick and terra-cotta. More than $1,700,000, including the cost of land, has been expended in its erection, of which sum $1,050,000 was donated by Andrew Carnegie to cover the immediate cost of construction. The purchase price of the land amounted to $502,000, while the actual cost of equipment exceeded $150,000.

The building is the headquarters of the American Society of Mechanical Engineers, American Institute of Mining Engineers and American Institute of Electrical Engineers (the three "founder societies" to which Mr. Carnegie donated the building), as well as other technical organizations of an allied character, which are tenants. Among these are the National Electric Light Association, Association of Edison Illuminating Companies, American Street and Interurban Railway Association, Illuminating Engineering Society, Society of Heating and Ventilating Engineers, New York Electrical Society and others. Each of the three founder societies occupies a floor laid out in accordance with its own plans. The American Institute of Mining Engineers has the ninth floor, the American Institute of Electrical Engineers the tenth, and the American Society of Mechanical Engineers the eleventh. These floors are all devoted to administrative and executive work, and the libraries of the three societies have been concentrated in the two top floors of the building. The building also contains an auditorium (on the second floor) capable of seating 1,000 persons, two large assembly rooms, a number of small lecture halls, committee rooms, provisions for serving light refreshments, a museum, as well as the joint library, which has been mentioned.

The corner-stone was laid in the eastern wall by Mrs. Carnegie on May 8, 1906, the time for completion being fixed for November 15, 1906.

Building Construction, Heating, Ventilation.

The woodwork in the building has been reduced to a minimum. Many of the window frames are of cast-iron, and the others, of wood, are covered with kalamined iron. All the doors in the basement, first floor and at the ends of the auditorium promenade, are kalamined-iron fire doors. The windows up to a height of 100 feet (the building being 218 feet 6½ inches high) are glazed with wire glass except on the Thirty-ninth Street front. The insurance rate for the building is low—convincing proof of its safe construction and solid workmanship. As an extra precaution against fire an 8,000-gallon tank has been placed on the roof, with a standpipe at each end of the building, the tank being fed by two electric pumps. All the walls and ceilings are painted in neutral tints and the decoration is simple.



MAIN ENTRANCE TO THE ENGINEERING SOCIETIES BUILDING.

Steam is employed for heating and ventilating purposes, generated at low pressure by three boilers of the wrought-steel header type, of Babcock & Wilcox manufacture, having an aggregate of 5,226 square feet heating surface. The boilers, as well as the valves, piping and attachments in connection with the boiler plant, are designed and arranged for high-pressure steam.

The heating is accomplished by low-pressure steam circulating through radiators placed underneath the windows. Pure, fresh air in large quantities is supplied to all the rooms and the main corridors in the lower six floors by means of four electric-driven Sturtevant blowers, located in the basement. Air is exhausted from these floors and from the basement throughout the building, by means of four electric-driven Blackman exhaust fans, located in fan-houses on the roof. C. and C. electric motors are installed for driving the blowers and exhaust fans.

A VIEW IN THE JOINT LIBRARY IN THE ENGINEERING SOCIETIES BUILDING.

Electric Service.

As in the case of the other departments of the building, the electrical equipment and the illumination had to fulfill unusual and peculiar requirements, owing to the special purpose for which the building is to be used. The electrical current supply is derived from an outside street-main service introduced into the building from the New York Edison Company and the United Electric Light and Power Company, so that both alternating and direct current are available. Space has been provided, and the steam and electric equipment have been designed, so that an electric generating plant may be installed at any time.

The feeders and mains for the lighting system are arranged on the three-wire system, and the two-wire system for power. In all cases, all of the wires of a given circuit are installed in the same conduit, so as to permit alternating current to be used on any circuit. The feeder system is arranged so as to provide means for measuring the current consumption separately in different portions of the building. For this reason the feeders are subdivided and the switchboard designed to have meters on each feeder, so as to permit making proper charges for electric current for each floor, separate feeders being provided for the entrance halls and corridors.

Two separate feeders from the New York Edison Company have been introduced, so as to afford additional security in case of failure of one of the service mains. Two separate feeders are provided for the lighting of the main auditorium, connecting at the switchboard with the two independent service street feeders, thereby providing duplicate and independent lighting service for the main auditorium, so as to preclude, as far as possible, the liability of interruption of the lighting service of the auditorium.

By means of the two hall feeders, it is possible to light one-third, two-thirds or all of the hall and corridor lights from the switchboard in the basement. In addition, further control is provided by means of switches located in a main cabinet at the first floor, and by local switches at the various cabinets on the upper floors. This flexible and convenient system provides abundant opportunity for reducing to a minimum the current consumption required for the hall and corridor lighting.

A control switchboard has been provided for the auditorium, in the passageway back of the stage. At this point the feeders terminate, and all of the circuits for the auditorium originate and are controlled. At the upper part of the switchboard, dimmers are provided for the control of the auditorium lighting. At this point also the special feeders and empty conduits for demonstration purposes terminate. Special outlets have been provided on the stage for musicians' lamps, table lamps, etc. Stage pockets are located in the center of the balcony and in the floor of the center aisle of the main floor, for stereopticon or similar purposes. Cut-out panels have been provided in each of the assembly and lecture rooms at the fifth and sixth floors, so as to provide convenient control of the lights in each room. Special feeders and empty conduits have been provided for demonstration purposes in all of these rooms.

A circuit is run to a corner in the ceiling in each room, and from this point a square of molding is placed 18 inches from the wall and symmetrically aligning with the room parallelogram. At any point on this molding a small rosette may be inserted and an attachment for a drop light provided.

In order to provide ample current facilities for demonstration purposes, lectures, etc., special feeders have been run from the switchboard in the basement to the auditorium and to each of the assembly and lecture rooms. These feeders consist of six conductors of No. 0 B. & S. gauge, installed in 2½-inch conduits. These feeders terminate at special panels in each case, each conductor connecting with a single-pole knife switch and a lug to which connections may be made for extending to the lecture-room table, machine or appliance, as the case may be. The connections of these feeders at the main switchboard in the basement are such that any desired arrangement of combination of the conductors may be made and, if desired, connections for either direct current or alternating current, single phase, two-phase, three-phase, may be quickly and

conveniently made. The Western Electric Company executed the electrical construction.

ILLUMINATION.

Complete specifications were prepared and sketches made by the consulting engineers, acting in co-operation with the architect, for the illumination of every room and for every fixture in the building. It was realized by the engineers that the illumination was necessarily only one feature of the building and must be subordinate to and in harmony with the architectural features.

The central space in the entrance hall or foyer is lighted by means of individual lamps placed in recesses and concealed by panes of ground glass in the ceiling at the sides of the rectangle formed by the columns around the large central area. In addition to this, larger crystal balls are provided in the outer corridor beyond the central space and in the elevator hall, entrances, etc. The effect of the individual lights in the recess, screened by glass, is to afford ample illumination without any glare.

Crystal glass balls holding metallized filament lamps of various sizes from 50 to 250 watts are used on the principal floors, from the first to fourth, inclusive. In some cases pagoda reflectors are used inside the balls to increase the effective illumination and to reduce the current consumption. In other instances, however, in order to subdivide the number of lights in the hall fixtures, several lamps have been placed inside the crystal balls. In all such instances the metal plate at the top of the fixture supporting the sockets has been silvered to act as a reflector and to increase the efficiency as far as possible. In the halls above the fourth floor glass globes have been provided to screen the lamps. These globes, made according to the specifications of the electrical engineers, are unusual in the fact that the intrinsic brilliancy of the lamp is reduced without an excessive loss in the efficiency, and at the same time a warm, pleasing opal glow is produced.

NEW ENGINEERING SOCIETIES BUILDING IN NEW YORK CITY.

The lighting of the auditorium is the most effective and probably the most interesting feature of illumination in the building. The result was obtained by the complete co-operation of the electrical engineers with the architects. At the engineers' suggestion the architects provided a space of about 15 inches between the ceiling of the auditorium and the beams of the floor above. At the suggestion of the engineers also a glass septum was substituted in place of the proposed plaster panels in the ceiling. The details were then carefully worked out as to obtaining access to the lamps for renewal and tests were made by the engineers to find a glass that would reduce the intrinsic brilliancy or glare and at the same time would not have an amount of absorption prohibitive on the score of economy. The result obtained has been very satisfactory, and it is possible to sit through an entire lecture without being disturbed or distracted by the lighting. The general effect is both soft and pleasing, and resembles or suggests sunlight passing through glass.

MAIN AUDITORIUM IN ENGINEERING SOCIETIES BUILDING.

As a matter of fact the solid arches of the floor above are within two or three feet of the glass through which the light passes. Additional lighting screened by the same kind of glass is provided at the rear and at the sides under the balcony. Dimmers are provided for reducing the amount of illumination in the auditorium to any desired point, and also for the purpose of gradually increasing the lights to the maximum after the room has been darkened for a stereopticon, thereby avoiding the unpleasant sensation produced on the retina of the eye by flooding the room with light immediately following comparative darkness.

The lighting of the assembly and lecture rooms was also designed to prevent the lights from being distracting or unduly noticeable. For this reason the cove method was adopted, with additional outlets in the ceiling for supplemental fixture lighting. The difficulties of the building construction did not admit in all cases of obtaining continuous coves nor coves of the exact form and dimensions desired. While the cost of lighting by this method is in excess of that using exposed lamps, the fact that the rooms are not in continuous use, but occasionally, for lecture purposes, offsets this objection.

The general illumination of the library is obtained by means of lamps placed above the glass ceiling skylight on a plan similar to that used in the auditorium, the glass in the ceiling skylights being of the same kind as that used in the auditorium ceiling. In addition, ceiling outlets are provided for general illumination, so that the indirect lighting above the glass need be used only at certain times. The light for reading is obtained by means of standard fixtures placed upon the tables. The general effect is charming and agreeable. The specifications and plans for the electrical equipment, the illumination, electric fixtures, etc., were prepared by Messrs. C. O. Mailloux and C. E. Knox.

OTHER FEATURES.

The telephone system comprises a specially designed single-position switchboard connected to the Bryant central office of the New York Telephone Company by means of seven lines. The switchboard has an ultimate capacity of 15 central office lines and 60 extension lines.

The elevator shaft for passenger travel occupies the middle part of the western wall of the building. There are two Otis passenger elevators of the latest type electric drum machines, being equipped with double screws, compound momentum brakes, automatic stop-motion switches mounted on the drum shafts and energy brakes. Both elevators are designed to travel at a speed of 325 feet per minute with a load of 2,500 pounds.

The building will be formally dedicated on April 16th, the exercises beginning at 3 p. m. Mr. Charles Wallace Hunt will preside. Edward Everett Hale, chaplain of the United States Senate, will offer prayer and there will be communications from the president of the United States and other dignitaries. Charles F. Scott of Pittsburg will deliver a historical address and E. E. Olcott will formally accept the building. Andrew Carnegie, the donor, will make an address, to be followed by an oration by President Hadley of Yale on "The Professional Ideals of the Twentieth Century."

In the evening there will be a reception.

On April 17th, commencing at 2:30 p. m., there will be an introductory address by J. W. Lieb, Jr., followed by addresses by Dr. Samuel Sheldon, Dr. F. R. Hutton, Dr. John Hays Hammond and Dr. James Douglas. The John Fritz medal will be presented to Alexander Graham Bell. There will also be presentation of medals for distinguished services to Mr. K. W. Pope, secretary of the American Institute of Electrical Engineers; Dr. F. R. Hutton, past secretary of the American Society of Mechanical Engineers; Dr. Rossiter W. Raymond, secretary of the American Institute of Mining Engineers.

Cable-boring Insects Have no Fondness for Lead

The lead-boring insect found recently to be the cause of many punctures in the lead sheath of electric wire cables at the Union Stock Yards in Chicago has been examined by Dr. W. J. Gerhard, curator of the division of entomology at the Field Museum. According to a statement concerning these larvæ printed in the Valve World of the Crane Company and furnished at the request of the editor, Dr. Gerhard finds that the insect larva has no desire to feed upon the lead nor the insulation within, but the borings are simply in the process of finding a safe retreat. Following is the statement of Dr. Gerhard:

"The insect larva with an apparent lead-eating tendency [illustrated and described in the Western Electrician of February 23d] is the immature form of the beetle *Dermestes vulpinus*, belonging to the family *Dermestidæ*. All the members of this family, with a few exceptions, feed upon dead animal matter. It is, therefore, not strange that some of these beetles are quite common in the stock yards. A dark, well-heated and partially filled hoof-room naturally would be an ideal place for them.

"*D. vulpinus*, when about to pupate, bores into wood quite freely, not because it feeds upon the wood itself, but merely to make or find a safe retreat in which it can pass its more or less helpless pupal stage. It was in this way that the lead insulation around the wires was damaged. Obviously, a similar injury would occur only under like favorable conditions. Whenever lead insulation is used in a room which contains an abundance of dead animal matter, the larva of this beetle may cause some trouble, but otherwise lead will not be attacked."

The Cincinnati Gas and Electric Light Company, through the lessee, the Union Gas and Electric Company, has acquired an extensive tract of land on which a large new power plant will be erected, which will cost, it is said, about $1,500,000.

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DATES AHEAD.

Iowa Electrical Association (annual meeting), Lafayette Inn, Clinton, Iowa, April 18th and 19th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

Exposition of alcohol gas and electricity, Lincoln Auditorium, Lincoln, Neb., April 22d to 27th. Given by the Lincoln Gas and Electric Light Company.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4-7, 1907.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

EASILY SECOND among the electric-railway organizations of the country, the Central Electric Railway Association of Ohio and Indiana—two states whose interurban railways are closely connected—occupies a prominent and useful place. It holds frequent meetings, the latest being at Dayton last week, as reported in this issue, and it discusses timely, practical topics. Track bonding, car wheels, trolley wheels and other subjects were treated in papers presented at the Dayton meeting, and the discussion was helpful. But the association does not limit itself to technical matters, for its members are confronted by many problems of administration and policy growing out of the present transition stage of the interurban railway, and mutual co-operation is in every way advantageous.

AFTER lo these many years—after discussion and debate, wrangling and political intrigue, theorizing and experiment, legislation and litigation—a settlement has been reached at last in relation to the street-railway-franchise question in Chicago. Let the bells of joy be sounded and the Te Deum chanted in the churches, for 10 years of miserable street-railway service and rancorous contention has heartily tired everybody concerned, which means the people of Chicago. On April 2d the electors voted for the pending ordinances by a decisive majority, and 20-year franchises will now be granted to the companies, with the provisions for profit-sharing, possible purchase by the municipality, municipal control and other features already explained in the Western Electrician. Municipal ownership is defeated, at least for the present, which is a gratifying outcome of the affair. But it must be admitted that better terms have been wrung from the companies than could have been obtained without the tedious controversy through which Chicago has passed, which will long stand as an instructive chapter in municipal history.

TELEGRAPH tolls have been increased, apparently, although it seems rather difficult to get any exact, official information on the subject. Colonel Clowry, president of the Western Union, denies that there has been any general increase in rates and says that most of the rates increased were 25-cent 10-word rates. Labor and material have risen in price, and it is unprofitable, Colonel Clowry says, to handle telegraph messages at 25 cents each. It is believed that the Postal company has raised some of its rates also, for the two companies compete in service, not in price, and, assuming that that is the case, the newspapers raise a rather interesting question. It is whether an apparently concerted increase in telegraph tolls is a violation of the Sherman anti-trust law as being in restraint of trade. Is the transmission of telegraph messages "trade"? Possibly it is in a legal sense, and if so the concerted raising of rates may be in restraint of trade. But there is much doubt on the point, and in any event it is difficult to see how the courts could compel the companies to do business at a loss, unless, indeed, it is argued that the business as a whole is profitable and that some branches of it may be conducted at a loss on broad grounds of public policy.

FOULING by anchors of vessels is the source of considerable loss to companies owning submarine-telegraph cables. A case came up in the High Court of Justice in London recently where a rather unusual aspect of this difficulty was exhibited. The owners of the steamship Agincourt sued the Eastern Extension, Australasia and China Telegraph Company and the Great Northern Telegraph Company for compensation for the sacrifice of the ship's anchor in order to avoid damaging cables belonging to the two companies. The submarine cables in question are in the bed of the River Yangste Kiang, in the neighborhood of Woosung, in China. With a view to preserving these telegraph cables from injury in the event of their being fouled by vessels, the cable companies in August, 1902, issued a notice promising to compensate owners of ships who would be able to prove that they had sacrificed their anchors in order to avoid injuring the cables. In September, 1905, owing to indications of a typhoon, the Agincourt weighed anchor, which was found to be foul of one of these cables. Relying on the defendants' notice, the master of the Agincourt sacrificed his anchors and incurred other loss. The cable companies alleged that they distributed charts showing the position of the cables, but did not indicate the position by means of buoys or lights. Mr. Justice Bray gave judgment for the plaintiff. Evidently the submarine-cable companies, like everybody else, must stick to their business promises. But the existence of such an undertaking shows the solicitude with which these ooze-embedded strands of copper are regarded.

FREIGHT CLASSIFICATION of electrical apparatus has always been a sore subject with makers and buyers of electrical machinery and appliances. It is charged, and with good reason, that the railroad freight-carrying rates on this class of merchandise are excessive, disproportionate and inequitable, in many instances, when compared with the rates on articles in other lines of business which are fairly comparable. The electrical men want to know why this apparent discrimination exists, but have met with no great success in their search for enlightenment. When they ask why, for instance, dry batteries should be in the first class in the Official and Southern territories and in the second class in the Western territory, they are put off with polite evasions. Why should there not be a universal classification for the whole United States? Why should not the shippers of electrical apparatus get as low rates as anyone else shipping goods having the same characteristics as to weight, bulk and care in handling? Surely a dynamo or a transformer or a coil of wire is not "deadly" in transit. There can be no daily-newspaper story of horror in this aspect of the electrical business, which is now being considered.

The subject is one of considerable importance, as is shown by the existence of the National Electric Light Association's committee on freight classification, of which a former president, Mr. Ernest H. Davis, is chairman. This committee is now seeking data on the subject by means of a circular letter asking a number of questions, and it is to be hoped that members of the association, and indeed others who may be interested, will do their part to secure a needed reform by answering the questions and otherwise co-operating with the committee.

BUYING COAL for power plants should be put on a more scientific basis than is now the case with the majority of electric-light plants. The consumer wants the coal for its heat value; usually he pays for it by weight alone, with some stipulation as to kind, size, location of mine, etc., but not one word about the actual heat units. The United States government has now, largely through the efforts of Mr. J. E. Woodwell, inspector of electric-light plants for the Treasury Department, adopted a standard specification for the purchase of coal for public buildings. By this plan the contractor agrees to deliver coal having a certain number of British thermal units, which he specifies in writing, and also a certain percentage of ash. He agrees to accept a certain price per ton, to be affected, however, by periodical tests, as the coal is delivered, to show the heat units actually given by the coal and also its content of ash. If, within a reasonable margin, the coal does not come up to the basis established in the contractor's proposal, a certain amount is deducted for each ton in the shipment, according to a predetermined scale. Preferably the sample (not less than 100 pounds, but reduced to a small quantity, for test) is taken at the time of delivery. Other details of the method are carefully provided in the specification, a condensation of which is given on another page in this issue.

Of course the small central station cannot hope to introduce the elaborate testing system of the United States government. Nevertheless, the plant manager may do much to improve present methods to help him to get his money's worth in heat value. Calorimeters are to be had, and it is not difficult to procure chemical analyses. In several states the state universities will gladly test samples of coal for a small fee, covering merely the actual expense involved.

Underwriters' National Electric Association.

The fifteenth annual meeting of the Underwriters' National Electric Association (electrical committee), which was held in the rooms of the New York Board of Underwriters March 27th and 28th, was perhaps the most important in the history of that important body. There were over 200 present, representing manufacturers, insurance men and others interested in the National Electrical Code. The subjects presented for consideration covered almost every conceivable phase of electrical construction and maintenance. The attendance was in every respect representative of the most advanced ideas, both from the manufacturer's and the underwriter's point of view.

The greatest latitude was given to the full discussion of every one of the 200 or more subjects scheduled for action, and when the time for adjournment arrived every member felt that nothing had been left undone to make the rules for 1907 as nearly perfect as could be devised.

The session opened with the consideration of the reports of the various committees.

The following recommendations were adopted as reported, with some minor changes: Rules for signaling system; slow-burning weather-proof wire; wiring and equipment of street-railway property, including rolling stock; double and single-pole switches; variable-speed motors; theater wiring; series lamps; insulating joints; metal moldings; laboratory reports on condulets, and omitting fuses in neutral of three-wire systems.

The report of the committee on construction and installation of rheostats recommended as an amendment to Rule 60, Section A (National Electrical Code), that "Rheostats used in dusty or linty places or where exposed to flying of combustible material must be so constructed that even if the resistive conductor be fused by excessive current the arc of any attendant flame will be quickly and safely extinguished," and that "Rheostats must have the resistance so enclosed and supported that even upon a burn-out there shall be no smoke, smell, flames or spilling of hot metal." Also, in Rule 60, E, it was recommended that "The current-breaking contacts be so constructed as to 'break' with a quick snap independently of the slowness of the movement of the operator's hand, or that a magnetic blow-out or equivalent device be used."

These recommendations evoked an animated discussion, in which many of the prominent manufacturers participated, arguing the impossibility of regulating the location of the rheostat to constantly changing conditions of what might at one time be termed "dusty or linty places," or otherwise.

In the matter of the "enclosure and support of resistance," etc., much diversity of opinion was developed as to the advantages or disadvantages of enclosed or open resistance boxes, during which the merits of the different forms of construction were stoutly contested by their respective advocates. After a long discussion this amendment was adopted with some changes and then laid upon the table to allow for the consideration of one or two minor points on the next day.

The report of the committee on Electric Signs was promulgated as a rule, but the matter was not considered far enough advanced for its adoption as a standard.

The convention then took up the consideration of other suggested changes in rules, and during the afternoon made rapid progress. It passed upon about half of those submitted, but favorable action was only taken on about one-quarter of them.

On the resumption of business the following morning the matter of changes in the rules was again taken up and for some time good progress was made, about one-quarter of the proposed changes being rapidly accepted as proposed, or with unimportant amendments and little discussion, until the association reached Rule 24, Section E, to amend as follows: "Wires must be protected on side walls from mechanical injury when crossing floor timbers. Where they may be exposed to injury they must be installed in approved conduits." This amendment evoked prolonged discussion as to its being prohibitive to ordinary molding or to exposed work, and was finally laid over.

Amendment to Rule 24, E, reading: "In frame buildings where the work is not exposed to moisture and the system has a difference of potential exceeding 300 volts, approved flexible tubing may be used as a complete tubing system," with certain restrictions, was discussed at length and finally referred to a special committee to report in time for insertion in the 1907 Bulletin. After the amendments had been disposed of, "Miscellaneous Suggestions" were taken up. A few of the suggestions were adopted, but the majority were referred to the different committees for investigation.

A committee for the recodification of the Code for 1907 was appointed. A vote of thanks to the presiding officer and secretary and to the Board of Underwriters for the courtesies extended to the association was taken, and the meeting adjourned.

Street-railway Franchise Ordinances Approved at Chicago Election.

The proposed ordinances granting the two large surface street-railway companies of Chicago 20-year franchises, under conditions with which readers of the Western Electrician are familiar, were approved by the voters of Chicago at the election on April 2d by the large majority of 33,126. The vote was 298,566, divided as follows: For, 166,846; against, 132,720.

Mayor Edward F. Dunne, who two years ago was elected on an "immediate municipal-ownership" platform by a plurality of 24,518, was defeated for re-election by a plurality of 13,016. Mr. Dunne's campaign platform opposed the ordinances and favored condemnation proceedings as a means of securing municipal ownership of the street railways. The successful candidate for the mayoralty is Fred A. Busse.

The franchises provided by the ordinances which were the campaign issue are for 20 years. The ordinances were passed by the City Council on February 4th by a vote of 56 to 13. They were vetoed by Mayor Dunne on February 11th, and passed over the veto by a vote of 57 to 12. The ordinances were to be effective April 1st if approved by the voters. They provide for immediate reconstruction of the street-railway properties and improvement of the service. A board of engineers is to have charge of reconstruction and rerouting. The net earnings are to be divided—55 per cent. to the city and 45 per cent. to the companies. The city has the power to buy the lines whenever it sees its way clear to do so by paying the appraised value of $50,000,000 for the properties, plus the amount expended on additions, reconstruction and improvement between the time the ordinances went into effect and the time of purchase.

Death of H. W. Goode.

The death of Mr. Harry W. Goode at Atlantic City, N. J., on the morning of March 31st, will cause regret to many electrical men throughout the country. The Pacific Northwest, also, loses one of its most prominent citizens.

Mr. Goode, who made his home in Portland, Ore., was originally a district manager for the Westinghouse Electric and Manufacturing Company, and subsequently became manager of the Northwest General Electric Company at St. Paul. Upon the formation in 1892 of the Portland General Electric Company, which has developed large waterpowers near Portland, Mr. Goode became general manager of that company, and at the time of his death had been for several years president of this company, as well as of the Portland Railroad, Light and Power Company.

He was president and director general of the Lewis and Clark exposition in 1905, and enjoyed the almost unique record of having carried through this extensive exposition at a financial profit. The deceased was in his forty-sixth year, and had been prominently connected with electric, traction and waterpower interests since his boyhood.

While a disciplinarian and thorough business man, he was possessed of considerable personal magnetism and was exceptionally popular. He is survived by a widow and two children. W. H. Fairclough, Sr., of the Chicago Edison Company, is the decedent's father-in-law. Interment took place in Chicago.

New York Central Officials Indicted.

In returning indictments on March 27th against the New York Central Railroad, General Superintendent Ira A. McCormack and Vice-president Alfred H. Smith, charging manslaughter in the second degree for the wreck of the electric suburban express train on February 16th, the Grand Jury of New York County handed up a presentment containing many recommendations to the state railroad commissioners concerning restrictions upon railroad operation in that state.

The Grand Jury holds that the wreck was due to the high speed of the train, which was estimated by some of the witnesses at 75 miles an hour. The Grand Jury declares that the railroad company "feloniously, wilfully and carelessly, with gross culpable negligence and misconduct," omitted to ascertain at what speed it was safe for the electric train to pass around the curve. It charges, also, that the company omitted to exercise any effective measures to prevent the train passing around the curve at a speed faster than was safe, and that it placed the train under the control of a motorman not properly trained and experienced and not competent to run the train with safety.

Messrs. McCormack and Smith entered pleas of not guilty and were released on $10,000 bail each.

Direct-current Power Transmission.

London, March 22.—The discussion at the Institution of Electrical Engineers upon the possibilities and probabilities of the high-tension direct-current system for power transmission has ended, and for the present leading men have committed themselves to little, probably with due regard to the future.

Two things stand out in connection with the discussion. It has brought before the world in a most prominent manner the genius of Mr. Thury and it has demonstrated, as Mr. Highfield said, the "magnificent constancy of purpose" displayed by Lord Kelvin, who was present during the whole of the debate, which extended over two evenings. At such an advanced age as Lord Kelvin's, who is in his eighty-third year, such an effort certainly did set an example which might well be copied, as was pointed out in the discussion.

No one asked the question as to whether Mr. Highfield intends to adopt the system in his London power area, but as he evidently does not anticipate being ready for two or three years, perhaps it is unfair to expect him to express an opinion at such a comparatively early date. One can only hope that the strong advice given to British manufacturers to devote their attention to developing this class of plant and cables will not pass unheeded. Mr. Highfield has had to prepare his estimates without any guide whatever, for, to quote his own words, British firms did not know themselves what to charge for high-tension direct-current plants. G.

Electrical Exports for February.

Electrical exports from the United States in the month of February, 1907, amounted to $1,161,527, not quite as much as in February, 1906, when the amount was $1,191,438. Goods classified as electrical appliances, including telegraph and telephone instruments, show a gain for February as compared with the corresponding month last year. Electrical machinery, however, shows a decline. The figures are: Electrical appliances—February, 1906, $544,906; February, 1907, $599,855. Electrical machinery—February, 1906, $646,532; February, 1907, $561,672.

The following countries were the principal buyers of electrical appliances and machinery from the United States in the month of February, the amounts given representing the total value of the exports to each country: British North America, $189,678; Mexico, $182,766; United Kingdom, $117,700; Japan, $113,947; Brazil, $81,655; France, $48,139; Cuba, $36,845; Germany, $36,013; British Australasia, $35,868; Central American States and British Honduras, $28,067; British East Indies, $25,687; Argentina, $21,108; British Africa, $19,983; Belgium, $9,357; Philippine Islands, $8,682; Hongkong, $2,338; European countries not elsewhere mentioned, $73,255; South American states not elsewhere mentioned, $118,816; West Indies and Bermuda not elsewhere mentioned, $7,548.

New Officers for the Institute.

At the regular monthly meeting of the American Institute of Electrical Engineers in New York city on March 29th Secretary Pope said that at the meeting of the board of directors held in the afternoon 139 associates were elected, and Prof. Alexander S. Langsdorf of St. Louis and Leslie Lawrence Perry of New York were transferred from associate to the grade of member.

Mr. Pope also announced that at the meeting of the board the following-named nominees were selected as directors' nominees for the coming annual election:

President—Henry G. Stott, New York.

Vice-presidents—L. A. Ferguson, Chicago; W. C. L. Eglin, Philadelphia; James G. White, New York.

Managers—Percy H. Thomas, New York; B. G. Lamme, Pittsburg; H. W. Buck, New York; Morgan Brooks, Urbana, Ill.

Treasurer—George A. Hamilton, New York.

Secretary—Ralph W. Pope, New York.

Mr. Stott, who has been nominated for the presidency, is superintendent of motive power of the Interborough Rapid Transit Company of New York city.

A United States patent has been granted to Arthur B. Goodspeed and Bernhard Beskow of New York city on a method of generating power. The patent, No. 848,026, covers a method which consists in generating steam and charging air with aqueous vapor. The air is heated with waste heat from the furnace of the generator, and the charged air is delivered into the steam generator to be mingled with the steam.

Lightning and Lightning Arresters.

At a meeting of the American Institute of Electrical Engineers on March 29th in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York city, the following papers were presented: "Lightning Phenomena in Electric Circuits," by Prof. Charles P. Steinmetz, Schenectady; "Protection Against Lightning, and the Multi-gap Lightning Arrester," by D. B. Rushmore, Schenectady, and D. Dubois, Schenectady; "New Principles in the Design of Lightning Arresters," by Prof. E. E. F. Creighton, Union University.

Lightning Phenomena in Electric Circuits.

BY C. P. STEINMETZ.

[Following is a condensation of Professor Steinmetz's paper, the author having treated the subject under three headings, "Electric Charge," "Impulse and Traveling Wave," and "Standing Waves, Oscillations and Surges."]

In its most general meaning, as understood now when dealing with electric circuits and their protection, lightning denotes all phenomena of abnormal voltage and abnormal frequency. The lightning phenomena in electric circuits comprise: External lightning, the disturbances due to atmospheric electricity; internal lightning, the disturbances due to defects of the circuit or its operation, etc.; surges, that is, disturbances in the flow of generated power, brought about by the external or internal lightning and depending for their energy on the power of the generator system, hence frequently destructive.

The potential difference against ground, or pressure of the total electric circuit, may gradually rise by an electric charge accumulating in the circuit. The electric charge discharges across the lightning arresters, or punctures the insulation, whichever is the point of least resistance.

Some causes of such steady and gradual accumulation of electric charge and of potential difference against ground, of an electric circuit, are: (a) Collection of static charge from rain, or snow-drift, or from fog, carried by the wind across the line, when the electrostatic accumulation of charge, in the case of efficient lightning protection, may appear as a series of discharges over the lightning arresters, which periodically follow each other; (b) electrostatic induction from a passing cloud; (c) potential differences between line and ground, due to differences of atmospheric potential in different regions traversed by the line, especially if the line passes through different altitudes, as valleys and mountain ranges; (d) accidental electrostatic charges entering the circuit, as friction electricity from the belt of belt-driven machines; (e) unsymmetrical conditions of the generator potential; (f) existence of higher harmonics in the electromotive-force wave of a polyphase system, of such order that they coincide in the different phases, that is, the whole system rises and falls with their frequency; so in a three-phase system, the third, ninth, fifteenth, etc., harmonics coincide and may cause trouble, where they appear, as, for instance, by star connection or primaries and secondaries of transformers with grounded neutral.

The danger of such accumulations of potential lies in their liability to damage the insulation of the system by puncture, and in their liability of producing, by their discharge, other and more serious disturbances. In taking care of them by lightning arresters arranged to discharge at a safe margin of voltage above the normal, the main problem is to arrange the discharge path so that the discharge passes harmlessly, that is, without producing other disturbances. It is the same problem as in the protection of a waterpower station against freshets by dam and overflow, safely to discharge the water by means of the overflow.

The effects of steady electrostatic stress, whether unidirectional or alternating, appear not only in its own circuit, but also in circuits in inductive relation thereto, and may even be more serious in secondary circuits.

In connection with the impulse or traveling wave, a sudden local electrostatic charge of a transmission line, as by a lightning stroke, or inductively by a lightning flash suddenly discharging a cloud or any other sudden local change, produces a wave of potential and of current which runs along the line, just as a water wave over the ocean surface. Such a potential wave or impulse is very high and of steep wave front at its starting point or point of impact, but gradually broadens and flattens out, and ultimately disappears, if the line is of unlimited length, just as the wave produced, for instance, by throwing a stone into a body of water, is steepest at the point of impact and gradually flattens out and disappears.

When reaching the station—generating or substation—such a traveling wave is partly reflected by inductance of reactive coils, transformers, instruments, etc., partly transmitted. The different reflected and transmitted waves superpose upon each other, that is, the impulse is broken up into a number of secondary impulses and local standing waves, which may reach voltages far higher than that of the traveling wave, just as an ocean wave when approaching the beach is broken up into the surf, with wave crests far exceeding in height that of the unbroken wave. The complex system of phenomena resulting from the approach of a traveling wave to a station is analogous to the breaking up of an ocean wave into surf, and may indeed be called "electrical surf." While individual effects, as the formation of high-frequency standing waves or oscillations from an electrostatic impulse entering a circuit of inductance and capacity, the effect of an inductance in the path of an impulse, the phenomena occurring at a branching point between two circuits, etc., can be calculated, the complete predetermination of all the electrostatic and electromagnetic effects of an electric wave entering the complex system of circuits of a station is no more feasible than the exact calculation of the motion of the water particles of an ocean wave when it breaks as surf at the beach.

The breaking up of an impulse or a series of impulses or traveling waves, in entering a station, appears as electrostatic displays, sparks, streamers and brush discharges, at conductors, switchboards, etc., the so-called "static," which signals in the station the existence of a disturbance on the line.

Some of the causes of traveling waves are: (1) Direct or secondary lightning strokes entering the transmission line, usually giving a single impulse, or very few impulses, of extreme steepness of wave front, but short extent, and capable of exerting very considerable power only locally, but not after traveling considerable distance, that is, a direct lightning stroke may shatter several poles, but do no damage to the station, if not very near to it; (2) electrostatic induction by the clouds; (3) discharges of slowly accumulated potential, resulting in a series of successive impulses; (4) any spark discharge from the line to another line or to the ground; (5) an arcing ground on one phase of an insulated system, or, in general, the existence of a "self-rupturing arc" in the system; (6) sudden changes of load, connection and disconnection of apparatus, etc., as when connecting a dead transformer to the system an impulse traverses the transformer, and usually penetrates beyond the transformer into the circuit.

An oscillation of a transmission line is a complex wave, containing fundamental and higher harmonics. The relative proportions of the different harmonics in the oscillating wave depend upon the distribution of potential and of current at the moment of the start of the oscillation. If the distribution of potential and of current at the start of the oscillation were perfectly sinusoidal, only the fundamental wave would appear. The more irregular the distribution is, the more prominent are the higher harmonics; with a very irregular and abrupt distribution, the fundamental wave does not appear at all, but only higher harmonics.

Standing waves or oscillations in electric circuits vary from the very low frequency of the fundamental surge of very long transmission lines, which approaches commercial alternating-current frequencies, to frequencies of several hundred million cycles per second, in the discharge oscillation between the cylinders of a multi-gap lightning arrester. Due to this enormous range of frequency, the physical effect of the oscillation also varies greatly. In very high-frequency oscillations the power is very small; the electrostatic effects, as luminous glow, brush discharge, streamers and sparks, are prominent, but the direct damage usually insignificant, and the effect local. Inductance opposes a fairly effective barrier. On the other extreme, low-frequency surges show little or no luminous display; inductance offers no obstruction, but, due to their high power and wide extent, considerable damage may be done all over the system. Oscillations, therefore, are frequently subdivided into high-frequency oscillations, in which the lower harmonics are absent, and low-frequency oscillations, in which the fundamental predominates. The name surge is frequently applied to denote the latter.

The problem of lightning protection is threefold: (1) Prophylactic; to guard against the entrance or origin of disturbances; (2) restrictive, to guard against a disturbance leading to other disturbances; (3) curative; to discharge a disturbance harmlessly. The problem is a vast one, and comprises nearly every part of design, installation and operation of the system.

Protection Against Lightning, and the Multi-gap Lightning Arrester.

BY D. B. RUSHMORE AND D. DUBOIS.

[In the following condensation of this paper the term "lighting" is used in its comprehensive sense to include all phenomena of abnormal voltage and abnormal frequency.]

In considering lightning protection, the first step is naturally to study the apparatus to be protected, then the forces to which it will be subjected, and finally the protecting apparatus. For apparatus to be protected, we have insulators, transformers, switches and generators. The usual specification for high-tension transformers is that they shall stand from line to core twice the normal line voltage, independently of whether the transformers are "Y" or delta connected. Switches are made to stand 2½ times normal line voltage, and insulators should stand three times the line voltage dry, and 1½ times the line voltage with a precipitation of one-fourth inch per minute at 45 degrees. The allowable rise of potential on the line is therefore less than 100 per cent., and about 60 per cent. of line voltage seems a desirable point at which the protective apparatus should operate. Protecting apparatus consists briefly of lightning arresters, horn arresters, static discharges, choke coils and ground wires. Here lightning arresters are defined as apparatus that can relieve the line of high voltage without disturbing operating conditions.

From the standpoint of protection of the system from static disturbances, whether external or internal, the grounded star transformer connections with overhead ground wire offer the best conditions, and are in general recommended where other conditions do not decide. The causes of most frequent disturbances on transmission systems are short-circuits and grounds. As regards short-circuits between wires, there is but little to choose between the star and delta connections, but as regards grounds, and especially partial grounds, the grounded star system affords a great advantage in the reduced possibility of a disastrous increase in voltage. When a ground is formed on one line of a high-tension transmission, that line should at once go out of operation, and with a properly designed system no interference with the delivery of power should result. All of the considerations which enter into the question of transformer connections are not pertinent to the question of lightning protection, but from that standpoint the grounded star system with the overhead ground wire is most desirable.

Due to its apparent simplicity, the horn lightning arrester has of late received considerable attention. It is, however, not a piece of real protective apparatus in the sense of protecting the line without disturbing the conditions of operation. If it is used without resistance, it has the effect of a short-circuit, and with resistance high enough to prevent it from causing a great drop in voltage, the protective features are largely eliminated. It is in reality an emergency device, a weak point in the system, which is the first to rupture when the voltage rises to a dangerous value, and if the system is without protective apparatus, it locates the point of breakdown when the condition is such that some failure must occur.

The real function of the horn arrester is its use to protect insulators along a transmission line, where the horns are so arranged that the current will jump to the horn before it will arc around the insulator. In this case the system would be disturbed either way. Where it is allowed to arc around the insulator the latter would probably be destroyed and the time of disturbance of the system might be considerable—possibly until the insulator is replaced. With a horn protecting the insulator, the resulting short-circuit, while very undesirable in itself, is less disastrous than in the former case, and may only necessitate starting up the synchronous apparatus again.

Practically complete protection for wood-pole transmission lines can be effected against disturbances from atmospheric lightning. The best method is that of an overhead ground wire in connection with a lightning-rod and horns protecting the insulators. The overhead ground wire relieves the electrical stresses that would otherwise be thrown on the transmission line. The pipe supporting the ground wire acts as a lightning rod, and also as a horn to the top conductor, protecting its insulator. Side horns are attached to the cross-arm, protecting the two lower insulators, and these are all well grounded by a conductor attached to the side of the pole. The addition of the lightning rods has in some cases been found very efficacious.

From the description of the new form of multi-gap arrester it is seen that the arrester includes a static discharger, consisting of the high resistance with the smallest possible number of gaps in series. This should offer sufficient protection against static wherever the arrester is used. There are cases, however, where the complete arrester is not thought necessary; such, for instance, as to protect underground cable systems having no exposure to lightning. In these cases the high resistance and series cylinders can be installed alone. Of course, no protection against low-frequency surges of power is secured, and if such are likely to occur the whole of the arrester should be used.

What is known as the water-jet arrester has been used abroad to some considerable extent, and in certain localities has apparently obtained a reputation which it is difficult to justify. The equivalent needle-gap and the resistance of this arrangement are so great that it is evident that no real protection is obtained by its use. Its only function can be that of a high resistance connected permanently to the line, and in this case it has the advantage of being self-repairing, if ruptured by discharge.

Without doubt an overhead ground wire affords protection to a transmission line. This protection is not complete, as a very few cases exist where insulators have been lost by lightning strokes even when a ground wire was used, but these instances are so very rare that the use of a ground wire is strongly recommended. It should, however, be installed in addition to other apparatus, and, while it will almost entirely protect the line, it does not protect the station apparatus completely. The use of a ground wire very greatly relieves the stress

which can be thrown on the station apparatus, however, and much reduces the duty required of the station lightning arresters.

The disturbances on a system in which protective apparatus is used come from various sources and have various characteristics as regards voltage and frequency. When the disturbance is inside the choke coil, high reactance is undesirable. In the case of a system with large capacity, an arcing ground in series with the high reactance choke coil may cause excessive rise of voltage. In some cases high reactance in a choke coil is desirable and in others it is equally undesirable. It is, therefore, recommended that a choke-coil be used, but that it possesses but moderate reactance, sufficient to reduce the pressure thrown on the station apparatus by an amount which will in general bring it within the safe value of the dielectric strength of such apparatus. Moreover, a choke-coil to be effective at high-frequency discharges, should have very little capacity between turns; otherwise the discharge will merely pass through from turn to turn.

It is of the utmost importance to have lightning arresters well grounded. The ground wire, preferably flat copper strip, should lead directly to ground with as few bends as possible. It sometimes happens that a good ground cannot be conveniently made near the arrester, or that a better one can be made at a more distant point. In this case it is recommended that the principal ground be made at the more distant point, but that a ground of some sort, the best possible under the conditions, be made directly beneath the arrester. By the use of three grounds at a station the ground resistance of each can be determined.

Resistance is one of the important factors of lightning-arrester construction. Its usual functions are, in general, to limit the current and, by shunting part of the arrester, to give fewer gaps for low frequency to break across. Series resistance limits the current under all conditions, but, although in this way protecting the arrester, it is dangerous in case of a surge.

The ideal lightning arrester should prevent any rise of voltage dangerous to insulation. It should offer a free path of discharge from line to ground and from line to line, and should perform its functions without disturbing the operation of the system. It should put out the arc at the end of the half-cycle in which it starts, and should have no discrimination in its protective power as regards the frequency of the disturbance, that is, it should discharge at a certain voltage for any frequency.

New Principles in the Design of Lightning Arresters.

BY E. E. F. CREIGHTON.

[Following is a condensation.]

Arresters can be built to take care of high-frequency surges, low-frequency surges, grounded phase surges during an hour or so, and standing waves. This leaves the causes of interruption of the electrical circuit limited to short-circuits. These short-circuits may be limited to accidental conditions, such as a wire thrown across the transmission line, overheated apparatus, etc.

The novel features of a new multi-gap arrester consist, first, of the discovery of a true non-arcing condition of shunted gaps; second, a combination in a cumulative manner of several shunt resistances, and third, the design of ohmic resistance by the volume method rather than by the radiating surface.

By the term "non-arcing" in the present application it is meant that the condition of sparking exists without the formation of an arc. The discharge of several hundred amperes for a brief period has been produced across a gap without bringing the difference of potential across the gap down to the normal value of 40 volts, corresponding to a current of one ampere. The power in this case was large as compared to the energy. It seems to require an expenditure of power for a much longer time to bring the arc voltage down to even 100 volts. As the heating continues the voltage decreases.

It is possible to discharge induced static electricity directly to ground without the intervention of resistance rods or wires and still prevent the dynamic current from the generator following, with the resultant short-circuit. This condition requires the adjustment of the resistance in parallel with the gaps such that the current will be transferred through the resistance before the heat expended in the gaps is sufficient to bring the arc voltage to a low value.

The extinction of an established arc in a multi-gap arrester cannot take place until the potential reduces to zero at the end of the half cycle in which the discharge takes place.

Oscillograms show that if the arrester circuit is inductive the arc is not extinguished until the potential has passed through zero and is well along in the second half-cycle. Since the arc voltage is only 16 volts per gap for heavy currents, the condition is nearly equivalent to a short-circuit. When the current dies out the voltage across the gaps suddenly jumps to the value generated.

Except in the case of recurring high-potential surges, the multi-gap arrester should extinguish the dynamic arc within the time of a cycle of the generator wave. This period of time is so brief that radiation of heat need not be considered in the design of the resistance. The basis of design is the utilization of the specific heat or the heat capacity of the resister. The specific resistance of the material must be chosen so as to give a length of rod great enough at least to prevent the formation of an arc along the surface. In the matter of selection of material for the resistance, notable improvements have been made.

The liquid electrode arrester may have any one of several forms all involving the same principle. One form consists of two metallic electrodes extending into a vessel containing an electrolyte of high conductivity. The electrodes may be dipped into the electrolyte or there may be a small gap left between the electrode and the electrolyte. If current is passed from one electrode to the other in either direction, the liquid must become negative at one or the other electrodes. It requires about 1,500 volts to maintain the current through the cell, in spite of the fact that the resistance of the cell is extremely low. The current is limited by the so-called counter-electromotive force of the arc.

The difference in effect produced by the conditions of contact between the electrodes as compared to the air-gap setting is marked. For example, three of these cells were placed in series across a circuit having an impressed voltage of 2,300 volts effective. Each electrode was set with a small gap. The equivalent needle-gap was the same as for four one-thirty-second-inch gaps between standard brass cylinders without series resistance. With this arrangement several hundred static discharges having an initial value estimated at 1,000 amperes were passed through the cell, but no dynamic current followed the discharges. The novel relation of counter-electromotive force practically as great as the spark voltage of the cell is obtained. The sum of the counter-electromotive forces per cell is greater than the impressed voltage of the circuit, consequently a spark passes without causing the formation of an arc.

When the metallic electrodes touch the liquid it is necessary to introduce a single gap in series to hold back the line potential. Since the counter-electromotive force of arcs in the arrester limits the current, this single gap suffices even at the high potentials used on long-distance transmission circuits.

(Discussion (in part).

Dr. F. A. C. Perrine of New York city: Aside from the increased constants, capacity and self-induction of the long-distance transmission line we will have some additional difficulties, due to the fact that in a long-distance transmission line, covering a great area, there may be a storm in a certain part of the line and clear weather in the remainder of the line, or we may have two independent storms in different parts of the line, giving us lighting effects which induce waves which meet and combine, and increase the effects. Otherwise we would not have the great difficulty of protecting fairly well long and extensive low-potential lines. When we string that line out in series to a greater extent of territory, we have, as we all know, a very much more difficult problem. I am inclined to disagree with the presentation of the case of the horn arrester. The horn arrester, where used successfully, has been used on the principle that the wave trains do in themselves produce potentials which will break down the insulations of high-potential lines. The principle is that we had better spend our money in erecting our lines in such manner as not to make the insulation subject to the wave trains of relatively low potential, such as we would have to guard against in our lower potential lines, and the horn arrester is introduced with the idea of saving the apparatus from destruction where any other form of arrester would not itself be destroyed, and even if protected, the machinery would leave the line open for damage in the further continuance of the storm. When we get the extreme cases, which Dr. Steinmetz has described, of the short-circuiting potential and discharge across the arresters of extraordinarily high energy, the multi-gap arresters generally fail, and the line is then left unprotected, even if the machinery is safe. The horn arrester is introduced in such cases as being able to take care of these great discharges, and while possibly giving trouble with the synchronous motors on the line by its long interruption, it has saved the apparatus and saves itself as well.

At a recent meeting of the Institute Mr. Mershon described his system of horn arresters with varying resistances in series with a group of horn arresters. If I remember correctly, he said he used five sets of horn arresters, each of a different value of resistance in series. That system has had about a year of operation at Niagara Falls, and it has shown that the system of protection is not complete and requires for certain types of discharge that come from the line a set of multi-gap arresters, in connection with the horn arresters, situated probably inside the station.

I disagree with Mr. Rushmore and Mr. Dubois in their belief that the horn arrester is better adapted for discharging high-frequency discharges. As a matter of fact, the higher the frequency discharge the more rapidly is it carried over the multi-gap arrester. The low-frequency discharges are not as well taken over the multi-gap arrester, whereas over the horn arrester the low-frequency discharge is more rapidly taken than over the multi-gap arrester. It is my opinion that in our present state of the art the best protection we have is a combination of the horn and multi-gap arrester, the multi-gap arrester to take charge of the relatively high-frequency discharges, and the horn arrester to take charge of the low-frequency discharges.

I have always believed that a barbed wire, if made properly, is a better means of line protection than a smooth wire; at the same time I question very much whether a satisfactory barbed wire can be made. Another important thing discussed in the paper in reference to the ground wire is the loss experienced, in certain lines, where the ground wire was frequently grounded, of magnetic energy due to the circuits of the grounded wire. This matter has not been very thoroughly investigated. There is one line in California which used the ground wire for a time, and reported a very serious loss of energy. Mr. Creighton shows us the benefit of the oscillograph in the study of lightning-arrester problems, and that benefit is probably greater in these problems than in other classes of problems we have met. Our somewhat restricted methods of work in the laboratory can better be explained and extended to practical use by study, through the means of the oscillograph, than by any other possible methods of study.

Farley Osgood, New Milford, Conn.: Experience seems to show that lightning-arrester protection is an individual study for each individual plant, and for each individual locality. In talking with other operating engineers, I find that they use quite different means of protection from the ones we use, and they are equally successful or unsuccessful. I do not think the difficulties of atmospheric conditions are so very serious, generally speaking. Dense fog causes most of our trouble to the outside system. During other times we seem to get along without difficulty.

We have found choke-coils very effective, and consider that they are a great protection to the high insulation, outside insulators. A 20-turn coil seems to answer our purpose fairly well. The development of the liquid arrester brings out the fact that, at least for grounds, it may be necessary only to have arresters at the generating end of the system, or at least at the extreme ends, with no equipment in between. This is rather a radical step, however, and I would just as soon that some other operating engineer should experiment with it.

Percy H. Thomas, Cooper Hewitt Electric Company, New York city: The multi-gap arrester with shunt resistance, leaving out of account the electrolytic arrester, seems to be by all agreed to be the most promising direction in which to work. I do not agree with Dr. Steinmetz's definition of lightning discharge. We must recognize the fact that an arrester is not only effective, if it is effective at all, against lightning, but also against the other sources of disturbance. If we want a general term, I would suggest that the word "static" has been pretty generally used.

I am more inclined to agree with Mr. Rushmore in connection with the horn type of arrester than with Dr. Perrine. The grounded wire is some protection, but not complete protection. One of the difficulties, even if the wire is placed in, is that the discharge which strikes the line is more apt to come from the side. Coming from the side, it approaches one of the side lines before it does the high line, and, furthermore, there is at all times one of these lines which is at a negative potential, with regard to the charge which is coming in the atmosphere, that is, it has a higher protection to receive the discharge than the ground wire itself. Taking these two things together, although the grounded wire will reduce the number of troubles, it can hardly be expected to completely eliminate them. In the constant-current transformer, where there is provision to separate the windings, if the coils are close together, you have a perfect relationship between the primaries and secondaries, and you have a perfect reaction of the secondary on the primary. If you separate the secondary from the primary, the effect of the secondary on the primary is almost negligible, considering the secondary formed by the grounded wire, no independent circuit introduced, there will be practically a negligible effect of the secondary on the primary.

In his discussion of the principles covering the discharge through a series of gaps, there was one thing Mr. Rushmore did not take into account, and that is, the fact of the leakage of current over the surface of the insulator between the cylinders. This will tend to distort the conclusions numerically reached. If this phenomenon gives trouble, it is easily controlled by placing a considerable gap in series with the arrester, between the lines and the first cylinder, or by using a shield. I would like to ask Mr. Creighton whether in his tests the results are based on anything more than the work with the 2,300-volt outfit, and whether higher voltages or larger powers were used.

Mr. Creighton: We have taken some measure-

ments at higher voltages, but we have not made as complete a study of them as in the case of the 2,300-volt machine.

Mr. Evans: The question of power behind the tests is absolutely of importance in this sort of work, and inherently the higher voltage is more difficult to handle.

A. G. Converse, Niagara Falls: It has been my experience that the greater part of lightning difficulties causes us trouble along the line rather than at the generating and sub-stations. We have had very little trouble at our stations. The Ontario Power Company, during the whole of the last season, had only one discharge from the generators at the generator station, but had a considerable number of discharges from the lines, breaking the insulators. These lightning arresters, which have been described, are essentially station arresters. Our experience has been that lightning will hardly travel more than four or five tower lengths, before it will go to ground from the tower. We must not overlook the fact that the line protection for continuous operation is also important, nearly as important as the protection of the generating station apparatus.

William McClellan, New York: It has been my privilege in the last few months to take part in the adjustment of the lightning protection of a sub-station which takes current at 6,000 volts and delivers it at 11,000 volts to a trolley line. We were impressed with the fact that the choice of lightning protection depends very much on the amount of power you have back of it, and the voltage of the line you are trying to protect. For the 11,000-volt circuit we are intending to use a form of multi-gap arrester; perhaps some of these multi-gap arresters are better than others, but I see no reason why any of them should not answer the purpose fairly well. For the small amount of lightning which we have at this season of the year, I notice these gaps begin to show the effect which we know is the chief difficulty in the multi-gap arrester, and that is, that, sooner or later, if the discharges are heavy and frequent, they will burn out. If we can get hold of an arrester which is a real safety valve, in other words, an arrester which has just the qualities which this electrolytic arrester seems to have, we shall have solved the whole problem. At present, in connection with the station to which I refer, we have decided on the horn type of arrester, and if we had been absolutely free to act in the matter we would have used two horns, one in connection with the fuse, meaning an exceedingly low resistance, and, from our experiments it shows if the discharge does go through it, it will open the circuit in a short time, in as short a time as half a cycle.

While I agree in general with everything that has been said here in regard to the horn arrester, as to its value, I think there are some cases where it has been successfully used. I do not believe in five or six different resistances. Those who seem to have had most experience and know most about it, have never been able to give me an explanation why five are necessary. When we put extra turns on the transformers and powerful insulators on the line, that is supposed to take care of a certain rise of voltage. Any rise in voltage above this you want to take care of, and there is no use in putting a gap and resistance on the line which will continue the discharge every time the voltage rises a small amount above the normal.

Ray P. Jackson: Years ago, when Mr Wurts discovered non-arcing metal, he found certain meals belonging to one group that had that quality to a large degree, and other metals that did not have that quality to any considerable degree. They belonged to one group—cadmium, mercury and zinc. They are all monotic in their characteristics, that is to say, their gases are formed of molecules which have one atom. This is a very important relation to the non-arcing quality, in that these gases have twice the volume that other gases from other metals have, and also it is highly probable that a comparatively small number of ions will exist in the gases. Therefore, there would be a much less chance for the arc to establish or maintain itself, and possibly a much greater pressure beyond when the spark goes through.

Regarding the horn gap, I very much doubt the claim that the arc rise is due to magnetic effect. I have not found that true in experiments I have made, and I understand in the Ontario Power Company the horns were arranged in coils to increase the magnetic effect, without much gain being found in that way. The electrolytic arrester, which we have never experimented with, so far as I have been able to learn, has a certain equivalent that is controlled largely by Ohm's law. If you increase the area of the plates or the electrolyte, you decrease the equivalent; if you increase the length of the electrolyte, or both, you increase the equivalent, and that equivalent seems to have comparatively little relation to the volume of discharge through it, so that it seems to be possible to predetermine the voltage which could escape through the arrester, and simply short-circuit everything above that. In the type of electrolytic arrester which I have used, however, I do not consider it to be the counter-electromotive force that limits the power current. It seems to be a dielectric film, and that film is capable of puncture and capable of rescaling when the voltage drops below certain volumes. It acts like a valve, with a spring behind it. When it is punctured, if the static excessive voltage exists long enough, there would be a very large power current flowing through, but, of course, the high voltage due to lightning or surges exists for a very short interval, so that the power current that follows is insignificant. Concerning the horn arrester, I think its virtues may be considered to lie chiefly in its mechanical characteristics. It is comparatively simple and cheap, and can be put out of doors.

H. C. Wirt, Schenectady, N. Y.: For some work, especially at lower voltages, the electrolytic arrester would not be a convenient arrester to put around a city. As regards the multi-gap arrester, I think that one judging that arrester must be sure he is basing his judgment on the most approved form of the arrester. It is evident that, for a given breakdown, the greater number of gaps we can have in series makes it more non-arcing. I cannot see that if the shunt resistance is properly connected to the arrester, how any employment of this resistance is going to help matters very much. The shunt resistance should be connected so that the arrester will break down at about 50 per cent. rise in voltage. If you put a resistance beyond that point, you are adjusting the circuit too near to the working voltage. The double-resistance type for 2,000-volt work may be all right.

Professor Steinmetz: Regarding the objections raised against the use of a fuse in these arresters, if we omit the fuse with shunts and gaps, that means we have to leave the gaps in, and if the fuse blows, we still leave that protection in the system, which would be the only protection, I think, if we desire to eliminate the fuse. The use of the fuse permits us to give a closer protection for most of the time and under most of the conditions, than would be permissible if we did not desire to use the fuse.

Ohio State "Electricals" at Milwaukee.

During a recent inspection tour to Cincinnati, Chicago and Milwaukee a party of electrical engineering students from the Ohio State University was photographed at the works of the Cutler-Hammer Manufacturing Company in Milwaukee, and the accompanying group picture is the result.

OHIO STATE "ELECTRICALS" IN MILWAUKEE.

A party of bright-faced, intelligent young men is shown, such, apparently, as would do credit to any college. The date of the visit to the Cutler-Hammer Works was March 27th. The students left Columbus, Ohio, on March 24th and returned to the university on March 31st. A third of the time allotted to their trip was spent in Milwaukee. While in that city the visitors were the guests of the Allis-Chalmers Company at a luncheon given at the clubhouse at West Allis. The party was in charge of Prof. Francis Cary Caldwell and consisted of 44 students.

Illinois Traction Company Gets St. Louis Franchise.

The Illinois Traction Company has succeeded in securing a franchise in St. Louis, Mo. The bill providing an entrance for the McKinley lines passed the House of Delegates with but one dissenting vote, and it is expected that Mayor Wells will sign it.

The franchise provides for the entrance of the traction company into the north end of St. Louis from Venice, with both freight and passengers. The bill requires a payment of $5,000 a year for the first 10 years, $7,500 for the second 10 years and $10,000 a year for the last 10 years. The franchise means much to both the interurban company and the people of St. Louis. It means a new bridge across the Mississippi, for which federal permission has been granted, that will cost $2,500,000 and be 2,365 feet long. There will be three central spans, each over 300 feet long, and four shore spans of the same dimensions. Roadways and walks will also be provided, besides the tracks of the company.

Three passenger and express depots will be erected. The cost of the buildings is estimated at $1,800,000, including the freight depots, repair shops and car sheds. The company owns 24 acres of land at the foot of Salisbury Street, where buildings will be erected. It also owns a right-of-way from the bridge approach to Ninth Street. Two new sleepers and 15 new passenger cars have been purchased and will be put on shortly between East St. Louis and the other cities they are operating in. The General Electric Company has built for the McKinley company two electric locomotives for switching purposes in Decatur and Springfield. They are equipped with four 55-horsepower motors and will give a pull of 18,600 pounds.

Commercial Motor-vehicle Exhibition in London.

[From the London correspondent of the Western Electrician.]

Before describing the remaining gasoline-electric transmission systems exhibited I will mention the exhibit of the second concern, which shows electrically driven vehicles. This is the Electric Van, Wagon and Omnibus Company, which employs the Gould battery. There were shown an express delivery van to run 50 miles on one charge, fitted with a 2½-horsepower motor and arranged with two speeds forward and one reverse; an electric dry-goods delivery covered wagon having a load capacity of 2,000 pounds, fitted with a five-horsepower motor, with four speeds forward and one reverse. This is said to be capable of running 59 miles on one charge. There was also on the same stand a hospital ambulance fitted with stretchers for two patients and special seats for doctor and nurse. Finally a five-ton heavy wagon, six-horsepower motor, is fitted with an electric windlass and hoist under the driver's seat.

Greenwood & Batley, electrical engineers, showed a 35-horsepower omnibus chassis fitted with their system of gasoline-electric transmission. In this a 35-horsepower gasoline engine is coupled direct to a 20-kilowatt compound-wound four-pole generator, which supplies direct current to a double-armature electric motor, which drives a rear axle by worm gear without a differential. There is no mechanical connection from the engine to the road wheels—in other words, the drive is electrical at all speeds—and there are no batteries. The generator is not of the flywheel type. The motor is of the protected four-pole type, series wound, with two separate armatures within the same yoke. Alignment of armatures and worm shaft is obtained in all positions of the rear axle by the fact that the motor is carried on a trunnion and is connected to the rear axle by a large central radius tube. Thus while the weight of the motor is carried on the spring-borne frame of the car, it is free to move on both a transverse and longitudinal axis. Two separate gears are driven by the two armatures. The control is a combination of series parallel and field control. The series speeds, which are the two lowest, give a differential action, while the parallel one gives a torque inversely proportional to the speed of each roadwheel.

In the Stevens gasoline-electric systems a 20-horsepower engine drives a dynamo having a double-wound armature with two commutators. This latter generates constant current at the most efficient speed of the engine, the voltage varying inversely with the amperes of the electric motor. A fan is fixed on the end of the dynamo shaft and circulates a strong current of air through both the dynamo and the motor, keeping both machines cool under all conditions of load. The leads from the motor are carried through variable resistance switches to the controller and thence to the series-wound electric motor. The dynamo is of the interpolar type, weighing about 400 pounds, and is capable of generating 15 kilowatts at 1,400 revolutions per minute. The control is such that when a foot pedal is in its normal position no resistance is in the armature circuits, but when the foot pedal is depressed, say to half its stroke, the whole of the resistance is in circuit with the two halves of the dyanamo armatures and the controller. A further movement of the foot pedal breaks the electrical circuit, and a still further movement puts on the brake. Owing to a locking arm, controlled by the foot pedal, it is impossible to operate the controller by the change-speed lever until the pedal is depressed sufficiently to put all resistance in and break the circuit between the dynamo and motor, thus preventing all sparking in the controller.

The engine control is partly electrical and partly mechanical. With the rise of the voltage consequent on the reduction of the demand of the electric motor for current the pull of a solenoid overcomes the tension of a controlling spring and closes the throttle. Thus the engine will be automatically governed. The governing voltage is predetermined by the tension of the spring, which is controlled from the steering column.

The exhibition also contained an assortment of accessories such as batteries for ignition purposes, etc., but the chief feature has been the advent of the purely electrical engineer into a field hitherto untouched by him. G.

At a recent meeting of the executive committee of the American Institute of Social Service, held in New York, announcement was made that the Scientific American will give annually a gold medal to be awarded by the Institute for the best device for safeguarding life and limb.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

X.—Characteristics and Uses of Direct current Types of Machines.

Motors.

Before reviewing the characteristics of direct-current motors, the kind of current which is to be supplied to them should first be considered. The supply of direct current may be of two kinds, either constant-potential, in which the amount of the current varies, or constant-current, in which the voltage varies. In all central-station work, with the exception of series arc lighting, constant-potential current is universally employed, and therefore practically all uses of electric motors are made in connection with constant-potential current, and the use of motors on constant current may be dismissed in a few words.

Series-wound motors are the only kind used with constant-current circuits, and under these conditions they cannot be made self-regulating. From the nature of the winding it will be apparent that if a constant current passes through the field and armature windings, the armature current will be the same, whatever the load, and the torque of the motor will remain constant. Now if the load is partly thrown off from the motor, it will gain correspondingly in speed, and when the load is entirely removed, the speed increases to a degree which tends to be destructive to the motor. On the other hand, if the motor is greatly overloaded, it follows, as the torque is constant, that the speed will be reduced proportionately to the load, and the motor may even be held still without any chance of injury, as the amount of current is always the same.

Some form of mechanical regulation is necessary to vary the speed or torque of a series motor on a constant-current circuit. This regulation may be effected either by cutting in or out some of the field coils, by means of which the field strength is varied, or the brushes may be slightly rotated upon the commutator away from the neutral position to reduce the magnetization of the field magnet. The use of motors on constant-current circuits, however, is of very rare occurrence.

The characteristics of shunt-wound, series-wound and compound-wound motors, which will now be considered, refer to motors operating on constant-potential circuits.

Shunt-wound Motors.

The shunt-wound motor is the type most commonly met with in stationary work, and its principal characteristic is the fact that its speed is practically constant for any load within its rated capacity. The shunt winding on the fields of such a motor always carries the same amount of current for a given electromotive force, and therefore the field strength always remains constant. The torque of the shunt motor therefore varies directly as the armature current. In practice, there is a slight reduction in speed as the torque and armature current increase. As the electromotive force of the supply circuit is constant, the counter-electromotive force of the motor must decrease in order to increase the armature current, and this decrease in the counter-electromotive force of the motor will reduce the speed slightly.

There are, however, a number of ways in which the speed of a shunt motor can be varied. One of these is by reducing the electromotive force of the current supplied to the brushes, and as the speed of the motor varies directly as the applied electromotive force, it is evident that the speed can be reduced by inserting a resistance in series with the armature which will cut down the voltage to a certain extent, depending upon the amount of the resistance.

While the insertion of a variable resistance in the armature circuit is a very simple means of varying the speed of a shunt motor, it is also a very expensive method, as a large amount of current is thus wasted in the resistance in merely producing useless heating. For a continuous operation such a method would not be at all advisable, but this method of armature resistance is often found useful where it is necessary to start under slow speed for short intervals, after which the resistance may be cut out of the circuit, and normal speed used. The use of armature resistance, however, is not to be recommended except for starting conditions.

There is considerable difference between the resistances used in the armature circuit merely for starting, and those used continuously for regulating. Starting resistances may be made comparatively small, as the very short time which they are in service does not permit them to heat up very greatly. If, however, they are used to carry the armature current for longer than the few seconds which they are required for starting the machine, they will be burned out.

The regulating resistances for constant service have to be made with a far greater amount of radiating surface, so that the heat developed in them will be dissipated as rapidly as possible.

Another method of varying the speed of shunt-wound motors is by varying the field strength of the motors. This is a very simple method, and is very widely used. It consists of cutting resistance in or out of the field circuit only, and as the field current is very small relative to the armature current, but little energy is lost in the field resistance.

Another method of regulating the speed of shunt motors is by changing the strength of the magnetic field. This is used to a very slight extent, and it requires some mechanical regulation whereby the lines of force passing through the armature are either diverted through a movable piece of iron near the pole pieces, or the length of the air gap between the pole faces and the surface of the armature is altered by a mechanical device for changing the relative position of the pole pieces and the armature.

It is also possible to change the speed by varying the number of wires in the armature winding, or, what amounts to the same thing, changing the separate parts of a double winding from series to multiple connection. This, however, involves the use of different brushes for each winding, and is therefore of more theoretical than practical interest. The addition of more brushes is very undesirable from an operating standpoint.

The method of regulation by varying the field is preferable to any other, from the standpoint of economy; but even this method has certain disadvantages. In order to increase the speed, the field of the motor is weakened, and to decrease the speed, the field strength is increased. It is seen, therefore, that the efficiency of the motor is somewhat reduced by this method, because if the speed is decreased, and the torque remains constant, the motor develops less power, and there is also a slight increase of loss of energy in the fields.

In order to secure the maximum amount of work from a motor of a given size, it is necessary that the field magnets should be worked near the point of saturation of the iron; that is to say, at a point where increasing the number of ampere turns does not appreciably increase the number of lines of force passing through the magnets. Now, if the field is weakened in order to increase the speed, it is evident that the full power of the motor is not being developed; and, in general, where a wide variation in speed is secured by means of variation of field strength, a larger motor frame is required in order to develop the rated horsepower at low speeds, than would be necessary to develop the same power at its normal speed with saturated field magnets.

Another difficulty is also encountered in greatly weakening the field, which is that the armature current tends to distort the field so that the position of the neutral point, or point of commutation, is considerably changed, and this will cause injurious sparking at the brushes. This field distortion, however, may be overcome by the use of auxiliary windings, which neutralize the armature distortion, and by means of which a machine covering quite a wide range of speed can be made. In general, it may be stated that the speed of an ordinary shunt machine built with a fairly liberal-sized frame may be varied in a ratio of two to one, without reducing the rated capacity of the machine, at low speeds, while in case a compensating winding is used, the variation in speed may be as much as four to one.

The shunt-wound motor has by far the widest application of any direct-current motor made, and, in fact, the number of its applications is practically unlimited. The conditions under which it is best adapted to operate are when the load can be applied to it gradually and where a very high starting torque is not required. It will be gathered from what has already been said in regard to its regulation that the shunt motor is adaptable to a wide variety of conditions, including not only those where practically constant speed is required, but also operations in which quite a wide variation in speed is desirable. In practice we find machines of this type in general use for operating all kinds of machine tools, such as lathes, planers, shapers, drill presses, etc., and it is also used for operating the various classes of machines used in nearly all industrial establishments, such as printing presses, air compressors, fans, blowers and hundreds of other devices too numerous to mention.

Where constant speed, or where small variations of speed are required, the practice is to regulate these motors by means of a rheostat in the shunt field only. Where extreme variations of speed are required, armature resistance is sometimes employed, as well as the special auxiliary windings previously referred to. It will also be found that for machines of similar horsepower ratings those which are arranged for wide variation in speed are built on somewhat larger frames than those which are used for constant-speed operations. This is necessary, in order that the capacity of the machine will not fall below the rated output when the machine is operating on its slowest speeds. In order to accomplish this, the variable-speed motor must operate on its average speed, with its fields considerably below the point of saturation, in order that for very slow speeds there shall be sufficient iron in the frame to permit a large increase in the field magnetization.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Arrangements for the National Electric Light Convention.

As has been stated, this year's convention of the National Electric Light Association will be held on the tenth floor of the New Willard Hotel, Washington, D. C., June 4th to 7th. The committee on hotels has already made reasonable reservations for members and full details concerning hotel accommodations, rates, etc., will be sent to members later. Those who know the hotels, and care to do so, may make reservations now, addressing the committee at the office of the president of the association, 55 Duane Street, New York. It is desirable to have as many reservations in advance as practicable, and well in advance of the day of the meeting assignments will be checked and verified carefully, so as to avoid confusion and misunderstandings upon arrival.

The master of transportation, Mr. George F. Porter, is now arranging for special railroad rates from different parts of the country. If a sufficient number can be secured from the large centers, undoubtedly arrangements can be made for special cars from those points. Details as to transportation will also be the subject of a special circular later.

Following the plan of last year, arrangements are being made for an exhibition by associate members. For this purpose the large ballroom of the New Willard, having a floor area of approximately 10,000 square feet, has been secured. This room is on the same floor with the hall in which the meetings will take place, and ample elevator service at both ends insures to each section about equal value from the standpoint of attendance and display.

A departure from last year's practice will be made in the renting of sections, in that the price will include the erection of booths, wiring and lighting. The prices have been fixed at $100 for wall sections, and $125 for center sections. A circular incorporating all the details relating to the exhibition will be sent shortly to associate members. In the meantime it would be well for those who desire, to communicate with the vice-chairman of the exhibition committee, Mr. Walter Neumuller, 55 Duane Street, New York city, for reservations.

It is expected that the rental to be derived from exhibits will not much more than pay the expenses in connection therewith. The committee is striving in every way to make this convention a success. The plan inaugurated by the association last year of meeting the expenses of the convention, rather than allow the local company to assume such burden, will be followed this year, and it has been decided to ask that the convention expenses be met by individual company subscriptions. These may be sent to Mr. W. C. L. Eglin, who has kindly consented to serve as treasurer of the convention.

While it is expected that this meeting will not fall behind any previous one in its reputation as a "working convention," still the location selected this year, surrounded as it is by objects of national and historic interests, gives ample assurance that opportunities for entertainment will not be lacking.

Dudley Farrand, 297 Market Street, Newark, N. J., is chairman of the convention committee.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Organization and Conduct of a New-business Department.[1]

By John G. Learned.

The first question that enters into the organization of a new-business department is, "Is it worth while to have such a department; under what conditions is it advisable to maintain such a department?" The size of the company and the size of the town in which it is doing business are important factors in deciding whether or not it will be justifiable to establish a new-business department.

Everyone readily agrees that no matter how small or how large a district a central station is operating in, it requires someone to care for the old and new business. This is very often taken care of by the manager or his assistants, until the management of the company feels the necessity of having the contract work superintended exclusively by a specialist.

We now have arrived at a point where it is absolutely necessary to secure the service of an able contract man to have exclusive charge of all work incident and relative to the securing of new business and increase the central-station load. The solicitors should be appointed and report directly to him, so also should the construction department, meter department and advertising department; in fact, all other departments must of necessity be subservient and work in conjunction with the contract department. Before going further it should be impressed upon all members of this department that the most liberal policy should be used in its conduct. The contract agent is most successful who is a judge of human nature and who is able to select as his assistants men of strong personality, capable of becoming friends of the public. The individuality of the agent counts a bit in the amount of business secured. This contract department must of necessity consist of able and apt salesmen. If the central-station company does not have the talent to thoroughly instruct members of the contract department in this art of salesmanship, it may be readily acquired from several schools which make a specialty of salesmanship.

The number of solicitors required depends upon the size of town or city in which you are operating. Would suggest, however, that there be one solicitor for every 15,000 inhabitants. Impress upon all your solicitors the absolute necessity of hustling, morning, noon and night. Have them establish confidence in the public, and at all times the motto of the contract department, and in fact the motto of the company should be "A square deal to the public." Pay your agents a salary and a very liberal commission on business secured and connected to the service. By doing this you will find that the results obtained are far more satisfactory than if you paid a straight salary.

The duty of the contract department is to create a demand for the commodity of the central station, because, as we all know, juice must be treated as any other item of commerce. We are here to sell it, promote its uses, create a demand for it, compel the unwilling to learn of its comfort, conveniences and power. Inasmuch as we are here to teach the public in its uses, less talk and more work is required. Office systems are a grand thing, in fact, systems of all kinds are; however, business cannot be secured sitting in the office, especially lighting and power business. Results are what we are after, therefore we must be up and out after the business, early and late.

It is absolutely necessary at times that the central station should maintain a wiring department, and also should encourage private local persons in the wiring business, as the results are manifest. The more competition you have in the wiring business, the quicker your load will grow. If necessary throw a few wiring jobs to the local man. It pays. Induce the man selling appliances to visit your territory. This also pays. If feasible, get all and any firms handling reliable electric appliances to solicit in your community. They are all working indirectly for the central-station company. The connected load is increased, the income is increased. You are selling current, let the other fellow sell the appliances. The current revenue is perpetual.

Give the resident prospect a cost estimate for wiring his place. We find that by offering to put in the wiring and fixtures at cost on monthly installments we have secured a very large number of old houses which, if it were not for this proposition, would still be using antiquated methods of illumination. It is the old residences that need the most attention. The new ones will, as a matter of course, take care of themselves. It is a very easy matter to induce a man building a new home to have it wired.

Experience has taught us that wiring for a porch light at cost has been the means of securing on our service a very large number of customers. Sixty customers were secured out of 275 persons approached by a circular letter. This, you will admit, is a very large percentage. The cost of burning a porch light is nominal and rarely runs over 75 cents or $1 per month. At first sight, you may think it does not pay to put in service for one lamp. It does. It is only a short time before the entire house or part of it is wired.

The next proposition for old residences is to wire for six outlets at a concessional price of one-half, or the actual cost, the outlets mentioned to be placed as per direction of the consumer, with restrictions according to the conditions existing in your particular locality. Six outlets will give the customer a chance to try the light, and invariably result in putting on additional lights. This proposition was offered to about 600 old residents, out of which 53 responded and 23 were secured to the service. This is considered a small percentage.

The average man is always ready to accept something which apparently is free; therefore, for a period of three months, make a standing offer to allow $25 worth of current free to any resident who wires his home for a certain number of lights during that period, said free current to be used within a specified time. The results from this offer were very gratifying, in fact, flattering, as about 40 old houses which before making the offer were almost impossible to reach, readily came on the service.

Most towns have a few tenement and flat buildings. It is sometimes a task to obtain the lighting of these buildings. It is a good policy to have them wired at any cost, having the halls wired separately from the flats; this being done in the first place, the rest is easy. As a rule, tenants in flat buildings are very good customers, easy to secure and easier to hold. In order to permanently secure and hold the hall lighting, the central station should allow the owner a special commission in the form of a discount on his hall lighting, this discount depending upon the number of customers in the building which use the central-station service. As a result of this proposition the owner or agent of the building is instrumental in having a backward tenant use light. This proposition also applies to office buildings.

In order to show the storekeeper that window lighting is not an experiment with you but an absolute necessity, and that you have confidence in the fact that he will continue to use electric service, wire his windows free of charge. It is not only an advertisement for the storekeeper, it is also the best advertisement the central station can obtain. The income is good, as a storekeeper, as a rule, is a long-hour user. Induce him to use the light in his windows when he has closed the store. In order to sell goods you must show them, and show them under the most favorable conditions. This may be done by using electric light. The writer considers trough-reflector window lighting the most advantageous. The lighting of the interior of the store follows as a natural result. Each and every place requires special attention.

In districts where you find it will pay to maintain patrol service, install arc lamps on a flat-rate basis. Furnish the standard arc lamps, do the wiring, both for flat-rate service and also on meter basis, on meter basis with a special minimum monthly guaranteed. Experience has taught us that arc lamps are most satisfactory for space lighting and that a large amount of well-paying business has been secured by doing free wiring. Special attention should be given to the distribution and maintenance of arc lamps.

There are several companies that now make a specialty of furnishing central-station companies signs at a reasonable price, which may be used time and time again. Signs furnished free to the customer have been means of securing a vast amount of business. By free the writer means that the signs are furnished, hung and connected without expense to the consumer, under a special contract whereby he agrees to use a certain amount of current each month. If patrol service is convenient, furnish the sign on patrol basis; if not, on meter basis.

The factory lighting business depends entirely upon local conditions and the price of the current. Constant soliciting will secure this business where light is used at all. It should be the ambition of every central-station manager to run day service, provided he can see his way clear to make it pay.

It is often surprising to learn of obscure places where power service may be installed. Sell motors at cost or as near cost as possible. Sell them on time. If possible, rent them. Place a motor in on trial; in fact, do anything and everything to obtain the consent of the consumer to take power service. The writer does not know of one case in which the service was removed on account of the inefficiency thereof. Convince the customer that electricity is the proper and only power for him.

The time has now arrived when the central station should be active in placing electric appliances among its current-consuming devices. The electric flatiron seems to take best because it is an article which is in general use. There are several methods of placing them with the customer. Thirty days seems to give best satisfaction.

Recently in a small community 37 irons were placed out on 30 days' free trial, and only two were returned. These small appliances are mostly used during the day. The income received from an ordinary No. 6 flatiron is from $3 to $9 per year. Therefore it seems advisable to sell appliances at as near cost as possible.

A good scheme is to have a young lady call at the premises of the consumer and demonstrate the various electric appliances which you carry. Make it easy for the customer to secure the various articles. It is marvelous to think of the efforts some of the central-station companies make in the advertising line in order to secure new business. Most of the small companies are inactive in the advertising field. Why they should remain dormant in this line is a mystery. The question is, how to impress the fact that you are doing business. First and easiest will be the newspaper as an advertising medium. Secure a small space in a local paper. Change your advertisement periodically. Tell the public in a clean, clear and concise way of your business. Each advertisement to be a story, not too long, and should bring out a new point each time relative to the advantages obtained in using your service. As a rule, the newspapers are always ready and willing to accept copy. Why not make it electrical, readable, interesting, in the form of a story, telling the uses and advantages of electricity.

In most towns there are a few drug stores. Advertising through the medium of a drug store seems to be profitable, as every class will at one time or another call and make purchases at a drug store. Would suggest that an advertising cabinet 30 by 50 inches be placed in each drug store. Over the top of this cabinet place an incandescent lamp with a globe on it inscribed "Use electric light and power," the cabinet to be provided with a glass door. In back of the glass door insert advertising matter periodically.

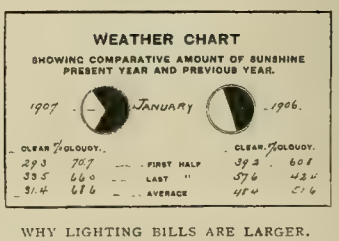
The writer considers that from 10 to 15 cents per kilowatt-hour for residence and store lighting and from five to 10 cents per kilowatt-hour for power service is a reasonable rate. The rate, of course, depends entirely upon the locality in which the central station is doing business. It is of the utmost importance that you give each and every customer the proper attention and treatment after he is on your service. Experience has taught us that it sometimes takes a better man and argument to hold a customer than to secure him in the first instance.

Systems are fine, but they do not get the business, and business is what we are after. Have all employes of the contract department up, out and doing, aggressive at all times, courteous beyond criticism. At all times inspire confidence in the public. Confidence signs contracts, and signed contracts are what we are after. In order to impress it upon you, I again repeat that the motto of the central-station company should at all times be, "A square deal to the public."

1. Extracts from a paper presented in the prize contest conducted by the Co-operative Electrical Development Association, under the auspices of the National Electric Light Association last year. The author lives in Evanston, Ill.

Cloudy Weather Makes Larger Light Bills.

It frequently happens that customers of central stations who keep a close watch over their lighting bills complain occasionally that their last bill was larger than for the corresponding month in the previous year. They feel that something is wrong



WHY LIGHTING BILLS ARE LARGER.

because they are sure they used no more current than before. A common cause for this complaint, and one which consumers are apt to overlook, is the fact that a given month one year is apt to have much more cloudy weather than the corresponding month of the previous year. Naturally, to secure effective lighting, the customer consumes more electricity in the cloudy month than he did in the brighter month.

To impress this point on its customers the Edison Electric Illuminating Company of Boston published the accompanying chart comparing the months of January, 1906, and 1907. Any increased use of electricity must, of course, be shown in the bills of the company, and the different conditions prevailing should be remembered when any comparison of bills is made.

Unique Window Display of Electric Porcelain.

That much can be done to make a show window attractive by using materials at first sight unpromising is shown by the accompanying reproduction of a photograph showing a street window of the Central Electric Company of Peoria, Ill. The little house shown on the right in the window is built of porcelain tubes attached to a wooden frame with

UNIQUE WINDOW DISPLAY OF ELECTRIC PORCELAIN.

string. The whole display is laid out to represent a farmhouse scene, showing the dwelling, barn and yard, with a henhouse built of cleats and some tubes on top for a roof. The road winds around in realistic fashion, while the fence is made of porcelain cleats laid to represent the old-time rail fence. A windmill is conspicuous and is also made of porcelain tubes, with a fiber ring for the wheel. An old-time well-sweep, made of three porcelain tubes, with the bucket (a porcelain knob), is in the yard. The barn is built of clay tubes two inches in diameter.

The window contains nothing except porcelain used in the electric-wiring business, with the addition of a few accessories, such as small cotton chickens and an irregular shaped mirror, having edges covered with sand, which makes an ideal pond, on which are two small ducks.

A rural telephone line is built of a few small twigs with coarse thread for wire.

Louis B. Van Nuys arranged the window for an Easter display, and judging by the attention which it attracts it may be considered a great success. The total cost for chicks and a little green stuff for grass in the house yard was 45 cents.

The Peoria Gas and Electric Company also has an attractive window, showing the life of a chicken in seven chapters, or from the egg to the pan. But at the present writing (March 30th) the small chicks are running around in the window, having been hatched a couple of days before Easter.

Profit in Charging Automobile Batteries at Night.

That the furnishing of power for electric automobiles can be made a profitable source of revenue for central stations is the belief of Mr. James Macnaughton of Buffalo, who read a paper on the subject recently before the Association of Electric Vehicle Manufacturers. Probably the greatest hindrance to the use of electric vehicles is the cost and the difficulty of obtaining current to charge the batteries. Even in communities where electric-light plants exist it is sometimes difficult to secure current, often owing to the reluctance of the officers of such companies to embark in what they term a "side line."

It is asserted that if the ease with which batteries of electric vehicles may be charged were but impressed upon many of the officers of lighting companies all over the country it would not only result in an increased use of these clean, neat, quiet and serviceable machines, but it would have a tendency to lower the cost of maintenance of those already in operation.

Mr. Macnaughton says: "Now, the reason that electric current is so high is because they [the central-station companies] have to average up on the 24 hours, and when I presented to them the idea that they could find a market for the current between midnight and 6 o'clock for the charging of electric vehicles I received a most agreeable welcome. * * * I succeeded in getting them to name, in the place of 12 cents for light and 8 and 10 cents for power, a price reduced as low as 6, and in some cases as low as 5 and 4, and in one 3 cents, and in getting them to waive their minimum-charge rate and make a flat rate of 3 cents for charging electric vehicles during these hours. Now, that enables a salesman to go right out, and he can tell you how to take care of your electric vehicle. If you will charge it between those hours you can get it at 3 cents a kilowatt, and we can sit right down and tell you how much it will cost. The other items we all know. * * *

"This business means a considerable amount of current, and it comes easily as compared with all the electric apparatus that they are trying to sell in a retail way. You can see immediately the advantage to a salesman. I am speaking now as though you were all manufacturers and none of you were on the road. But what an advantage to be able to say to a man: 'Why, yes; we will provide you current at 3 cents a kilowatt. You can get it right in your own factory.'"

The writer speaks, of course, from the viewpoint of the automobile man. His remarks are interesting, but many a central station will be unable to furnish current for batteries profitably at three cents after midnight or at any other time.

Domestic Science Lectures and Demonstrations in Dubuque.

The city of Dubuque, Iowa, has many enterprising citizens who are always doing things, usually something new. Now the Dubuque Woman's Club, which is composed of 400 of the representative women of the city, and the management of the Union Electric Company have joined in giving a series of lectures and demonstrations in domestic science. The affair is under the auspices of the household economics division of the Woman's Club, assisted by Mr. L. D. Mathes, general manager of the Union Electric Company. It is conducted at 436 Main Street, where there is a fine showroom with 50 feet front. Here the opening, on Monday night, April 1st, took the form of a reception by the Woman's Club and a lecture on "The Science of Housekeeping" by Mrs. F. Violet Sanborn of St. Louis. Admission to the reception was by

FACSIMILE OF INVITATION TO OPENING LECTURE IN DUBUQUE.

cards of invitation, a reduced reproduction of which, together with the musical programme, is presented here.

The opening reception was distinctly a society affair, attended by many of the best people of the city. There were palms and potted plants, electrically prepared refreshments, music and plenty of electric light.

After the reception the doors were thrown open to the public. The plan is to have the series of lectures and demonstrations continue for 15 days from the opening. Other lecturers on the programme besides Mrs. Sanborn are Prof. Isabel Bevier, head of the household-science department of the University of Illinois at Urbana, Mrs. Norton of Chicago University, and the head of the domestic science department of the Iowa State College at Ames. All these women are talented and well able to present the material upon which they will talk and demonstrate.

A five-room cottage is fitted up in the display hall in the most modern fashion. The feature of the cottage is in the electrical applications. Electric lights are used for illumination and for decorative effects. The dining table has a bouquet of electric lights in variegated colors and ferns.

Electric cooking and heating devices fill the kitchen. Among them the chafing dish is very popular as a solution of the problem of midnight suppers and late breakfasts. The demonstration is entirely educational, but it will no doubt create much interest in the possibilities of electric heat, power and light in the household.

Central Electric Railway Association.

The regular bimonthly meeting of the Central Electric Railway Association, composed of Ohio and Indiana electric-railway men and others interested in traction development, was held in the Algonquin Hotel, Dayton, Ohio, on March 28th. The attendance was good, perhaps the best outside of the annual meetings ever held by the association, while the interest and enthusiasm has not been surpassed by any previous regular meeting.

The members came by electric railways from all points of Ohio and Indiana, and in several instances some record runs were made, the most notable being that made by the Fort Wayne party, which covered the distance of 150 miles in a little less than five hours. This record would have been beaten by the Indianapolis special carrying 37 members and guests had they not been laid out for half an hour at Richmond.

The morning session was called to order by President H. A. Nichols, but before any order of business was announced ex-President E. C. Spring presented Mr. Nichols a bunch of roses and carnations and in a graceful speech congratulated him upon his election to the presidency of the leading electric-railway association (outside of the national association) in the country. After the applause had subsided President Nichols responded briefly, saying that he regarded the position one of honor and that he thanked the association for it.

After the reports of the officers were made the regular programme of the meeting was taken up. Two papers were read at the morning session. The first was on "Track Bonding," by Thomas B. McMath, civil engineer of the Indianapolis and Terminal Traction Company. Mr. McMath said the earliest track bonding coming under his experience was that of old tram rails on wooden stringers. The bond consisted of a No. 4 galvanized wire with about two turns around a set rivet. The next effort under his knowledge still retained the galvanized iron wire feature, but a wire was run full length of the track and connecting with each joint bond. The failure of bonding during these periods was not hard to explain. The entire track construction was too weak to secure a proper return. It was a mistake to expect this construction sufficient for electric cars if it were only bonded. The channel pin was generally used with wire bonds and held its own in popularity and efficiency until driven out by bonds concealed under the fishplate. Its efficiency was due to its easy application by unskilled workmen; its failure was due to ease with which the copper was stolen on exposed track.

Mr. McMath described each type of bonding in its evolution and cited tests of efficiency among them. The description was made interesting and instructive, because he pointed out the principal causes of failure or partial failure in some of the types of bonds used. He said the manufacturers do not pay sufficient attention to smooth terminals. Frequently terminals are so rough that an appreciable flow of material under compression will be required to bring cavities into contact.

The use of a bond brazed to the rails by means of an electric brazing device gives the best contact that can be obtained, but this form of forging a bond can only be entrusted to a workman of the highest skill. Mr. McMath urged the necessity of bond testing and described the simple instruments required. Too little attention is given to the condition of the bonding. A bond supervisor should be employed to make proper inspection. A test car for the general inspection of bonding would be a good investment for electric-railroad systems. Such a car gives general conditions, registers the open joints or breaks in contact and will show the conditions in bonding for less expenditure per mile than any other method.

After the paper was thoroughly discussed and many questions asked and answered, the next paper was read by Mr. C. Skinner, master mechanic of the Sciota Valley Traction Company of Columbus, Ohio, on "Car Wheels." Mr. Skinner described the different types of car wheels now in use on the electric lines, gave the dimensions, the tread and the flange of the wheel which he deemed the most satisfactory for safety and durability. He said it had become necessary to reduce the size of the wheel flanges somewhat in order to operate over city streets, and in his judgment the flange dimensions may be safely reduced to 1⅛ inches, or one inch in depth, and to 1¼ inches, or 1⅛ inches through the throat, but was firmly of the opinion that the four-inch tread is essential to safe tracking and to obtain proper efficiency in breaking with heavy equipment.

Mr. Skinner gave a brief resume of the experience of his company with the wheel question, the wear on flanges and the average mileage life of certain types of wheels used. This paper likewise provoked a good discussion and many good points were brought out.

The first paper presented in the afternoon session was on "Car Inspection," by Mr. Lees M. Jacques, master mechanic of the Fort Wayne and Wabash Valley Traction Company. Mr. Jacques said car inspection is considered one of the most important services required in electric-railway management. This is true from the standpoint of safety to the public, maintenance of proper sched-

ule and economy in maintenance of equipment. The old adage that "a stitch in time saves nine" is expressly applicable to the safety of travel and the maintenance of electrical apparatus. Individual car inspection will discover small defects, prevent accidents, such as burning out of controllers and derailments caused by broken flanges and the consequent results. Since the electric lines are handling many more people than the steam lines they should be equal if not superior to them in regard to inspection and maintenance of equipment, and this can be accomplished only by thorough and complete inspection at frequent intervals. Mr. Jacques described the facilities necessary in a first-class inspection shop and explained in detail methods employed by the road with which he is connected. This paper aroused quite an animated discussion and considerable difference of opinion relative to methods employed.

One point in particular was debated pro and con, and that was as to the advisability of educating motormen up to a point of such proficiency as will enable them to make repairs on disabled cars. Some of the members said that it was not advisable to spread the repair shop from one end of the line to the other; that motormen are not supposed to get down under a car and make repairs, but only to report to the shop foreman any impairment they may have discovered. Others said it was a good plan to promote motormen from the shop where they had first learned all about a car and its machinery and in case of emergency could readily repair slight impairments and proceed with the run. However, it was agreed that inspection and repairs should be made by competent and skilled men and that inspection could not be made too frequent to safeguard against accidents to the public, to the equipment and for the financial economy of the road. The more thorough and frequent the inspection the less the liabiilty to damage suits and the more economical the service.

The concluding paper was read by Mr. M. M. Baxter, electrical engineer, Western Ohio Railway Company, Lima, Ohio, on "Trolley Wheels." Mr. Baxter is a good reader and his paper was well received. The discussion of this paper brought out a variety of experiences with trolley wheels, and the many suggestions made were regarded with much favor by the members.

The papers read at this meeting were regarded as being the most interesting and instructive yet read during the history of the association and the writers were given a special vote of thanks for having prepared such admirable and instructive papers. The express matter question was deferred until the May meeting to be held in Indianapolis.

A vote of thanks was extended to the Algonquin Hotel management, to the people of Dayton and to the various interurban roads for courtesies extended and free special trains for transportation.

S. S.

New England Electric Lighting Engineers.

The Association of the Electric Lighting Engineers of New England held its fifth annual meeting on March 20th and elected officers as follows: President, W. S. Mulligan, Springfield, Mass.; vice-president, A. H. Kimball, Fitchburg, Mass.; secretary and treasurer, P. C. Brown, Boston; executive committee, J. C. Norcross, Hudson, Mass., S. F. Smith, Salem, Mass., W. P. Hazeltine, Lynn, Mass., A. E. Bliss, Malden, Mass., G. E. Crosby, Boston, and C. H. Miles of Lexington, Mass.

Papers were read as follows: "Automobiles in Central-station Practice," by D. F. Burritt of Springfield, Mass.; "The Moore Tube System of Lighting," by Prof. H. E. Clifford of the Massachusetts Institute of Technology; "High-efficiency Units," by Mr. Deane; "Employers' Liability; Its Benefits and Cost," by Mr. Linscott.

Papers were also presented on the desirability of establishing a department for the soliciting of new business, by presidents, managers and solicitors of various electric-lighting companies.

Mr. Burritt's paper was a plea for the use of motor cars instead of horse-drawn vehicles, on the grounds of efficiency and economy. Mr. Deane dealt with the possibilities of increased candlepower and daylight quality of illuminants.

Electric-light Plants for Lighthouse Tenders.

The Lighthouse Board at Washington is calling for proposals for the construction of eight lighthouse tenders, each of which is to be equipped with a complete electric plant, which may be furnished by the contractor for the vessels or may be bid for and installed separately. The generating sets will be two in number for each ship and of the steam-turbine type, one to have a capacity of about 13 kilowatts and the other of seven. They will operate under 190 pounds steam pressure and will be equipped to operate condensing or non-condensing as desired. The dynamos will be direct-current multipolar machines, compound-wound, of 110-125 volts, to operate at an approximate speed of 2,000 revolutions per minute. Switchboard apparatus is also to be provided. The vessels will each be wired for 154 16-candlepower incandescent lamps, not including the running lights. The running lights will form a separate and independent circuit and will consist of two sidelights, three masthead lights on the foremast, one on the mainmast and the towing aft light. These lamps are to be of 32 candlepower. There will be one 18-inch searchlight for each vessel, with pilot-house control, the mirror to be of the Mangin type.

Official Aspects of Radio-telegraphy.

The select committee of the British House of Commons, which was appointed (see Western Electrician of January 12, 1907, page 38) to consider the radio-telegraphic convention signed at Berlin on November 3, 1906, and to report what, from the point of view of national and public interests, would in its opinion be the effect of the adhesion or non-adhesion of Great Britain to the convention, began the hearing of evidence on March 20. Sir John Dickson-Poynder presided, and there are on the committee Mr. Sydney Buxton, the postmaster-general, and Mr. George Lambert, civil lord of the admiralty.

Mr. H. Babington Smith, secretary to the post-office, who was under examination throughout the sitting, stated that the use of wireless telegraphy was increasing very rapidly. Only a small proportion of the stations in use or in course of construction are on British territory, and the greatest number are in the United States. At present there is a preponderating number of stations on the Marconi system in Great Britain, Italy and Canada, but in other parts of the world, with very few exceptions, they are on other systems. In answer to a question by the chairman as to whether wireless telegraphy would in time be likely to supersede ordinary telegraphy, the witness said that it did not seem probable that it would ever be able to compete with ordinary telegraphy on land, but there could be little doubt that if transoceanic communication could be effected with certainty and at reasonable speed there would be an extensive field for its employment in long-distance transoceanic communication. It would, however, he should think, be subsidiary to and not in substitution for cables. At present 20 messages passed from ship to shore for every one that passed from shore to ship.

With reference to the Berlin conference, the witness declined on grounds of public policy to produce the instructions which were given to the British delegates, but stated generally that they were instructed to secure the conditions considered necessary by the admiralty, and the admiralty delegates were instructed to judge independently whether those conditions were satisfied. He pointed out that the objects aimed at by the convention could not have been secured without such an international agreement.

The committee afterward subjected the witness to a searching examination with regard to the special position of the Marconi company, whose policy was stated to be to make it a condition of supplying its apparatus that it should not be used for communication with any other system. He had no doubt that the main object of the Marconi company had been to secure a monopoly by forcing all ships that pass along British shores to use this particular system in order to be able to communicate with the British coast at all. He enlarged upon the very serious objections to a monopoly from the point of view of public interests.

Continued High Price of Copper.

The price of copper still remains high, and it appears that the only way to secure a reduction in price of that commodity will be to develop new mines and expand the old ones. Until this is done high prices are likely to prevail, unless, of course, the demand should fall off, which, from the present outlook, seems unlikely.

New York quotations of March 28th gave the price of Lake copper at 25¾ cents. The reported decline in the market price at London, England, a couple of weeks ago did not amount to anything.

Commenting on the situation in the March number of Copper and Brass, a new Detroit publication, Paul Leake says:

"Although it is a fact that copper is being shipped almost red hot from the smelters at Lake Superior, manufacturers are complaining that they cannot get the metal promptly, and are behind in the delivery of their spring orders in consequence. Many have had to carry over into March orders that should have been delivered in February. This is especially true of the brass trade."

"There are inquiries in the market for several millions of pounds of Lake copper for delivery up to the end of June this year. It is positively stated that the American Brass Company is in the market for 1,000,000 pounds for one of its constituent properties, while one of the western brass foundries is also endeavoring to obtain a like amount for April, May and June deliveries. Twenty-five and a half cents a pound has been paid for round lots of Lake copper for June delivery. It is said the United Metals Selling Company shaded its price one-eighth cent for electrolytic beyond June, while 24¼ cents rules for shipments up to the end of that month."

The president of a corporation which is said to consume 75,000,000 pounds of copper a year is credited with the following rather enigmatical utterance:

"There will be plenty of copper to go around among the larger interests in the copper and brass-working trades. The increase in copper production is small; the increase in consumption is apparently moving along at about the gain of 10 per cent. more than the world's output. I do not think copper will move beyond 25½ cents for a few weeks. I cannot see any ground for the belief that the big producers can hold the market down to 25 cents. Natural conditions will bring about higher prices in most base metals."

The United States Navy, it is said, will use 3,655,000 pounds of copper during 1907.

BOOK TABLE.

LOOKING FORWARD: The Phenomenal Progress of Electricity in 1912. By H. W. Hillman. Northampton, Mass.: Valley View Publishing Company. 1906. Pp. (5 by 7½ inches), viii., 310, with six full-page illustrations, including a portrait of Edward Bellamy. Price, $1.50.

One characteristic of this story is pre-eminent: it is electrical through and through, from first to last, from cover to cover. Raising the veil of the not-distant future in modest emulation of Bellamy's well-known sociological novel, Mr. Hillman tells in the form of a simple tale of love and adventure what may be expected of the progress of electricity in the next few years. Himself an electrical man of wide acquaintance, the author alludes to many men, business corporations and localities prominent in electrical affairs, using pseudonyms that but thinly disguise the real persons and places. In this way many phases of electrical activity are presented before the book ends satisfactorily with a grand electrical wedding. Thus, Thomas A. Edmunds is Edison, George Westlington is Westinghouse, the Glendale Electric Company is another well-known "G E" company, and so on.

Of course the hero is an electrical engineer, and the heroine has also taken the electrical course at her college, for in 1912 it was thought wise that women should be conversant with an industry which had such an important bearing on the home life of the country in cooking and other household arts. At that time the electric automobile had replaced all others, and, more than that, electric railroad trains ran from the Atlantic to the Pacific. Even the spikes that held the rails were driven by the electric sledge-hammer. Street lighting is effected by small arcs set in building fronts with powerful reflectors behind and an opal shade in front to soften the light; these lamps burn a thousand hours without attention, which, as the author says, is a radical advance in the art. San Francisco is rebuilt, or partly rebuilt, without chimneys. Even the toothpowder in use is an electrolytic product, and on every hand the marvels of electricity are exhibited.

One of the wonders of the age was the electric aeroplane, developed by Lord Kelton. This airship is operated by "wireless" from stations on the earth's surface. The hero's party pays a visit to England en route to the International Electrical Congress, and Lord Kelton takes them for a ride in his electric airship. Assuming that this distinguished host is in real life Lord Kelvin, as one would suppose, one cannot sufficiently admire his lordship's scientific ardor, for he was at that time 88 years old. However, although the voyagers have an exciting adventure in mid-air, due to the machinations of the villain, they reach their destination in safety.

In Berlin the party meets Emperor William, and finds that he too is greatly interested in electricity. Chicagoans will be pleased to know that His Majesty had met "Louis Fernaldson" and thought him a charming fellow. Further, the hero declares that the "Shecargon Edmunds Company of Shecargon, Ill.," is the largest and most progressive electrical company in the world—"first in light, first in heat and first in the power of the industrial world." "It has been said that the management of this company was the best, most energetic and successful of any company in the world." The president of the company is complimented in glowing terms.

The interesting fact is revealed that in 1907 the National Electric Light Association changed its name to the National Electrical Association, for the power and heating ends of the business had become such important factors in the industry that the title was not broad enough. This is, in sober earnest, a sensible suggestion and worthy of attention. But the greatest wonder of many in the book is the calm statement that when this association met in San Francisco, in 1912, at the first session "promptly at 10 o'clock all the delegates had taken seats." All attendants at electrical conventions will agree that that accomplishment was indeed revolutionary.

The Syracuse and South Bay Electric Railroad Company of Syracuse, N. Y., has been incorporated with a capital stock of $1,500,000. The incorporators are A. K. Hiscock, W. Nottingham and C. D. Beebe, all of Syracuse.

New Type Direct-current Generators and Balancer Sets.

A complete line of direct-current generators ranging in size from 1½ kilowatts to 17½ kilowatts has lately been developed by the General Electric Company. The machines, illustrated in Fig. 1, are designated as type CQ, and embody

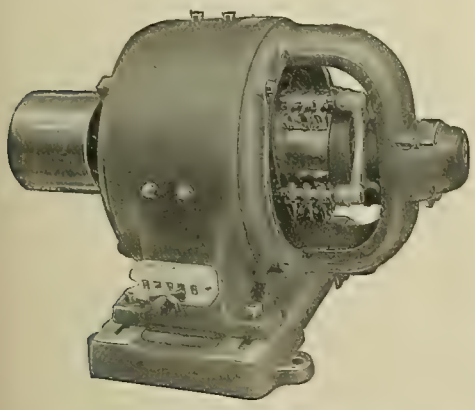


FIG. 1. NEW DIRECT-CURRENT GENERATOR.

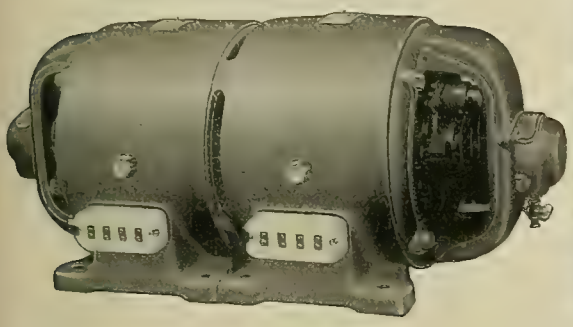


FIG. 2. NEW BALANCER SET.

the compact cylindrical construction which has been found so satisfactory in the CQ and CR motors. They are especially applicable as exciting units for alternating-current generators or as direct-current generators for small power-plant purposes, where a low-capacity belt-driven generator is suitable.

Compactness is the keynote of the design of CQ generators. The bearing heads are so constructed that the machines can be installed on floor, wall or ceiling, thus adapting generators to crowded locations. Because of the general compact construction, as well as the good quality of material incorporated, the magnetic circuits are short and the iron losses are low.

Field and armature coils are form-wound and removable, and both receive a special insulation treatment which renders the coils practically impervious to water. The field coils are held in position by the flanged tips of the steel pole-pieces, which are seated firmly in the field frame by bolts passing through the frame and secured with nuts. The armature coils are held in toothed slots on the core and extend beyond the end flanges, being firmly banded, to prevent vibration or movement. This form of winding gives a large radiating surface for the conductors, and so keeps the temperature rise very small.

The bearings are arranged with ring oilers, and, as has been mentioned, can be adjusted for wall or ceiling installation by turning the bearing heads through 90 or 180 degrees. Carbon brushes, sliding in finished box guides, are firmly held against the commutator by adjustable individual springs. Due to the excellent electrical constants, as well as the careful commutator and brush construction, the generators will, it is said, operate sparklessly from no load to full load, without shifting on the brushes.

Standard CQ generators, as described, are compound-wound from 120 to 125 volts and from 240 to 250 volts full load.

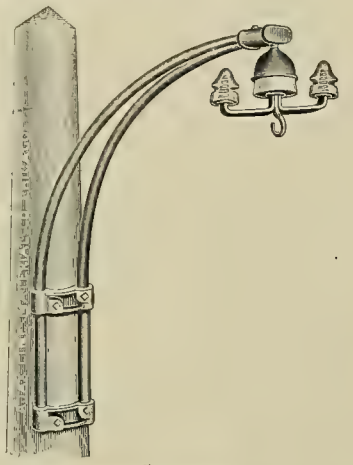
A further development of the CQ type of generator is the balancer set, shown in Fig. 2. For the regulation of three-wire systems, the compactness and simplicity of the new machines make them peculiarly suitable. The outfit consists essentially in grouping two CQ generators as one, with both armatures mounted in a single shaft. This elimination of end shield and middle bearing reduces to a minimum the floor space occupied by the balancer sets and permits of grouping the set neatly in a generator room where floor space is already at a premium. In operation, one armature revolves as a motor, while the other acts as a generator, the action interchanging according to which side of the three-wire system has the greater load.

The generator frames are riveted together through space blocks, the common armature shaft being used to eliminate the third bearing. To strengthen the shaft at the point of greatest deflection, an intermediate armature head is mounted between the armatures.

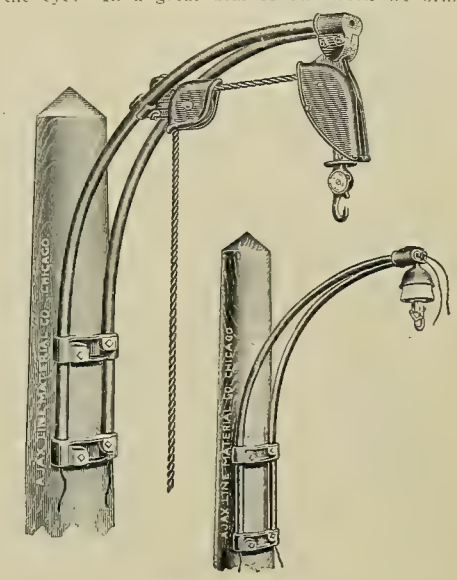
This method of compactly grouping the generators necessitates a somewhat limited amount of air space betwen the generator frames. Good ventilation, however, is assured by placing on the shaft, between the armatures, a fan which draws in air through the ventilating spaces and permits as good temperature guarantees as are obtained in the individual CQ generators.

Ajax Arc Lamp Brackets.

The curve is the line of beauty, and when the curve brings with it simplicity and strength it lends itself to practical designs. Hence the three arc-lamp brackets pictured herewith. One is adapted to be wired through the piping; another has a high voltage cross-arm for guiding the line wires while also insulating the lamp, while the third is designed to lower the lamp for trimming and is entirely self-contained, both the outer safety pulley and the inner companion pulley being fastened to the fixture itself. All three types have



"QUADRANT" FIXTURE.



"PULLEYED" FIXTURE. "FRONT" FIXTURE.

universal plates which fit either round poles, square posts or flat walls, and are supplied by the Ajax Line Material Company of Chicago.

Illumination as Affecting the Eye.[1]

By Dr. Wendell Reber.

The most delicate photometer we have is the retina of the eye; it is the original of all photometers. We use the photometer sometimes in our work to ascertain various data. In certain people excessive tobacco smoking will reduce the acuteness of light perception. In others, lead workers, for instance, you will find very greatly reduced light perception, especially if their vocation is such that they inhale the lead dust. Painters are not so liable to reduced light perception as are workers in lead fixtures.

The retina, which is about as thick as a piece of tissue paper, is in itself a most marvelous chemical laboratory. It is the camera, dark room, and the whole thing in one, and the most wonderful chemistry is done there that is done in the world. It takes the picture, develops it, and presents it to your vision all in one operation.

The retina is backed up with a pigment layer, to do away with radiation, and if people work under too high a light stmulus, a certain amount of the protection got from the pigment is used up. These people usually begin to show an intolerance of ordinary light. Of course, today, when you begin to talk about ordinary light, the question arises, "What is ordinary light?"

There is a greater temptation to abuse the human eye today than there ever was. Nowadays light can be instantly produced in any hour of the twenty-four. Not so in the days of candles, when people went to bed early. We turn night into day in almost every possible way, and in almost every way we use our eyes in a manner that our forefathers never did. Everyone does now about three times the work in 16 or 17 hours that people did 100 years ago, and the consequence is many people are wearing glasses.

Of course, the matter of lighting public buildings, schools, etc., is one of the big present-day problems of this country. Twenty-five years ago the Germans were prompted to go into this matter because their generation was rapidly becoming near-sighted. Japan is pushing them hard for that honor. With the Germans the cause is found in three things: Abominable type, insufficient illumination and poor hygienic conditions, all of which they are making terrific struggles to overcome. They went at their schools and applied their principles in the right way, and every German scientific publication of today is published in the Gothic type, and they are trying very hard to use it in their textbooks. The average person who studies Greek or German is in danger of becoming near-sighted.

It is evident that we are developing a large proportion of near-sighted young people in our schools, and the ratio of those who are far-sighted is much lower than it ought to be. Every schoolhouse ought to be constructed to get the greatest amount of light consistent with the safety of the building. For the minimum amount of light there should be not more than five square feet of floor space for each square foot of glass. The German government intends creating a commission of architects or engineers to decide how the lighting of the schools shall be carried out, and this question will receive attention as new schools are built.

Discussion.

W. C. L. Eglin: What is the effect of heat upon the eye? In a great deal of our work we bring the lamp close to the eye and it throws a good deal of heat directly on the eye. Another point: Are not too much light and a wrong position of the lamp more frequently the cause of eye straining than not enough illumination?

Dr. Reber: There is no doubt that heat does affect the eye, but not to any considerable extent. Men who attend furnaces, such as the pig-iron furnace men, often show decreased light perception, but as to the heat given by a desk light or other similar light, I doubt whether that will have any effect upon the optic nerve.

In reference to reflection and consequent straining of the eye, if one works on a very light paper with the eye close to it, an excess of light is thrown into the pupil. Light coming directly at one is apt to strain the eye; hence the advice to have the light coming from behind. If the light comes from a direction in which one is looking, the eye is unduly embarrassed, and for that reason too strong a contrast will be quite as trying as too little light.

C. O. Bond: Would it help matters to give the paper a tint instead of making it all white?

Dr. Reber: The question of color opens a big subject. A yellow light is not a greater irritant than a violet light; in fact, the violet end of the spectrum is much more irritating to the eye, and green, standing midway in the spectrum, is the most restful. For that reason some advocate lightly tinted green paper, and some say they find it no more restful than ordinary white paper. The idea is prevalent in many quarters that yellow is very trying to the eye. If that is a fact, light shades of yellow seem to be very freely used. Blues, as a rule, are trying.

A celebrated oculo-physicist in France thought that if he used a violet glass, called "azurline" glass it would solve all difficulties. This man thought of filtering out the rays through this glass, and his own eyes were very much easier with lenses made of it, but he found that a light smoked glass gave him the same relief.

1. A discussion before the Philadelphia section of the Illuminating Engineering Society, January 18, 1907.

The Supply of Platinum.

Platinum has, during the last few years, exhibited a phenomenal rise in price. It is stated that about 90 per cent. of the world's supply of the metal is furnished by the Ural district of Russia, and according to the Commercial and Industrial Gazette of St. Petersburg, the value of platinum in 1890 had more than doubled in 10 years, and was then 6,200 rubles (a ruble is equivalent to 51 cents) per pood (36-112 pounds).

In 1901 the price per pood was 16,000 rubles, in 1902, 17,300, in 1903, 18,500, in 1904, 21,000, while last year the price rose from 22,000 rubles in January to 34,000 rubles in October.

During the period under review the amount of metal exported has been constantly on the increase.

Charter Day at Clarkson School of Technology.

The eleventh anniversary of the granting of the charter of the Clarkson School of Technology of Potsdam, N. Y., by the University of the State of New York, was observed on the evening of March 18th by appropriate exercises in the chapel hall. The programme, which was an interesting one, contained an address on "Capacity for Service an Ideal in Technical Education," by Frederick R. Hutton, E. M., Ph.D., Sc.D., of New York city, professor of mechanical engineering at Columbia University, and president of the American Society of Mechanical Engineers.

Professor Hutton presented in a masterly way the service ideal as a working and workable philosophy of life, and urged its being set up as an ideal in technical education of the twentieth century. The speaker, in referring to the developing of the thesis of the service ideal, suggested the establishing of two points, namely, that the service ideal is a defensible one in philosophy as an ideal for a life, and that technical education favors or can favor this ideal.

Mr. Rea M. Gordon, B. S., assistant engineer of tests of the Solvay Process Company of Syracuse, N. Y., communicated a response on behalf of the Clarkson Tech. Alumni Association, which was read by the director in Mr. Gordon's absence.

Telephone News from the Northwest.

The Conde Telephone Company of Conde, S. D., has been incorporated, with $50,000 capital stock.

The committee in the Minnesota senate to which was referred the bill to prevent telephone companies from making unreasonably low rates to drive a competitor from the field has killed the bill.

The telephone exchange of H. Fant at Thief River Falls, Minn., will be turned over to a stock company, and the system rebuilt.

Charles B. Vaughan has resigned as manager of the Bell Telephone Company at Dillon, Mont., and will go to Goldfield, Nev.

The Rockwell (Iowa) Farmers' Telephone Company will be incorporated with a capital of $25,000. J. H. Brown is president.

The Shields Telephone Company of Germania, Wis., has filed articles of incorporation, with a capital of $5,000. C. E. Peirce heads the list of stockholders.

The Madison (Minn.) Telephone Company has purchased $3,000 worth of material for improvements on its system. R.

Indiana Telephone Items.

The Big Springs Telephone Company has filed articles of incorporation, proposing to build and operate a telephone system throughout Boone, Hamilton, Clinton, Marion and Montgomery counties, with main office and exchange at Big Springs P. O. Addison Highbee, Elias Edwards and F. M. Cobb are directors.

The directors of the Stendal Home Telephone Company are asking for bids for material and for the construction of a number of extensions to its lines.

The Lewis Telephone Company, at Lewis, has completed its organization and is now preparing to build telephone lines throughout portions of Vigo, Clay, Sullivan and Greene counties. The company is in the market for a new switchboard.

The Chicago Telephone Company has set aside $100,000 for the improvement of its service in Hammond and Lake County. The growth of the company has been so phenomenal in Lake County during the last few years that extensions must now be made, and switchboard facilities increased. New toll boards must be put in at Indiana Harbor and East Chicago, and when Gary is a city the company is confident fully 20,000 telephones will be added to supply the demand.

The Home Telephone Company of Elkhart announces an increase in rates, to go into effect July 1st. Business telephones will be $2.50 a month and residence telephones $1.50 each, an increase of 25 cents.

The extent of the damages suffered by telephone companies where street and interurban lines have been constructed in the same street or highway containing telephone wires, by reason of the conduction of leakage from railway plants, thereby destroying the telephone service, is bound to come to the front for adjudication. The electric railway companies say the telephone companies ought to put in metallic circuit lines, and the telephone companies insist that the electric companies be compelled to remedy the difficulty. The electric companies say it is not a question of priority of rights, but a question as to which company will be put to the most expense in the installation of a metallic circuit.

A telephone service is being installed by the Pennsylvania Railroad on all its lines in this state. A telephone instrument attached to their telegraph wires answers the purpose. All the city and local offices are being supplied with telephones.

The Home Telephone Company of Ft. Wayne has just completed the installing of 8,000 feet of aerial cable at its Auburn exchange, where a growth of nearly 25 subscribers each week is reported. The company has also added 12,000 feet of cable to its Sturgis, Mich., exchange, just across the Indiana line, and will next add 15,000 feet of aerial cable to its Kendallville exchange.

At a recent meeting held in Logansport by representatives of Independent telephone companies from the First, Second and Third districts, the Independents resolved to turn down the proposition of the Bell company to close the Bell exchanges where there is competition if the Independents will take the Bell company's toll lines into their board and give it only the toll business which cannot be sent over Independent lines. The Independents say they have no need of such toll lines; that they will soon have toll lines covering the entire field and can afford to remain entirely independent.

The second annual convention of the Indiana Independent Telephone Association will be held at Indianapolis May 15th and 16th. S.

Ohio Independent Telephone Association.

The annual convention of the Ohio Independent Telephone Association was held at the Hartman Hotel, Columbus, Ohio, on March 28th, there being present nearly 350 telephone operators and delegates and about 40 representatives of manufacturing firms. Mayor Badger delivered the address of welcome on behalf of the city.

The report of President Frank L. Beam of Mt. Vernon showed that on March 30, 1905, the state of Ohio had 196,937 Independent telephones, with 668 exchanges, 1,452 toll stations and 17,029 stockholders. On October 1, 1906, there were 270,720 Independent telephones, with 835 exchanges, 1,663 toll stations and 24,650 stockholders. At the present time Ohio has approximately 300,000 Independent telephones, owned by over 25,000 stockholders. During the year 1906 almost every Independent company in the state paid dividends on its stock.

The International Independent Telephone Association was represented at the convention by J. B. Hoge, president; J. A. Harney, assistant secretary, and G. W. Weippert, managing editor of the Telephone Chronicle, the new magazine published by the international association.

The following vice-presidents of the association reported the condition of the movement in the following districts: C. L. Norton, No. 1, Cleveland; W. F. Laubach, No. 2, Akron; J. B. Rhodes, No. 3, Zanesville; H. B. Folsom, No. 4, Circleville; W. Gilbert Thompson, No. 5, Hamilton; I. H. Thedieck, No. 6, Sidney; D. M. Odaffer, No. 7, Marion; R. E. Hamblin, No. 8, Toledo; Dwight E. Sapp, No. 9, Mt. Vernon.

From the nine districts of the state the following were named as delegates to the international convention to be held at Chicago in June: District No. 1—F. A. Knapp, Bellevue; E. L. Coen, Vermillion. District No. 2—W. F. Laubach, Akron; J. F. Smith, Cadiz. District No. 3—A. H. Doudna, Bridgeport; A. B. Hobson, Flushing. District No. 4—H. A. Marting, Ironton; G. A. Schleyer, Circleville. District No. 5—William R. Fee, Milford; Charles E. Biehn, Georgetown. District No. 6—John A. Ainsworth, Dayton; W. W. Fisher, Bellefontaine. District No. 7—George H. Metheoney, Lima; J. A. Longwell, Van Wert. District No. 8—E. L. Barber, Wauseon; J. G. Steinkamp, Elmore. District No. 9—G. R. Johnston, Columbus; A. A. Whitney, Mt. Gilead.

The election of officers for the ensuing year resulted in the re-election of the former officials, as follows: President, Frank L. Beam; secretary, O. O. Welsheimer; treasurer, Ralph Reamer.

An elaborate banquet, held on the evening of the same day, brought the convention to a close. Andrew L. Harris, governor of Ohio, was the first speaker. Clarence Brown of Toledo spoke on "The Telephone Situation from a Point of View of a Professional and Business Man." Henry A. Lanman, president of the Columbus Citizens' Telephone Company, referred to the changed conditions which the securities of the Independent companies now occupy in the financial world.

Norman C. McCloud of Cleveland gave a short talk on "The Wireless Telephone." C. R. Krickenberger of Greenville spoke on "Hello," and Dr. Alfred Robinson of Ironton closed with an address on "Pride."

The convention was voted the most successful in the history of the association.

The Second District convention of the Central Union Telephone Company officers was held in Bloomington, Ill., last week. A number of interesting papers were read, as follows: "Prompt Reports and Collections," by I. P. Bach of Peoria; "The Public and How to Meet Them," by J. B. McMillan, of Decatur; "Village Subscriber and Our Farmer Subscriber," by W. Y. Ramsey of Petersburg; "Our Friend, the Opposition, Methods and How to Meet Them in a Business Way," by J. E. Halligan, of Quincy; "Maintenance of Plant and Co-operation of Employes," by Fred Beckman of Bloomington.

CORRESPONDENCE.

Continental Europe.

Paris, March 20.—A new outfit of steam turbines has lately been installed in the municipal plant of Bremen. Some time ago the station was equipped with a steam turbine of the Parsons type of 750 horsepower, which was added to the then existing equipment. The new outfit consists of four Zoelly turbines, and each unit is rated at 1,200 kilowatts. Up to the present date there are two of the new groups erected in the station, and the others will soon follow. The new boiler outfit consists of eight combination boilers, having 300 square meters heating surface, with mechanical stokers.

The town of Karlowo, Bulgaria, is making arrangements for installing an electric plant for public and private lighting which is to cost about $60,000. A new electric-light plant is soon to be erected by the municipality of Oravica, Hungary. In Roumania, the town of Focsanie will take measures for carrying out a considerable amount of work, so as to secure the needed current for the public lighting.

At Montreux, Switzerland, lying on Lake Leman, it is proposed to connect the wharf of the lake boats belonging to the Compagnie de Navigation with the railroad station, which lies at an elevated point. Two demands for concessions are presented by different companies for an electric-traction system which will climb up the grade. The first of these plans, presented by Zähnder-Spörri, calls for a line equipped on the third-rail system and passing in tunnel under the railroad tracks, then climbing the slope and reaching the railroad station. The difference of level is about 70 feet, and trains of 40 tons can be drawn without needing to use a rack-rail. The project calls for the sum of $560,000. A less elaborate project is presented by Cottier and Francey, in which the line will leave the wharf and end at the bottom of a large shaft. An elevator will take the cars up to the higher level, and there will be no need of changing cars. About $60,000 would be needed for the construction.

The Italian government is actively carrying on the work upon the radio-telegraphic stations which are erecting at Rome, Milan and Turin and also in the islands of Sicily and Sardinia. It has been decided to open these stations for public use.

On the 4th of April will be held the annual exhibition of the French Physical Society at Paris. As in preceding years, there will be a display of the latest physical apparatus of all descriptions, among which electrical apparatus will figure largely. I hope to describe some of the most interesting features.

A new single-phase short line railway is to be run in France from Tergnier to Anizy, in the Aisne district, and the railroad company has recently ordered the electrical outfit from the Société Westinghouse of Havre. The outfit includes the machines for the principal generating plant and the motor cars. About the first of June of this year is the date fixed for the opening of the new road.

A new electric power distribution company is in formation in the Rhone district of France, and it is to erect a hydraulic plant of considerable size at Cize-Balozon, in the Ain district. High-tension lines will run from the plant and are to cover a large extent of country. After passing the town of Bourg, the line will run toward the Saone River, lighting Chatillon and a number of other localities. At Taussans the line divides into two branches which run in different directions. The Southeast Railroad Company intends to use current from the lines in order to operate tramway systems which are to connect with the railway lines.

The Municipal Council of Rome is examining a project which is presented by the Technical Bureau as regards the erection of a central electric plant and its future increase. For the first outfit of 3,000 kilowatts the project calls for an expenditure of $700,000, and the first increase of 1,000 kilowatts will need an additional expense of $500,000. When the tramway system is reorganized there will be another extension of the plant, making a total outlay of about $2,600,000. A. DE C.

Great Britain.

London, March 22.—It is not at all beyond the bounds of possibility that some drastic measures will be taken by some of the leading electrical manufacturing concerns in Great Britain to place the industry on a sounder financial basis. So much has been heard during the last two years of dwindling profits, owing to excess of competition, that there may be some truth in the rumor that is floating around of an impending amalgamation of some of the larger companies.

Parliamentary sanction has been given for the introduction of the Dolter surface contact system of tramways at Oxford. The National Electric Construction Company, which is fostering this system in Great Britain, has now succeeded in "placing" it at Torquay, Folkestone, Hastings, Rawmarsh and Mexborough and Oxford. At Torquay and Rawmarsh the tramways systems are in successful operation, and the estimates in connection with the latter have proved remarkably correct.

The military authorities have expressed them-

selves dissatisfied with present searchlight arrangements and have intimated an intention of conducting experiments to bring about greater efficiency. This is interesting as showing the greater interest that is now being evinced by the British military authorities in the application of science to military operations. In the new army scheme special radiotelegraph companies have been formed to which sets of Lodge-Muirhead apparatus have been issued. These are giving the best results of any of the various systems of wireless telegraphy yet experimented with by the war office. Practically every system has been tried, but it is not at all unlikely that the royal engineer officers themselves will soon bring a system of their own, for they are working very hard at the present time with that object in view.

Between January 1, 1906, and March 31, 1907, 60 miles of tramway single track has been constructed upon the conduit system by the London County Council, and 42 miles of single track of horse tramways has been reconstructed upon the same system. Some 121 miles, single track, of electric tramways is now in operation in the County of London, of which 34 miles is in the north of London and 87 miles in the south.

A legal decision of some moment has just been given concerning the private-wire business of the National Telephone Company. It is now well known that a complete monopoly has been invested in the postmaster-general for all telegraphic and telephonic communication within the United Kingdom. In addition to its license for ordinary commercial business the National Telephone Company has developed a very considerable private-wire business, and the question involved was whether or not these private wires were within the exclusive privilege which the statute has given the postmaster-general. The courts have held that this portion of the company's business does fall within the monopoly.

The Poplar Borough Council has persevered in its attempt to undertake the manufacture of electrolytic disinfecting fluid for general sanitation purposes. I have made mention of it on several previous occasions. Twelve months have elapsed since the project was put into practical use, and during that time 17,000 gallons of disinfectant was disposed of, having a strength of from 4 to 4½ grammes of available chlorine per liter. The cost of keeping the borough supplied with disinfectant in this manner has worked out cheaper than did the supply of ordinary carbolic disinfectants during the three previous years. Electrical energy to the amount of 2,500 kilowatt-hours at 3 cents each was consumed.

In consequence of the terrible muddle in which the electricity finances of the Woolwich Borough Council have got, a special rate of 1s. 8d. on the pound has had to be levied for the coming year. The loss to March 31, 1906, was over $50,000.

G.

New York.

New York, March 30.—The Rapid Transit Commission is about to begin advertising for bids for the construction and operation of the Lexington and Eighth Avenue routes. The bids will be opened on April 25th. Separate offers will be asked for the construction alone and for both construction and operation. The plan provides for through trunk lines from the Battery to the Bronx and alternative bids for the extension south from the present subway at Forty-second Street and Broadway and an extension north from a junction of the subway at Forty-second Street and Park Avenue.

The Retail Dry Goods Association of this city has adopted a report emphasizing the pressing necessity for improved rapid-transit facilities and has invited a number of civic organizations to a conference to be held soon to consider the rapid-transit situation.

A joint hearing on the public utilities bill was begun on March 27th before the Senate and judiciary committees at Albany. Assemblyman Warren I. Lee is considering a plan of offering an amendment to the bill placing the telephone companies under the control of the proposed commission.

Now that a period of favorable weather has begun, work on the Pennsylvania Railroad's terminals and tunnels is going forward with great rapidity. A considerable section of the tunneling is actually completed. There has been another "meeting" of tunnels, this time in Long Island City. The southernmost of the four tubes being driven from East Avenue under the Long Island Railroad passenger terminal toward the East River has reached the river shaft and is now connected with the tubes that go out under the water. About 85 per cent. of the excavation work for the big terminal in Manhattan is completed. The greater part of the steel work which is to support Eighth Avenue as a bridge over the underground track is in place.

H. H. Stock, B. Sc., M. E., of Scranton, lectured at the Art Gallery last Wednesday evening before the departments of geology and electricity of the Brooklyn Polytechnic Institute on "Applications of Electricity in the Anthracite Coal Fields." The geography of these coal fields was first described, and it was shown that the large number of mines concentrated within a small area brought about changes in economic conditions, such as the increased royalties now demanded for coal, greater care required for preparing it for market, increased cost of mining through greater depth and thinner beds of coal, and increased economics wherever possible. The first steam-turbine plant used in mining is located at the Hampton plant of the Delaware, Lackawanna and Western Railroad and is used in connection with the central electric power station of the different companies. A brief description of the methods of mining anthracite and of the experiments made with undercutting machines, such as are used in mining bituminous coal, was given, and then the subject of electric haulage was dwelt upon at some length as being the most important application of electricity in the authracite field at the present time. The development of the mine locomotive dates from 1887, when the first one was used at Larkin, Pa. The lecture was fully illustrated, while hoisting and pumping, signaling and lighting and the use of electricity with anthracite breakers for preparing the coal for the market were described in detail. In closing Mr. Stock gave a resume of the advantages of electric power in anthracite mining and brought out many points, such as the cleanliness and the sanitary advantages of the better air.

D. E. P.

New England.

Boston, March 28.—The Massachusetts legislative committee on public lighting has held its last hearing on ex-Congressman William S. McNary's petition for legislation authorizing the building of an electric plant by the city of Boston. At this hearing Mr. McNary cross-examined E. W. Burdett, counsel for the Edison Electric Illuminating Company. Mr. Burdett said that he did not have the figures showing the reduction in cost during the last 10 years or the expenditures for improvements during the last year, and that the company's annual report to the state gas and electric-light commissioners would show the company's dividends, net earnings and surplus. The reserve fund, he said, was not all in the form of cash, but it was a bookkeeping charge and became part of the plant. He stated that the acquisition of plants in places near Boston had been accomplished by increasing the company's capital and that the purchase prices did not come from the earnings. Mr. McNary suggested that it would have been better to have used the money to reduce the rates in Boston, but Mr. Burdett thought that profits from the suburban plants had enabled the company to reduce rates and give better service. He thought the Boston rates were higher than those in other cities and he attributed this to higher expenses, the putting of wires underground under exceptional difficulties, and the greater cost of coal and labor.

The Southgate Building Company has leased a building corner at Broad and Batterymarch streets, Boston, and an electric plant will be installed to generate heat, light and power for manufacturing concerns which may occupy it. The building is seven stories high and covers an area of 10,000 square feet.

The Todd Electric Manufacturing Company has filed a preliminary certificate of dissolution at Hartford, Conn.

A fire in the store of James Wilkinson & Co., electricians, at 49 Franklin Street, Boston, a few nights ago, caused a loss of $1,000.

The New England Telephone and Telegraph Company has accepted plans for a telephone-exchange building at Wellesley, Mass.

The Wilkinson Company, Incorporated, electrician, of New Bedford, Mass., has been incorporated by James Wilkinson, Lester C. Billings and George H. T. Brown. It has a capital of $15,000.

The Henry D. Temple Company, electrician, Worcester, Mass., has been incorporated by Henry D. Taylor, Carl H. Page and George A. Gaskill, for $4,500.

The Electric Cable Company has accepted plans for the enlargement of its plant at Bridgeport, Conn., by the erection of a one-story brick factory, 100 feet long and 50 feet wide.

The New England Telephone and Telegraph Company moved its Melrose (Mass.) exchange to its new building at 56 West Foster Street, last Saturday. The common-battery system has been installed in place of the magneto system. There are 1,000 telephones connected with this exchange.

Harvey Hubbell, manufacturer of machine screws and electrical specialties, has obtained a municipal permit to build a concrete factory, four stories high, in Bridgeport, Conn.

The Edison Electric Illuminating Company's stockholders' right to subscribe for the 11,495 shares of new capital stock, at $215 per share, has expired. The stockholders took only about 600 shares of the stock. The balance will be sold at public auction at a date not yet fixed.

The Consolidated Railway Company has promised to build an electric railway between Hartford and Middletown, Conn., as soon as possible. The cost is estimated at $350,000. The company has obtained a charter and franchise for this line.

B.

Ohio.

Toledo, March 30.—Electrically speaking, this is to be the banner year in the history of Toledo. The outlook at the present time shows that there will be an increase of fully 50 per cent. in the building operations this year over those of last year, which were the largest in the history of the town. Not only is there bound to be a great amount of electrical work of the smaller construction sort, but already several owners of important plants have signified their intention of altering them this season. Several smaller factories are known to be in the market for electrical equipment, and several new projects have already been started. Principal of the new projects is the new Commonwealth Hotel, a 12-story structure. The contract for this job has not been let as yet. It will be a very large one; in fact, one of the largest in this part of the state, and competition for the work is very hot.

The Toledo Gas, Heat and Electric Company, which has been doing considerable changing over and remodeling during the last year, is practically at a standstill with this work now, and will probably not do any more with it until after its heating plant has undergone an overhauling. It has also been stated, somewhat authoritatively, that this company intends to erect a large sub-station on the East Side, but as yet nothing of a tangible nature is obtainable, and the company will not discuss the proposition.

The Toledo Railways and Light Company has installed a considerable amount of small power and construction work in its new summer resort, Ottawa Beach, situated about 10 miles down the river, on Maumee Bay.

Work on the new White City is progressing rapidly, and a great amount of wire and lighting work will be done there within the next few weeks. It is also probable that before the summer is over the Toledo Railways and Light Company will erect a sub-station on Central Avenue, to care for the increased load caused by the opening of the White City and by the rapid building up of that section of the town. Preliminary plans for this proposition have, in fact, been made, and the matter has been taken up by the directors of the road in Cleveland, but so far there has been no public announcement of what is to be done.

The Central Heating and Lighting Company, located in the Meredith Building, which supplies several stores and buildings in the immediate vicinity with lighting current, has just placed its orders with the F. Bissell Company for two small Northern Electric generators, to replace the old machines, which have served their time. With the installing of the new machines a 220-volt three-wire system will be installed.

One of the latest electrical devices to strike Toledo, and perhaps one of the most talked-of propositions that have been here for some time, is a large "talking" electric sign, installed on the Clinton-Close Building at the corner of St. Clair and Adams streets. This is the same type electric sign that has been installed in many of the larger cities, but it is the first one to reach Toledo. Because of its uniqueness it is proving to be a decidedly clever bit of advertising. The sign used here is operated by a 15-horsepower motor, and cost about $2,000 to install.

The electric-light and power-house plant in North Baltimore, owned by Dr. A. G. Henry, which supplied this city with light and power, was destroyed by fire last week, entailing a loss of about $25,000, partially covered by insurance.

For the fifth time in 15 years the F. Bissell Company of Toledo is undergoing an alteration of its plant. The offices, which have been located on the first floor, are being moved to the second floor, with the exception of the accounting department, thus giving the sales department the entire ground floor in the front half of the building. The second floor is undergoing a complete overhauling.

The F. Bissell Company last week was awarded the contract for the installation of the electrical equipment for the new factory of the American Bottle Company, located at Newark, Ohio. This contract calls for the furnishing of 12 separate equipments, to be used in the operation of 12 Owens automatic bottle machines. These machines are composed of three separate parts, known as the bottle machine itself, the glass tank and the lehr. The tank motor is two horsepower, 500 revolutions per minute, which is used to keep the glass tank revolving, to keep the glass at a perfect mixture. A five-horsepower, 500-revolution motor keeps the bottle-blowing machine revolving, so that the finished bottles can be automatically placed in the tempering oven. In the tempering oven is placed a three-horsepower, 400-revolution-per-minute motor, which keeps the bottles moving until they are cooled. These motors are all semi-enclosed, protected from mechanical injury, and gear-connected to the machines. Special panel boards will be made for each equipment. Between each two machines is located a 40-horsepower, 750-revolution-per-minute Piqua blower motor, which supplies the air pressure to operate two blowers. In addition to this equipment, there will be installed one machine-shop motor of five horsepower at 1,000 revolutions per minute. There will be 12 complete sets of the three smaller motors used in the op-

cration of the gathering, blowing and cooling of the bottles. The motors, with the exception of the blower, are all of the Northern type. The generating plant, it is understood, will be installed by the Allis-Chalmers Company of Milwaukee.

With the transfer of the Toledo and Western Railroad to the Toledo Railways and Light Company on Thursday, the Everett-Moore syndicate of Cleveland now controls the Toledo Railways and Light Company, the Toledo and Western, the Detroit, Monroe and Toledo; the Maumee Valley Electric, the Lake Shore Electric; the Detroit United, and some other smaller eastern properties. C. F. Franklin will continue as president and general manager of the Toledo and Western. Joseph S. Young will succeed J. R. Nutt of Cleveland, and W. R. Hodge will succeed Edward Kelley on the board of directors. Three new passenger combination coaches have been ordered. One new 50-ton electric locomotive has been contracted for, and work has been started on the reballasting of 25 miles of the line. Altogether, about $100,000 will be spent in improvements this summer.

The old Fisher Electric Company of Toledo has been reorganized and is now known as the Toledo Electric Company. New capital was taken in, and C. Maher, formerly general superintendent of the Toledo Home Telephone Company and before that foreman with the Central Union Telephone Company, was elected a director in the new concern and selected as general manager. The company will occupy its old quarters at 116 St. Clair Street, but the building will be remodeled and new equipment installed. H. L. S.

Michigan.

Grand Rapids, March 30.—It has been discovered that the Michigan statutes make it unnecessary for electric power companies to secure franchises in cities through which they wish to pass their lines or in which they wish to sell power. The law gives to the cities only police power as to the setting of poles and construction of lines. It is probable that a bill will go through the present session of the Legislature repealing this act and providing for the granting of franchises to these companies. In the meantime the Grand Rapids-Muskegon Power Company and the Commonwealth Power Company are doing business in a dozen cities without the necessity of buying franchise rights. The combined capital of these two companies is $7,000,000.

The city of Pontiac has brought suit against the Pontiac Standard Lighting Company to annul a 10-year contract with the company for the lighting of the city. It is alleged that the company has failed to provide additional lamps needed, has not lived up to its agreement to provide commercial lighting, and that its lines are in such condition that they are a menace and have destroyed the night telephone service in the city. The city asks $10,000, the forfeiture of the company's $5,000 bond and an order to force the company to remove its poles and wires from the street.

The Edison company of Detroit has started work on the development of the Huron River power, and a 415,000-horsepower plant will be installed at Lowell, near Ypsilanti, with three water wheels. Inside of a year another dam, with a 22-foot head, is to be built a quarter of a mile above the present dam.

The Grand Rapids Hydraulic Company of this city is preparing to expend $20,000 this year. Among the improvements will be a private lighting plant.

Work on the power dam at Berrien Springs has been commenced, with 100 men on the job. The dam is being built by the Berrien Springs Power and Electric Light Company, and is in charge of the village president, A. B. Ayers.

The Michigan United Railways is having trouble in the city of Kalamazoo. The city demands the payment of $16,000 back paving taxes within 10 days or forfeit of the franchise. The company has not yet made good. Its employes are on the verge of a strike and will decide at a meeting with the officials of the company Tuesday whether to walk out or remain in case their demands are not granted. They ask higher wages. I. W. B.

Indiana.

Indianapolis, March 30.—The Michigan City gas works and the electric light plant have been merged under one corporation, to be known as the Michigan Light and Gas Company. C. H. Geist of Chicago, who owns several gas and electric plants in Northern Indiana, is president. Mr. Geist owned the gas plant, and recently bought the light plant owned by the Michigan City Light and Power Company from the Boyd syndicate for $150,000. The Geist Company, controlling both interests, will be incorporated at $300,000. H. B. Hoyt and E. G. Staschen of Michigan City, and H. B. Hurd and W. F. Booth of Chicago, are officially associated with Mr. Geist.

The city of Alexandria has been without electric light and power for a week on account of the bursting of the boilers and the water pipes underground. The Alexandria Light and Power Company has been under care of a receiver for some time, and the service has not been satisfactory. The plant will likely be sold to persons who propose to rebuild and re-equip the plant and extend the service.

The work of harnessing the St. Joseph River for electric power purposes began several years ago. Last week the fourth big dam of the series of six was started. The enterprise is the project of the Berrien Springs Power and Electric Company, of which Fred A. Bryan, of South Bend, is vice-president. Although the three other dams are in successful operation, few people realize what the project means to Northern Indiana. It is in reality one of the greatest power undertakings ever attempted in the middle West. With its completion this electric system will furnish power to run the factories in all the cities within a radius of 100 miles of South Bend.

After eight years of litigation Judge McMahon of the Laporte County Circuit Court has granted a permanent injunction to prevent the city of Laporte from paying money or anything of value to the Laporte Water Supply Company, holding that the city is an undisputed owner of the $100,000 water plant.

The plants of the Seymour Gas and Electric Light Company and the Madison Light Company have been placed in the hands of receivers. The Western Gas and Investment Company is interested in these plants.

The Southern Electric Construction Company of South Bend has incorporated, capitalized at $100,000. The company's object is to build an electric railway from Washington, Daviess County, to Martinsville, Morgan County; also to construct, equip and operate power houses and plants for the generating and distribution of electricity for heat, light and power. The incorporators are T. J. Moore, Chicago; John F. Noel, South Bend, and O. H. Gabel of Indianapolis.

In the new railroad law for Indiana there are 13 different items relating to the prohibition of dangerous structures and the use of safety appliances on steam and electric railroads.

The Indiana Union Traction Company has completed a modern and attractive terminal station in Kokomo. The structure and equipment is complete to the minutest detail and General Manager Nichols is delighted with the building in every particular.

The Indianapolis and Northwestern Traction Company is making what is considered very effective and novel improvements in its water-cooling tower just south of its power house in Lebanon. The tower has been closed at the sides and ends and in the sides have been placed four big eight-foot air circulating fans, two on a side. These powerful fans will be operated by a 50-horsepower engine. The air currents provided are expected to cool the water much quicker and more effectively than by the means now in vogue. The plan is being watched by interurban companies.

The Terre Haute traction and light properties have been turned over to the leasing company, known as the McGowan syndicate. A general change in the management and in the policy of operation will be inaugurated at once. In the transfer of this property, Mr. McGowan has promised Terre Haute one of the most up-to-date local and interurban systems in the country. A large amount of new equipment will be put into service during the present year.

The Indianapolis Traction and Terminal Company will celebrate the beginning of the spring April 1st, by placing 15 new cars in service, all of the latest type and improvements. These cars can be readily prepared for summer or winter use, and are attracting favorable attention. S. S.

Illinois.

Peoria, March 30.—J. M. Robb, who has resigned as secretary and treasurer of the Peoria Gas and Electric Company and who leaves the company, tonight was presented a gold watch and fob by his associates in the employment of the company.

The Lincoln Railway and Light Company of Lincoln has been incorporated with a capital stock of $2,500, to operate street railways, light, heat and power plants. Incorporators are M. O. Payne, Charles H. Scott and Thomas Marshall.

The Farmers Telephone Company, of Sandwich, has been incorporated with a capital of $5,000, to operate a telephone system. J. S. Knights, F. L. Sleezer and O. H. Anfinsen are incorporators.

The Peoria Gas and Electric Company has given another donation of $500 to the Young Women's Christian Association. The young women are endeavoring to raise $65,000 to build a new building and the gift this week by the company is in addition to a like gift of some time ago. In a voting contest, the prize being a trip to Europe, being held here by one of the daily papers, the company has given a $20 gas stove to be awarded as a consolation prize.

In all, the company is following an extensive line of advertising, the latest being a request to send in the names of five people who do not use a gas stove; if the company sells the five stoves the sender of the list gets $5. This is called the Gasco Club. Membership, two cents; benefits, $5.

The Mount Sterling Telephone Company of Mount Sterling, has been incorporated with a capital of $12,000, to operate telephone lines. Incorporators are Alex. H. Clarke, Edwin Pendleton and Edward E. Clarke.

The Peoples Electric Light Company, of Canton, is considering the proposition to do heating, and is making a canvass of the city as to securing enough business to make it a paying proposition.

The Sullivan Mutual Telephone Company has been incorporated with a capital of $17,000. Incorporators are C. E. Harsch, J. C. White and W. I. Sickafuss.

Ray Smith, who formerly ran the electric light plant at Henry, has gone to Depew. Peter K. Smith takes his place.

Papers of incorporation of the Virden and Taylorville Traction Company have been filed. The nominal capital is $2,500. The officers are: President, John Gelder; treasurer, T. B. Tory; secretary, E. E. Barclay. The line will be built from Roodhouse to Taylorville first, but the ultimate intention is to construct a line from Quincy, Ill., to Terre Haute, Ind. The complete line as proposed is from Quincy to Hannibal and from there to Winchester. From Winchester to Roodhouse, and from there directly through Virden and Taylorville to Findlay, thence into Terre Haute, Ind. Short spurs will be built from the main line to Carrollton, Springfield, Sullivan and Shelbyville. It is the intention of the company not to enter any territory now covered by a traction company. Eastern capitalists have been interested in the project and there is said to be no lack of capital.

Negotiations are being made for a new park about five miles east of Decatur. The park will be connected with the city by an interurban line and be used as an amusement park for the summer. The park will not be under the management of the interurban company, but will depend upon the company for its success.

The contract for the construction of the Springfield and Jacksonville line of the Illinois Traction Company has been let to Tuttle and Company, who are building the Decatur-Champaign line. Three hundred and fifty thousand yards of dirt will have to be moved. The contract for the Springfield Belt Line has also been let to the same company. V. N.

Northwestern States.

Minneapolis, March 30.—The commission appointed by the secretary of war to investigate the feasibility of using the superfluous water flowing through the government dams of the Mississippi met in St. Paul last week. It is proposed to utilize this power for lighting and power at Fort Snelling and for the federal buildings at Minneapolis and St. Paul. Major W. V. Judson is chairman of the commission.

The Newton and Northwestern Railway Company has announced that it will have its line from Boone to Des Moines, Iowa, in operation by August 1st.

The large new power dam at Decorah, Iowa, which has just been completed at an expense of $100,000, was destroyed last week. It is thought that the trouble was caused by the fact that it was undermined by quicksand. The loss is practically total.

The Sparta-Melrose (Wis.) Railroad Company has organized with G. S. Cromwell of Milwaukee as president, and H. Teasdale of Sparta, secretary. It is planned to build a trolley line between these towns and to also furnish electric lighting.

The municipal electric-light plant and city hall at East Grand Forks, Minn., was destroyed by fire, the loss being about $50,000. At a mass meeting following the fire, it was decided not to rebuild the plant, but to enter into a contract for lighting with the Grand Forks (N. D.) Gas and Electric Company.

An electric-lighting franchise has been granted at Campbellsport, Wis., to E. H. Palen and W. L. Anderson of Pewaukee.

K. Krueger proposes to construct an electric-light plant at Westbrook, Minn. R.

Dominion of Canada.

Winnipeg, March 30.—The City Council of Calgary, Alberta, has decided to build a municipal electric-street railway to run along the principal streets of the city. A committee appointed to estimate the cost of such a line reports that the work will cost $250,000. It is understood work will be commenced as soon as weather permits, in the spring. City Engineer Thorold or Mayor Cameron may be addressed.

The council of Miniota, Man., has decided to install a municipal telephone system with 275 miles of pole line. Francis Dagger, provincial telephone expert, has reported on the proposed system and finds that the cost per subscriber will not be more than $15. J. L. Thompson, Beulah, Man., may be addressed.

The Alberta Southeastern Telephone Company, Medicine Hat, Alberta, has commenced active work

and already a large amount of supplies have been received. John Huston is president of the company.

The Alberta government has set aside $200,000 for the construction of telephone lines within that province. Already a number of long-distance lines are under construction and several others are now being planned. It is expected the center of the long-distance lines will be at Medicine Hat.

Owing to the extensive programme for the construction of long-distance telephone lines about to be undertaken by the Manitoba government it has been found necessary to appoint a new minister with sole charge of the work. Hon. J. H. Howden has been selected for the work, and in addition he is minister of telegraphs and railways. His office is in the provincial buildings, Winnipeg, Man.

Last year the city of Winnipeg spent $57,000 on street lighting.

The Crows Nest Pass Electric Light and Power Company, Fernie, B. C., has decided to establish telephone connection with Elkmouth and Hosmer, B. C., at once.

A. C. Reed of Kenora, Ont., has been engaged as superintendent of the electric-light and power plant at Moosejaw, Sask., at a salary of $2,000.

The Bell Telephone Company has apparently been beaten by an Independent telephone company at Crystal City, Man. A dispatch from that town is to the effect that the Bell company has offered to sell its plant there to the Louise Telephone Company. This is the announcement made after a bitter fight between the two companies.

The Canadian Pacific Railroad is going to build a railway line between New Westminster and Eburne, B. C., and as soon as it is completed it will be "electrified" by the British Columbia Electric Street Railroad Company.

The annual report of the Winnipeg Electric Company shows the receipts for 1906 amounted to $1,416,305, an increase of 26.47 per cent.

J. McMillan has been appointed superintendent of the Canadian Pacific Railroad Company's commercial telegraphs, with headquarters at Calgary, and R. N. Young has been appointed assistant superintendent, with headquarters at Winnipeg.

At a cost of $250,000 the City Council of Prince Albert, Sask., has decided to develop the electric power on the Sheel River and tenders for the work will be called in the near future. City Engineer Moon has charge of the work. R.

Pacific Slope.

San Francisco, March 28.—About 100 indictments have been returned by the grand jury in the sensational proceedings of the municipal "graft" investigation. F. J. Heney, who is managing the prosecution, has announced that it will probably require two years' time to complete the exposing and prosecuting of the grafters. After the cases against Mayor E. E. Schmitz and Abe Ruef, together with a number of wealthy alleged bribe-givers of high positions have been disposed of, the police department will be thoroughly purged of graft. The present proceedings are in connection with the granting of franchises to public service corporations. Additional indictments were brought this week against representatives of the Pacific States Telephone and Telegraph Company in connection with alleged bribery of supervisors and arrests followed. President Henry T. Scott and other officers of this company insist that they are innocent of crime.

According to published confessions of supervisors, nearly every one of the members of that extraordinary board is said to have received a bribe of $750 to affect his vote on the ordinance, which is passed each year, fixing the minimum rate to be charged for commercial lighting by gas. The proposed gas rate of 75 cents was increased to 85 cents. W. B. Bourn, the former president of the San Francisco Gas and Electric Company, has been called before the grand jury to explain what his attitude was toward the alleged corruption of city officials at that time. The wholesale destruction of the records of the Pacific States Telephone and Telegraph Company and of the San Francisco Gas and Electric Company has made it difficult to trace the financial transactions of these concerns at the period under consideration.

The City Electric Company has applied to the Board of Supervisors for permission to tear up the streets of San Francisco for the laying of conduits for the new distributing system for light and power. As soon as the ground dries up a little after the prolonged rains the digging of trenches will be prosecuted vigorously by the new company, which has been working for some time on its power station at North Beach. Contracts were closed some time ago for two 2,500-kilowatt Westinghouse-Parsons steam-turbine generators for this system. The generators are 11,000-volt, three-phase, 60-cycle. Charles C. Moore & Co. have taken the contract to furnish water-tube boilers. The company has leased rooms for offices on the ground floor of a new building on the corner of Grant Avenue and Bush Street.

It is reported that the San Francisco Coke and Gas Company, for which J. C. H. Stut is engineer, means to rush the installation of a second independent electric-light and power plant in San Francisco and will soon order a 5,000-kilowatt turbine generating set. The company is increasing its gas business, having extended its mains considerably south and west.

The Sierra Nevada Electric Company, headed by H. E. Huntington of Los Angeles, Cal., and capitalized at $1,000,000, was incorporated in this city yesterday. The company purposes to supply power for lighting and irrigation for the greater portion of the San Joaquin Valley. With Huntington in the project are associated William G. Kerckhoff, A. C. Balch, J. S. Eastwood and Frank N. Short. It is reported that the forming of the company was hastened by the recent change that was made by the United States Bureau of Reservations, whereby the Department of Forestry was accorded unlimited control of the timber and water reservations in both California and Nevada. It is now proposed to levy a tax upon the sale of all electric power generated by hydro-electric plants located within the boundaries of the numerous forest reserves. This is considered a great hardship by electric power promoters and will have the effect of discouraging manufacturing enterprises and preventing competition with the three big electric power corporations in California.

Advices from Portland, Ore., say that Harriman interests, which recently purchased the Corvallis and Eastern Railroad, propose to construct an electric instead of a steam road from Portland into Clackamas County, following the Clackamas River to a point about 20 miles from that city, where a town site is to be located. Power will be developed from the river for the generation of electricity. A.

PERSONAL.

Homer E. Niesz, of the Chicago Edison Company, is spending a week or two in California. Mr. Niesz is combining business with pleasure, it is said.

Herbert A. Wagner, Dr. William Benham Snow, Edward L. Haines, William J. Clark, Henry L. Doherty and Dr. F. A. C. Perrine were among the new members of the New York Electrical Society elected on March 27th.

The Société d'Encouragement of Paris has awarded the Ampère gold medal, which is the highest prize at its disposal, to Dr. A. D'Arsonval, the well-known French physicist and electrician, for his work in the electrical field.

Miss Harrisa Marguerite Low, daughter of Mr. and Mrs. Willard W. Low, will be married on April 10th to Mr. James M. B. Irvine of Los Angeles, Cal. The father of the prospective bride is president of the Electric Appliance Company.

Asa R. Beers, one of the founders and promoters of the Allentown (Pa.) and Reading Traction Company, died recently at the age of 63 years. Mr. Beers was a director of the company up to the time of his death.

H. S. Bolton, formerly chief electrical engineer of the Mexico City tramways, has been engaged, it is said, by the General Electric Company to superintend the installation of all the power-plant machinery for the Guadalajara (Mex.) electric street railway.

Edward C. Nichols, vice-president and general manager of the South Side Elevated Railroad of Chicago, and president of the village of Maywood, Ill., died on March 28th at his home in Maywood of pneumonia, at the age of 37 years. He was born at Maywood, and was graduated from the University of Michigan in 1892 and from the law department of the University of Chicago in 1894. Eight years ago he was appointed legal adviser of the elevated-railroad company.

A. J. Kennedy, who has been with the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., for a number of years in the engineering and later in their sales department, has associated himself with the Wire and Telephone Company of America at Rome, N. Y., as traveling representative of the company's sales department. Mr. Kennedy has a broad acquaintance in the telephone field and will no doubt be an important factor in developing the business of his new employer.

R. E. Breed, Jr., a former resident of Marion, Ind., who still has large interests in that city, has been elected president of the Gas and Electric Company of America. The company owns and controls electric and steam-heating plants in 26 cities, including Marion and Muncie, Ind.; Canton, Ohio; Altoona, Pa.; Auburn, N. Y.; Wheeling, W. Va.; Atlantic City, Rockford, Ill., and other places. The company recently set aside $5,000,000 to be used in further improvements and the erection and purchase of other plants. Mr. Breed maintains his office in Philadelphia.

W. L. Abbott, chief engineer of the Chicago Edison Company, has been elected to succeed L. H. Kerrich, who died on March 15th, as president of the board of trustees of the University of Illinois. The appointment was made at a meeting of the board held in Chicago on March 20th. Mr. Abbott, who is an '84 graduate of the university, was elected a member of the board in 1905 for a term of six years and his interest in the university has been constant and helpful for many years. The demise of Mr. Kerrich occurred the day after his (Mr. Kerrich's) election to the presidency of the board.

Ex-State Senator Maro S. Chapman of South Manchester, Conn., who was president of the Hartford, Manchester and Rockville Tramway Company when its control passed to the Consolidated Railway Company, died of heart failure at a private sanitarium in Yonkers, N. Y., on March 21st. He was 67 years old.

Mr. J. E. Woodwell, inspector of electric-light plants for the United States Treasury Department, has been appointed a member of the commission provided by Act of Congress to examine and report concerning the use by the United States of the waters of the Mississippi River flowing over the dams between St. Paul and Minneapolis, Minn. As a government electrical engineer, Mr. Woodwell will give especial attention to the possibility of utilizing electric power which may be developed at the dams for the United States buildings in St. Paul and Minneapolis under the control of the Treasury Department.

The London Sketch of February 27th says that the engagement is announced of Mr. George Westinghouse, Jr., only son of the president of the Westinghouse Companies, to Miss Evelyn Violet Brocklebank, youngest daughter of Sir Thomas Brocklebank, Bart., of England. It is said that the two first met in one of the Westinghouse factories, to which Miss Brocklebank was paying a visit. The gentleman who escorted the young lady around the big plant proved to be Mr. Westinghouse. Thus, it is reported, an acquaintance was first formed which ultimately culminated in the engagement.

ELECTRIC LIGHTING.

Switzer and Salsbury will install an electric-lighting plant at Ridgeway, Mo.

The electric-light plant at Grand Forks, N. D., was recently destroyed by fire, said to be of incendiary origin.

John Martz, city electrician of Seward, Neb., has been engaged by the city authorities of Friend, Neb., as consulting engineer to build the new electric-light plant at that place.

Plans are being prepared for the Omaha (Neb.) Electric Light and Power Company for a sub-station northwest of the city to convert and distribute light and power to Benson and Dundee.

Fire on April 2d destroyed an electric-light power house at Twenty-second and George streets, San Francisco, belonging to the San Francisco Gas and Electric Light Company. Several sections of the city were in darkness for a time.

The Dubuque and Southwestern Wisconsin Railroad Company has purchased the municipal lighting plant at Galena, Ill., and also taken over the contracts for lighting Galena for 25 years. The plant never has been profitable, and was built on the funds of a bond issue, the interest on which has not been paid. The new company has agreed to furnish twice as much light as the city did at only a 10 per cent. increase in the present price.

Henry Hewitt, Jr., of Tacoma, Wash., and Seymour H. Bell of Coos Bay have closed a deal, it is said, with the Idaho-Oregon Light and Power Company for the waterworks and electric-light plant at Ontario, Ore., and for the electric-light plant at Meridian. The consideration was $90,000. The new purchasers were represented by Mainland Bros. of Oshkosh, Wis., who are the capitalists behind the Ox Bow power plant on Snake River, about 50 miles below Huntington. The new owners will enter into the electric-railway business in Eastern Oregon and Southeastern Idaho.

What is recognized as an important step in the development of South America is the concession from the government of Brazil to Guinle & Co. of Rio Janeiro to sell electricity in the capital city as well as other important cities in the republic. The contracts for light and power in Nictheroy and other cities along the proposed transmission lines have already been set. The initial electric power sources will include several hydro-electric stations just being completed. These have an aggregate capacity of some 50,000 horsepower. The electrical equipment was furnished by the General Electric Company of the United States. It is expected that work on the transmission lines will be started in June.

ELECTRIC RAILWAYS.

President James D. Hanna of the Chicago, Lake Shore and South Bend Interurban Railway line recently announced that the Chicago terminal is to be at Kensington, Ill., on the Illinois Central. Each line will build a new station, and there will be a subway for passengers to go from one line to another. Contracts for the entire equipment of the line, except cars, have been let, and most of the material is on the ground. Fifteen miles of the 75 have been completed, and the president expects the line to be finished by July 1st. The line will be a single-phase overhead system. It will

run through Hegewisch, Hammond, East Chicago, Indiana Harbor, Aetna and Michigan City, at which place the power house is being constructed.

The Board of Railroad Commissioners of Massachusetts has presented its opinion to the Legislature on the right of the street railways of Boston to carry freight. The opinion, which is based directly on the application of the Boston Elevated Railway Company to transport coal and supplies over its lines for its own use, places the matter in the hands of aldermen and selectmen, subject to such state supervision as will protect interests which are of more than local concern. The board would not recommend any legislation in the matter.

PUBLICATIONS.

Copper and Brass is the name of a Detroit monthly publication which made its first appearance in March. It is to be devoted to the interests of the copper, brass, bronze and aluminum industries. E. R. Kranich is the publisher and R. Marshall is editor.

"The Moore Light" is the title of a folder issued by the Moore Electrical Company, 52 Lawrence Street, Newark, N. J. The company asserts that the Moore light gives six times as much illumination for the same money as the ordinary incandescent electric lamp.

The constitution and by-laws of the Chicago Jovian Club have recently been published. Any member of the Rejuvenated Sons of Jove in good standing is eligible to membership. The annual dues are fixed at $5, payable within 30 days after the annual meeting held on the third Friday in January of each year.

The Maine Hub and Manufacturing Company, Inc., of West Seboois, Me., is sending out a folder on "Winter-cut Black Birch Insulator Pins and Brackets." The company says that the black birch of the state of Maine is the toughest birch known. A list of electrical concerns which carry, it is stated, carloads of the company's goods is given in the folder.

Bulletin No. 18 of the Chicago Fuse Wire and Manufacturing Company, 170 South Clinton Street, describes "Union" enclosed fuses, blocks and fittings. Other products manufactured by the company include fuse strip, open fuse links, telephone fuses, switch outlet and ceiling boxes. On pages 12 and 13 is given a table of dimensions of the National Electrical Code on stranded cartridge enclosed fuse.

Allis-Chalmers Company, Milwaukee, is distributing to the trade its miniature bulletins Nos. 4002, 4003 and 4004 on the subjects of "Allis-Chalmers Direct-current Motors and Generators," "Electric Hoists" and "Polyphase Induction Motors," respectively. While the booklets are not intended to give a very detailed description of the machines, nevertheless they will be found useful for reference, as they can be carried in the pocket.

The Gail-Webb Manufacturing Company of Buffalo, N. Y., has issued its catalogue and price list No. 1, describing and illustrating adjustable electric fixtures and portables for complete office and factory equipment. The goods listed include the "Universal" electric-light holder, "All-metal Universal" electric-light holder, adjustable ceiling, wall and floor fixture, adjustable portable, flexible portable, adjustable bench fixture and the Buffalo electric-light guard.

The latest Bulletin of the Bureau of Standards contains these contributions: "Preliminary Measurements on Temperature and Selective Radiation of Incandescent Lamps," by C. W. Waidner and G. K. Burgess; "Revision of the Formulæ of Weinstein and Stefan for the Mutual Inductance of Coaxial Coils;" "On the Determination of the Mean Horizontal Intensity of Incandescent Lamps by the Rotating-lamp Method," by Edward P. Hyde and F. E. Cady.

The Manhattan Electrical Supply Company, New York city, has just issued its condensed catalogue No. 22, covering "Something Electrical for Everybody." It contains 144 pages and over 750 illustrations of goods manufactured and handled by the company, and is compact and comprehensive. The list comprises electricians' supplies, telegraph instruments and supplies, automobile and motor-boat sundries, telephones and telephone supplies, electrical novelties, burglar and fire alarms, automatic gas-lighting specialties, linemen's equipment, medical apparatus and laboratory supplies. The catalogue is liberally illustrated, is supplied with an index and is of convenient size for ready reference.

The General Storage Battery Company, 42 Broadway, New York city, has issued a booklet on "Installation and Operation of Transportable Batteries." It is replete with information on the proper use of batteries, method of charging, capacity, connecting, acid density, quality of water, assembling, electrolyte, etc. The following three operating rules are given: (1) Keep elements covered with pure electrolyte of correct density; add only distilled water, or water approved by the company. (2) Put in more than you take out, but not much more. (3) Avoid contamination by corrosion of brass, iron, etc.; there is no telling what it may do and there is no good remedy for it: keep it out. The company will be pleased to furnish any information other than that appearing in the booklet, which may be obtained for the asking.

SOCIETIES AND SCHOOLS.

The New York Electrical Society, of which George H. Guy is secretary, has now 755 members, the largest number since its organization in 1881.

The next meeting of the New York Section of the Illuminating Engineering Society will be held on Friday, April 12th, at 8:15 p. m., at the Edison Auditorium, 44 West Twenty-seventh Street, New York city. Subjects for discussion will be as follows: 1. Standards of light, primary and secondary. 2. Comparative rating of inverted and upright incandescent gas lamps. 3. Desirability of combining different illuminants and lights of different color in stores. 4. Modifying effect exercised by reflectors and globes upon the distribution of light about a source.

The 1907 schedule of summer courses of the Massachusetts Institute of Technology, Boston, contains the following subjects of instruction: Mathematics, Mechanics, Drawing, Mechanic Arts, Modern Languages, Chemistry, Physics, Civil Engineering, Mechanical Engineering, Architecture and Biology. Professional summer courses will be conducted in several departments, as heretofore. The main object is to make students acquainted with actual industrial and engineering operations. Dana P. Bartlett, acting secretary of the institute, will be pleased to furnish any information desired.

POWER TRANSMISSION.

Consul-general Richard Guenther of Frankfort, Germany, reports that two large electric power stations are to be erected along the River Rhine at Augst-Wyhlen, each with 15,000-horsepower capacity. One of the power stations is to be located on the Swiss shore, the other on the German side of the river. The company erecting the works pays $13,124 to the Swiss Canton for the concession; also an annual tax of $17,254, besides supplying 5,260 horsepower electric energy at cost price to the Canton authorities. The company also obligates itself to pay $24,125 toward the erection of a new bridge over the Rhine.

At Duluth, Minn., the Great Northern Power Company is about ready to operate its high-tension power-transmission system. The first installation of machinery is nearly completed and the transmission line is in place, ready to receive the current. In the congested district in Duluth the current is carried underground, and every reasonable precaution seems to have been taken to prevent accidental contacts with other conductors. The carbolite works, at West Duluth, is in readiness to receive the 13,000-volt current from the power company, although much of the low-potential-current wiring will be overhauled.

At a recent meeting of the stockholders of the Guanajuato Power and Electric Company the proposition to amend the articles of incorporation of the company so as to increase the capital stock from $3,000,000 to $3,500,000 was carried. The new stock issue of $500,000 is to be exchanged for the entire capital stock of the Michoacan company. The Michoacan company owns a concession from the Mexican Federal government, covering two waterpowers on the Angulo River, about 35 miles east of the present plant of the Guanajuato company. The gross earnings of the company for the year ended December 31, 1906, were $263,444, against $195,300 in 1905, and the net profit increased from $60,423 to $105,667.

MISCELLANEOUS.

The Empire Mining Company of Dodgeville, Wis., will install an electrical system.

According to advices from St. Petersburg, a syndicate has been formed there for the exploitation of the rich copper mines in Russian Turkestan. The syndicate has acquired rights over 15,000 acres of territory. The district is said to comprise the finest copper-producing area of the whole of the Russian Empire. The company will shortly be formed with an initial share capital of 1,500,000 rubles ($750,000).

The practice of using electrical drive for operating cement-making machinery has brought about numerous new applications of the induction motor. The service required of a motor operating ball and tube mills is very severe, especially as regards starting, when the mass of material in the mill must be lifted until a certain point in the revolution has been reached, thus requiring high-starting torque. Allis-Chalmers Company has developed a line of squirrel-cage type induction motors which are suited for this particular purpose. The German-American Portland Cement Company of La Salle, Ill., whose plant is equipped throughout with Allis-Chalmers cement-making and electrical machinery, recently ordered two additional five by 22 feet Gates tube mills, and a special Allis-Chalmers induction motor which will operate geared to the tube mill, at a speed of 660 revolutions per minute.

TRADE NEWS.

W. A. Biddle of Brazil, Ind., has purchased the electrical business of H. O. Vuncannon.

The business of the Eagle-Mercer Electric Company of Topeka, Kan., has been taken over by Charles Eagle.

The Electric Supply Company of Ozark, Mo., has succeeded to the business of the Water Power Light Company.

Under the name of the Standard Electric Company, W. H. Ralston and E. E. Snider, formerly with the Central Electric Company of Colorado Springs, Colo., have opened an establishment in East Bijou Street, where a general electric business will be conducted.

Detailed information has been received by the Bureau of Manufactures from American consular officers concerning the proposed construction of two new electric-railway lines—one in a Latin-American city, the other in the Orient. The consuls indicate that there is an opportunity to supply American electric and railway supplies. Information may be obtained from the Bureau of Manufactures, Washington, D. C., by referring to file No. 795.

T. J. Hayes, president of the Hayes Electric Company of Aurora, Ill., has disposed of his interests in the business to William Carney of Oglesby, Ill. For a number of years Mr. Carney was connected with the Western Electric Company at Chicago. The firm which will retain the name, "Hayes Electric Company," will make a specialty of motor and electric-sign work. It is stated that Mr. Hayes will locate in the East, probably in New York city.

The change of name of the Sawyer-Man Electric Company to the Westinghouse Lamp Company, mentioned in the Western Electrician of March 23d, is of more than usual interest, for by it the name of a pioneer company in the lighting industry becomes a matter of history. It has, of course, been generally understood for some years past that the Sawyer-Man Electric Company was a Westinghouse interest, and the change of name is but a logical result of changed conditions.

It is reported from Sandusky, Ohio, that the new Warren Electric Company has taken over the property and plant of the Warren Electric Company, which has been in the hands of receivers for some time. M. H. Nason of Cleveland purchased the property from James Flynn, John Whitworth and R. A. Shuck, receivers, and immediately turned the property over to the new Warren company, recently organized under the laws of Maine. The following-named officers of the new company were elected: President, M. H. Nason; secretary, Frank Warren of Sandusky; general manager, N. L. Hayden of Columbus. It is asserted that the new company has plenty of capital back of it and that an aggressive campaign for business will be made.

BUSINESS.

The Hill-Wright Electric Company of 105 and 107 Reade Street, New York city, is a renewer of electric lamps. The company reports business in the renewing line as being in a very prosperous condition, orders being received from every state in the Union, even Alaska, and from Porto Rico. It is constantly in the market for burnt-out lamps, for which it says that it pays higher prices than anyone else in the business.

The Union Switch and Signal Company is now making a number of improvements to its plant at Swissvale, which, when completed, will practically double the productive capacity of these works. During the last year the company's business has increased to such large proportions—its earnings having been 4 per cent. on a capital of $3,000,000—that the management found itself greatly handicapped for room, and as the orders during the last few months have continued to demonstrate the permanency of this increasing business, the board of directors recently purchased 34 acres of land adjoining their plant for the purpose of adding to the shops.

The Wire and Telephone Company of America, at Rome, N. Y., wishes to inform the trade that the fire which destroyed a portion of its plant on February 23d last, will in no way hamper the company in the matter of delivery of its various products. The fire destroyed only that part of the plant in which the bare copper wire was drawn, and immediate arrangements were made for the drawing of copper by other mills. The company is erecting a large addition to its plant, which, in connection with the rebuilding of its wire mill, is now well under way. When these buildings are completed it will have a modern wire-manufacturing plant in connection with another new and modern building to take care of the telephone business. The new building, in course of erection, will be of brick and steel construction, absolutely fireproof. The entire manufacturing plant will be operated by electric power, the equipment being so

arranged that the machinery can be driven independently in groups. The handling of copper throughout the works will be done by pneumatic hoists.

The Trumbull Electric Manufacturing Company of Plainville, Conn., in a booklet recently issued describing its ironclad switches, advises the trade to "Keep Ahead of the Times and Stand Pat." The company states that it has been preparing for the day when the "death-knell" of the non-ironclad entrance switch will be sounded. In a new folder the Trumbull company describes "the dark hour" as "the time when a man who thinks he is saving his good money by using cheap switches suddenly wakes up and finds that he has only a 'bug-a-boo,' and that he has spent more than enough money in repairs and trouble to have bought the best switches." Trumbull switches have shown in recent heating tests, it is asserted, a rise in temperature of from 25 to 50 per cent. lower than that allowed in both full and overload.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 26, 1907.

848,006. Electric Controller. Roy W. Brown, Amsterdam, N. Y. Application filed April 19, 1906.

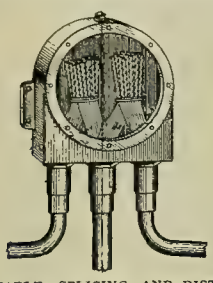
In the controller are combined a movable body having a number of contacts, a number of resistances connected to the contacts, a blow-out magnet located thereon and a number of fixed contacts adapted to make contact with the first-named contacts.

848,016. Electric Alarm. Jacob R. Donnenworth, Lacombe, Alberta, Canada. Application filed March 2, 1906.

The device comprises a source of electric energy, a contact plate, a circuit-closing spring plate, a longitudinally movable bar, means for supporting the latter above the floor, rollers carried thereby, a spring for normally forcing the bar away from the contact plate and an insulated head on the bar normally bearing against the circuit-closing plate.

848,028. Electric Switch. Gerald W. Hart, Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed June 25, 1906.

In an electric snapswitch are a pair of terminals, a switch-arm, a rotatable pole-piece carrying the arm, and an oil-containing receptacle surrounding the terminals and switch-arm and rotatable with the switch-arm.



NO. 848,047.—CABLE SPLICING AND DISTRIBUTING BOX.

848,035. Trolley-wire Sleeve. Charles W. Ketteman, Dayton, Ohio. Application filed October 29, 1906.

A chambered sleeve has end orifices, ears having inclines external to their tops, the eccentric arms pivotally held within the ears, and when in employment are nearly in line with the ears.

848,045. Lightning Arrester. James H. Pearson, Bloomfield, Ind. Application filed January 9, 1906.

The device comprises a block of insulating material provided with line terminals and columns of expansible conducting media connecting the same, and ground terminals secured to the block, the terminals being in communication with the columns and normally spaced therefrom.

848,047. Electric Cable Splicing and Distributing Box. Henry E. Procunier, Oak Park, Ill. Application filed February 6, 1905.

The box has at the bottom a pocket and a number of cable entrances leading into the bottom of the pocket and through which cables may extend up into the pocket, the box having a lateral opening above the pocket through which the cables are accessible for splicing. (See cut.)

848,072. Spark Controller for Explosive Engines. Luke W. Turnbull, Port Huron, Mich., assignor to the Wat Engine Company, Port Huron, Mich. Application filed November 25, 1905.

The device includes a cam-shaft rotating in unison with the engine and grounded therewith, a cam secured on the shaft, a shifting lever rotatable on the shaft, a contact point carried by the lever and insulated therefrom, periodically contacting with the cam, a terminal having sliding contact with the shifting lever, having cut-out points on which the lever rests when it has passed the positions corresponding to the moments of greatest compression of the engine, the sliding terminal being connected with the ground limb of the generator circuit, and the contact point with the other limb.

848,073. Modulating Telephone Receiver. Kelley M. Turner, New York, N. Y. Application filed January 13, 1906.

In a telephone receiver having a diaphragm are an annular pad of yielding or fibrous material in proximity to the central portion thereof, and cam means for moving the pad against the face of the diaphragm.

848,083. Electrocapillary Detector and Recording Apparatus. James T. Armstrong and Axel Orling, London, England. Application filed August 31, 1904.

In electrocapillary apparatus are a mercury chamber, a tubular part depending therefrom, a capillary end, a flexible tube to connect such capillary end to the mercury chamber and a body of electrolyte with which the mercury in the capillary end makes contact.

848,085. Spring Clamp for Electric Terminal Wires. Horatio J. Brewer, New York, N. Y. Application filed August 7, 1906.

The clamp consists of a spring lever having a coiled portion, a terminal wire holder and a bearing piece formed with a loop for the reception of the terminal wire holder, together with the article to which the terminal wire is clamped.

848,092. Sea Sounding. Albert F. Eells, Boston, Mass. Application filed February 23, 1907.

A sea-sounding apparatus comprises a vessel, means therein for generating sound waves, a hermetically sealed transmitter secured within the submerged portion of the vessel, a receiver electrically connected with the transmitter and means for automatically indicating the depth of the water by volume of sound.

848,116. Telephone Booth. Benjamin F. Merritt, East Orange, N. J., assignor to the New York Telephone Company. Application filed July 14, 1906.

Details are described.

848,117. Process for the Production of an Insulating Material for Electrical Purposes. Johannes Meyenberg, Baar, near Zug, Switzerland. Application filed December 4, 1905.

The process includes the subjecting of animal filaments to fermentation, then treating with an alkaline lye, precipitating the natural cements by a coagulant, removing resultant liquid therefrom, then mixing the residue and finally shaping the same.

848,120. Automatic Trunking Device and Selective Signaling Apparatus. August A. Monson, St. Paul, Minn. Application filed November 27, 1906.

In a trunk-line telephone system are a group of subscribers' stations connected to a branch central station which forms one terminal of the trunk line, electromagnetically actuated contacts arranged at the branch central station and connected one to each of the subscribers' stations for closing a circuit between the trunk line and the calling subscriber, and an electromagnetically controlled circuit-breaking mechanism connected in multiple to the group of subscribers and operable by any subscriber making a call for cutting off communication between all of the other subscribers and the trunk line. (See cut.)

848,138. Bleaching Cabinet. Wilmont E. Strong, Tacoma, Wash. Application filed June 1, 1906.

In a flour-bleaching cabinet are combined a mixing chamber, separate cell compartments connecting therewith, separate slides adapted to close the connections therebetween, electric fume-producing cells within the compartments, and short-circuiting switches mounted on the cabinet and connected to the terminals of the cells.

848,148. Circuit-breaker. Albert C. Woehrle, New York, N. Y. Application filed June 16, 1906.

In an induction apparatus are a core and contact screw combined with a yielding bearing for the screw and with an armature having resilient convolutions opposite the core.

848,153. Electrical Blasting Machine. Lucien W. Bowman, Reading, Pa., assignor of one-half to John H. Lewis, Reading, Pa. Application filed April 25, 1906.

Combined with an open circuit having terminals are a receptacle containing a battery and having in one of its sides an opening, a plate attached to one of the sides of the receptacle and being exposed, a jack-plug located within the receptacle and registering with the opening thereof, a battery located within the box and having one of its poles connected with the jack-plug and its other pole connected with the plate, the jack-plug adapted to receive one of the circuit terminals and the other circuit terminal being adapted to be brought manually in contact with the plate, a door hinged to the receptacle and adapted to close over the opening thereof, and means for securing the door in closed position over the opening.

848,163. Electric Heating. Samuel S. Eveland, Philadelphia, Pa. Application filed September 13, 1904.

The electric-heating apparatus described consists in means for establishing electrical contact between substantially coextensive surfaces including a surface of the object to be heated, devices for passing current through the contact, and provisions for rubbing the same coextensive surfaces of contact together to localize the incandescent heating effect.

848,167. Adjustable Hanger for Electric Droplights. Allen J. Gowan, Norwich, Ontario, Canada. Application filed April 19, 1906.

Combined are a stationary vertical disk, a rotatable drum concentric with the disk, a number of inwardly facing cam surfaces formed therein, balls between the disk and the cam surfaces, and recesses formed at each end of each cam surface to receive the balls when the drum is rotating.

848,182. Brush-holder for Motors and Generators. John Lindall, Boston, Mass. Application filed August 18, 1905.

In the brush-holder described are a body portion provided with a guideway for the reception of a brush, an abutment substantially in line with the guideway, and a spring interposed between the abutment and the brush and having its sections extended above and below the abutment and retained in its operative position solely by its elasticity.

848,205. Safety Plug. Bliss W. Robinson, Boston, Mass. Application filed January 5, 1907.

The plug comprises an annular exteriorly screw-threaded member provided with a central bore and having an annular resistance wall within the bore at the inner end thereof and connected to the member by fins, and fusible material filling the bore around the resistance wall.

848,221. Telegraphy. John C. Barclay, New York, N. Y. Application filed March 19, 1906.

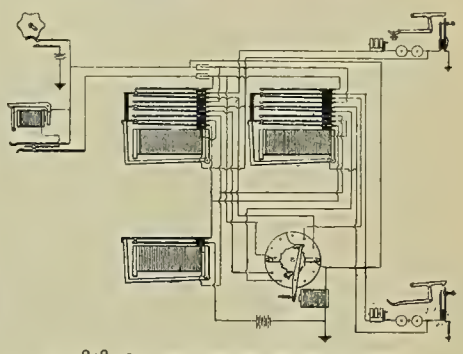
In a telegraph system are combined a number of transmitting sets for different lines, each set comprising two transmitters for currents of different polarity. An alternating-current generator is used, with distributing means controlling the supply of current to the transmitters, and commutating means for each set of the transmitters openerated synchronously. (See cut on next page.)

848,256. Lock for Railway Trucks. Cornelis Maaskant, Waterval Boven, Transvaal. Application filed November 27, 1905.

The apparatus described comprises an electrically operated lock fitted to the door of the vehicle, switches and a switchboard located inside the vehicle, the switchboard providing a number of contacts for each switch, conductors between the switches and the lock, an electric battery and detachable contact pins constituting the terminals therefor, which pins are adapted to pass through holes formed in the truck to make contact with any of the contacts of the switchboard to close the circuit.

848,269. Crosstree for Supporting Electric Conductors. Harry W. Smith, Worcester, Mass. Application filed July 31, 1906.

A device for supporting electric conductors comprises a metal crosstree and insulator supports projecting from the tree and formed integral therewith.



NO. 848,120.—TELEPHONE TRUNKING DEVICE.

848,280. Automatic Temperature Regulator. Frank A. Beckwith, Evanston, Wyo., assignor of one-third to Rudolph Dumbeck, Salt Lake City, Utah. Application filed August 25, 1906.

In a temperature-regulating system are means for controlling the temperature, including a thermostat, means for periodically and automatically adjusting the thermostat to cause the temperature to be changed from a higher to a lower degree and vice versa. A pair of electromagnets and an armature are employed, one of the electromagnets being adapted to move a pair of posts in one direction and the other electromagnet to move the posts in the other direction. The magnets can be alternately operated by clock mechanism and circuit connections to change the position of the posts in relation to the arm of the thermostat.

848,283. Switching Device. Jules A. Birsfield, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 13, 1905.

In a telephonic switching apparatus there are a number of switch-spring groups comprising actuating springs and inner and outer contact springs, a plunger for engaging the actuating springs, and a separator plate for normally retaining the outer and inner springs in proper adjustment independently of the plunger.

848,288. Sign. Hjalmar Christensen, Seattle, Wash. Application filed February 16, 1906.

In the extensible frame of the sign are electric lights removably supported therein, and a facing in the form of a letter or symbol carried by the frame having an opening forming a second letter or symbol.

848,289. Attachment for Burial Caskets. William Cole, St. Louis, Mo. Application filed November 24, 1905. Renewed October 25, 1906.

In a closed burial casket are a tube containing an electric-light bulb, a wire connecting the bulb with an electric circuit and a reflector within the tube behind the bulb.

848,292. Automatic Speed-controlled Circuit Closure for Electric Generators. Charles E. Dawson, Indianapolis, Ind., assignor to Artemus W. Fisher, South Bend, Ind. Application filed August 11, 1906.

Combined with the base of a permanent magnet of horseshoe formation secured to the base are bearing blocks arranged at opposite sides of the magnet, an armature having a hollow shaft journaled in the bearing blocks, a governor at one end of the shaft, a circuit-closer at the other end of the shaft, and a spindle extending through the shaft and moved by the governor to move the circuit-closer.

848,293. System for Operating Switch Points and Signals. Albert Descubes, Paris, France. Application filed August 27, 1904.

An apparatus for working the switch points and signals of a route having switches at and intermediate of its ends, includes in combination two levers corresponding respectively to the opposite ends of the route and means controlled by the two levers for operating all the switches of the route.

848,329. Recording Instrument. Charles E. Vawter, Jr., Blacksburg, Va. Application filed June 27, 1906.

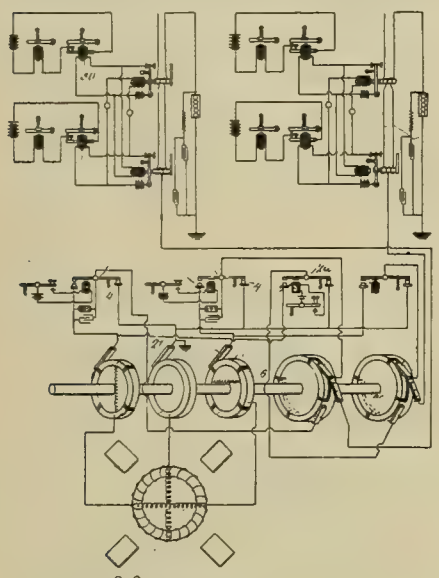
The apparatus comprises an angularly movable index arm, a marking device carried by the arm, an electromagnet to operate the marking device, record-sheet-feeding mechanism, electrical contacts operated thereby and controlling the operation of the magnet, an electromagnet to operate the mechanism, and a periodic contact device to control the operation of the last-named magnet.

848,353. Drop Table. William Elmer, Jr., Altoona, Pa. Application filed August 18, 1906.

An electric motor operates a pair of movable tables located in the pit of a working floor. A brake normally holding the motor stationary, is provided with an electromagnetic device for releasing the brake.

848,372. Electric Hoisting System. John D. Ihlder, New York, N. Y., and Rumsey W. Scott, Washington, D. C., assignors to the Otis Elevator Company, Jersey City, N. J. Application filed July 20, 1905.

Combined with a car are hoisting means for the same, a catch for preventing descent of the car, but allowing free upward movement thereof, electromechanical means for operating the catch, and an electric switch on the car for closing a circuit to the electromechanical means to actuate the catch so that the car may descend. An electric motor drives the hoisting means.



NO. 848,221.—TELEGRAPH SYSTEM.

848,373. Safety Catch for Elevators. John D. Ihlder, New York, N. Y., and Rumsey W. Scott, Washington, D. C., assignors to the Otis Elevator Company, Jersey City, N. J. Application filed July 29, 1905.

Combined with a catch normally projecting into the path of a part of the hoist carrier are interconnected toggles connected to the catch to hold the latter in fixed position when the carrier is supported by the catch, and electromagnetic means for actuating the toggles and releasing the catch to permit the hoist carrier to move past the catch.

848,378. Apparatus for Telephone Toll Lines. Thaddeus R. Laing, Chicago, Ill., assignor to the Kraft Combination Telephone Company, Chicago, Ill. Application filed January 4, 1902.

In a toll telephone system are telephone instrument, a chute for receiving a toll-piece, means actuated by the operator at central for storing the toll-piece within the instrument, and means actuated by the establishing of telephonic connection with another instrument to indicate to the operator the failure to store the toll-piece.

848,382. Overhead Trolley. Allen P. Lord and Nathaniel Wilkins, Bradford, Pa. Application filed October 29, 1906.

Details are described.

848,398. Automatic Exchange Selector. John G. Roberts, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed June 18, 1906.

In an automatic telephone exchange are combined with multiple line terminals arranged in rows in an arc-shaped field, a switch having a series of terminals corresponding to the rows, means for rotating the switch to bring any terminal into operative relation to its corresponding row, and means for oscillating the switch to bring the selected terminal into connection with the desired line terminal in its corresponding row.

848,405. Current-controlling Apparatus. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed June 12, 1905.

Combined in an elevator with an electric switch are means for retaining the switch in closed position, a floor controller, a cam moving with a part of the floor controller, means co-acting with the cam for releasing the retaining means, and means for throwing the switch to open position. (See cut.)

848,422. Method of Maintaining or Increasing the Fluidity of Molten or Semi-molten Materials by Means of Electricity. Frank Wynne, Westminster, London, England. Application filed June 23, 1905.

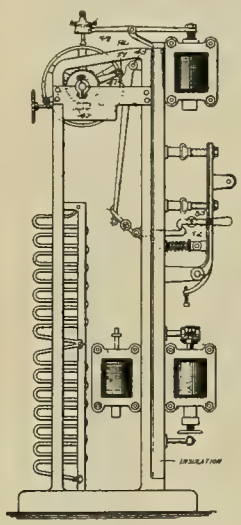
The method of increasing the fluidity of a stream of red hot molten or semi-molten material, consists in causing a regulated current of electricity to flow lengthwise through a portion of the stream that is falling from one place to another and is surrounded by a gaseous atmosphere and conducting the electrically heated and liquefied material as a continuous stream to a place where it is to be further dealt with while in a liquid state.

848,448. Telephone Toll-line System. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 14, 1902.

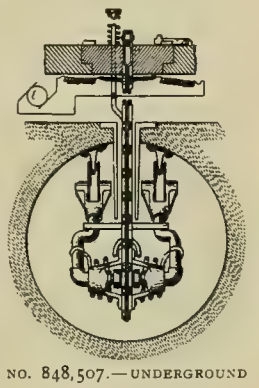
Combined with a toll-box are a chute leading through the box to the exterior thereof, whereby a deposited coin may pass through and be refunded to the depositor, a cash box, mechanism actuated through the agency of a deposited coin for stopping the coin in its passage through the box, means for operating the mechanism to release and refund the coin, and means for operating the mechanism to direct the coin into the cash box.

848,468. Electric Recorder. David J. Klepfer, Philadelphia, Pa.; Sarah L. Klepfer, administratrix of David J. Klepfer, deceased. Application filed March 28, 1902.

In combination with an automatic sprinkler system, including a valve normally obstructing the flow of fluid in the system, are a recording device comprising mechanism arranged to chronologically progress a record strip, an electric circuit connecting the recording device with the valve, arranged to be opened and closed in correspondence with the movement of the latter, and an electric signaling device bridged across the circuit in parallel relation with the recording device, comprising means arranged to contemporaneously interrupt the circuit including the recording device, and thereby contemporaneously produce an audible signal and a chronological record of the same.



NO. 848,405.—ELEVATOR CONTROL



NO. 848,507.—UNDERGROUND ELECTRIC RAILWAY.

848,473. Insulating Clamp. Thomas B. Lee, Charlotte, N. C. Application filed May 15, 1906.

The clamp comprises two separate semicircular sections adapted to clamp a transmission wire and engage the neck of an insulator, and means for securing the sections together.

848,483. Registering Device. Addison C. McEwen, Brooklyn, N. Y. Application filed October 19, 1905.

The street-indicating device for cars comprises a motor, a pair of winding rolls operated thereby, a belt connecting the rolls, a manually controlled device included in the motor circuit, and a disk operated by the motor and carrying a series of notches to receive the controlling device, the notches being arranged peripherally of the disk to gradually decrease the duration of each successive operation of the motor.

848,494. Speed-changing Mechanism. Louis Renault, Billancourt, France. Application filed April 28, 1904.

The mechanism designed for motor vehicles comprises a motor and its shaft, a dynamo embodying a stationary inductor and an armature fixed to and rotating with the shaft of the motor, the armature constituting a flywheel for the motor shaft, an electric motor embodying a fixed inductor and an armature mounted on the driven shaft. A friction clutch comprises two members, one of which is fixed to the armature of the dynamo and the other to the armature of the motor.

848,506. Insulator Pin and Support Therefor. Louis Steinberger, New York, N. Y. Application filed July 24, 1905.

The pin is provided with a portion entering an aperture in a cross-arm and with integral portions partially overlapping the top of the cross-arm and extending beyond the edges of the aperture. It is also provided with means for supporting an insulator.

848,507. Underground Electric Railway. Sylvester M. Sullivan, San Francisco, Cal. Application filed May 7, 1906.

In an electric railway, combined with a slotted conduit, are a trolley wire in the conduit, a hollow standard carried by the car, a hollow trolley-arm pivotally mounted on the standard and having suitable waterproof joints therewith, insulated current-collecting means on the arm engaging the trolley wire, a suitable conductor housed in the standard and hollow arm and electrically connected with the current collector, and means operative from the car for depressing the trolley-arm. (See cut.)

848,517. Mail Transportation System. Ern S. Upright, Ord, Neb. Application filed September 20, 1906.

The system comprises traffic wires and poles for supporting them, a carrier adapted to travel upon the wires, a motor located within the carrier and operatively connected with the carrier wheels and a battery located in the rear end of the carrier and driving the motor.

848,518. Electric Medical Apparatus. Carlos Van Bergh, Winnipeg, Manitoba, Canada. Application filed December 1, 1906.

An electric circuit includes a suitable source of electrical energy, and a noiseless interrupter, the interrupter comprising a motor having a rotary armature, magnets surrounding the armature, means within the magnets for retarding the rotation of the armature, and a commutator adapted to deliver a current to the armature during only approximately one-half of each revolution.

848,535. Annunciator. David H. Coker, Piedmont, Ala. Application filed April 7, 1906.

The annunciator has an indicator, a shaft for operating the indicator, a pinion fixed to the shaft, a ratchet wheel loosely mounted on the shaft and in frictional engagement with the pinion, a pawl for imparting an intermittent forward motion to the ratchet wheel, and electrical means for actuating the pawl.

848,559. Battery Plate. William G. C. Krause, Waterbury, Conn., assignor to Charles B. Schoenmehl. Application filed June 24, 1905.

In a battery-plate holder, combined with a cover, are a U-shaped wire frame atttached thereto, a U-shaped gate member hinged to the U-shaped frame, a plate intermediate the U-shaped members and means to lock the gate in its closed position against the plate.

848,568. Telephone Detector. Arnold R. Piehn, Alta Vista, Iowa. Application filed March 31, 1906.

In combination are a revoluble make-and-break device connected in the talking circuit, a contact carried thereby, a stationary contact with which the make-and-break contact engages to complete the talking circuit, a lug projecting from the make-and-break device, an anchor having pallets for engaging the lug, and means for operating the anchor.

848,570. Zinc Electrode. Charles B. Schoenmehl, Waterbury, Conn. Application filed November 16, 1905.

The electrode comprises a zinc having a reduced extension, a suspending rod embedded in but protruding from the extension, and an integral annular shoulder upon the rod adjoining the face of the zinc to form a hard-engaging surface for the cover.

848,573. Suspension Device for Electric Lamps. Campbell Smart, Swansea, England. Application filed January 12, 1907.

In the device is a stationary cylindrical hollow casting terminating at its bottom in an extended tube, the casting carrying electrical contacts.

848,581. Controller for Rolling Mill Repeaters. Frank P. Townsend, Elyria, Ohio, assignor to the National Tube Company, Pittsburg, Pa. Application filed November 12, 1906.

In a rolling mill are a repeater having rolls, a shunt electric motor for driving the rolls of the repeater, a rheostat in the field circuit of the motor, means for normally short-circuiting the rheostat, and a switch operated by the piece being rolled for removing the short-circuit.

848,600. Production of Homogeneous Bodies from Tantalum or Other Metals. Marcello von Pirani, Wilmersdorf, Berlin, Germany, assignor to Siemens & Halske, Berlin, Germany. Application filed October 4, 1906.

The method of producing homogeneous bodies of refractory metal, consists in triturating the metal, inclosing the triturated metal in a suitable vessel, excluding air from the vessel, and directing cathode rays on the triturated metal until it is fused and rendered homogeneous.

848,601. Electric-trolley Retainer. Edward T. Platt, Chicago, Ill., assignor of one-half to Herman Feldmann, Chicago, Ill. Application filed May 21, 1906.

Retaining arms are pivoted to the trolley pole, having outwardly flared portions extending above and beyond the trolley wheel.

848,610. Overhead Trolley Frog. Burt Wilbur, Syracuse, N. Y. Application filed July 18, 1905.

A switch for overhead trolleys comprises a substantially Y-shaped member having its intermediate top portion flat and straight, and its opposite ends curved upwardly and provided with slots to receive the current conductors. Clamps are carried by the top face of the switch, the clamps being adapted to receive the electrical conductors, and forming means for supporting the switch therefrom.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 1, 1907:

424,535. Electric Motor. L. Bock, Jr., New York, N. Y.
424,544. Marine Electric Light. A. G. Donnelly, New York, N. Y.
424,562 and 424,563. Lightning Arrester. O. P. Loomis, Brooklyn, N. Y.
424,575. Electrical Insulation. T. S. Reed, Jersey City, N. J.
424,595. Regulation of Electric Motors. S. Bergmann, New York, N. Y.
424,606. Choking Electromagnet. L. Cutmann, Fort Wayne, Ind.
424,607. Method of Operating Electric Railways. R. M. Hunter, Philadelphia, Pa.
424,635. Electric Call. F. B. Wood, New York, N. Y.
424,665. Safety Device for Electric Circuits. C. G. G. Young, New York, N. Y.
424,695. Suspended Switch and Traveling Contact for Electric Railways. C. J. VanDepoele, Lynn, Mass.
424,699. Electric Car Motor. E. M. Bentley, New York, N. Y.
424,703. Electromagnet. G. D. Clarke, Chicago, Ill.
424,725. Electric Indicator. M. D. Porter, Newton, Mass.
424,726. Electrical Indicator. M. D. Porter, Brooklyn, N. Y.
424,729. Electric Trap. F. Scherer, Paris, France.
424,734. Electric Motor. L. T. Smith, Providence, R. I.
424,751. Electrical Conductor. J. A. Barrett, Brooklyn, N. Y.
424,752. Arc Lamp. R. H. Beach, St. Paul, Minn.
424,778. Ventilating System for Electric Subways. W. Gee, New York, N. Y.
424,809. Electrode for Secondary Batteries. J. F. McLaughlin, Philadelphia, Pa.
424,810. Electric Locomotive. J. F. McLaughlin, Philadelphia, Pa.
424,848. Electric Railway. F. O. Blackwell, New York, N. Y.
424,887 and 424,888. Electric Railway. W. H. Knight, New York, N. Y.
424,928. Electric Railway. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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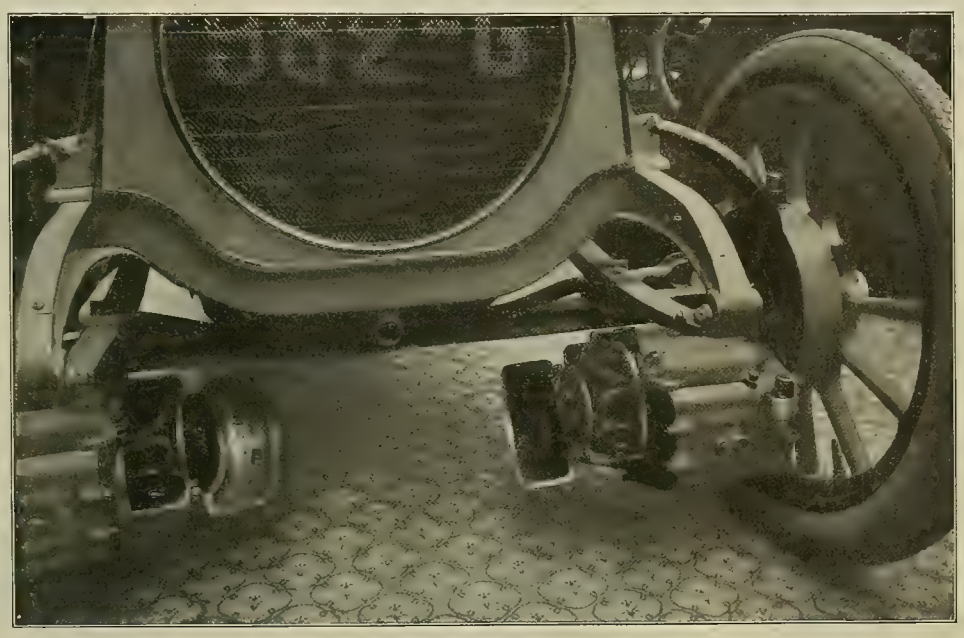
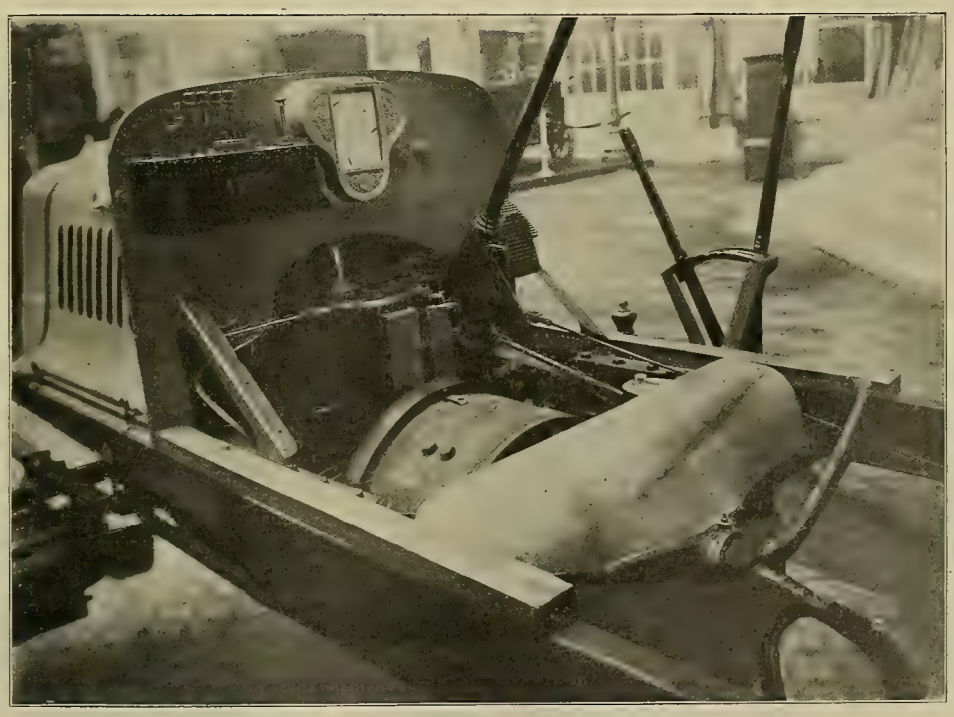
A New French Gasoline-electric Automobile.

By A. de Courcy.

At the latest automobile show in Paris the combination gasoline-electric automobile designed by Mr. Krieger and herewith illustrated was one of the most interesting electrical features of the exhibition. Various inventors have been at work upon the problem of the combination car, and it would seem that the present form of automobile comes near giving what is looked for in this direction. The use of the ordinary electric car with storage batteries and motors, while it is adapted for use within cities, is hardly adapted for running any considerable distance upon the road, owing to the difficulty of keeping the batteries charged, as well as the heavy weight of the car. Accordingly another method was sought, and of late inventors have been trying to perfect the combination system, in which a hydro-carbon engine connected with a dynamo is used to give the current for operating the car.



View Showing Electric Motors Geared to Front Wheels.



Chassis, Showing Engine and Dynamo.
NEW FRENCH GASOLINE-ELECTRIC AUTOMOBILE.

Storage batteries can be used to some extent in connection with such a system, provided their weight does not rise too high, and accordingly the latest method consists in the adoption of a gasoline engine running a small dynamo in combination with a battery of accumulators. Here the number of cells is relatively small, and their weight is not an important figure. Among the first cars of this type which appeared in Europe were those made by Pieper and Jenatzy, and they were based on the principle of a gasoline engine and dynamo group having the electric circuit connected upon the car motors and aided by a storage battery, which only came into play at times when an extra amount of current was needed, as, for instance, upon hard places on the road and climbing hills. Certain constructors gave the principal role to the battery, which became the normal source of current. A small dynamo group acted to keep the battery charged and could also come in to aid it at certain times. This is the principle of the Mildé combination car.

But storage batteries, outside of city service, are not considered advisable for high speeds and long-distance touring. This is the reason why, in the present Krieger car, the battery is practically suppressed. Accordingly the car is lightened of a considerable weight, which allows it to reach a much higher speed with the same fuel consumption, or for the same rate of speed, to require a much lower power to run the car. Owing to the lightness of the car it can climb hills at a better rate of speed, so that the average speed is greater than for a car of the same power, but fitted with storage cells.

What Mr. Krieger, who is a Paris engineer, desired fundamentally was to keep a constant power and speed upon the gasoline engine of the electric group, and a constant electric power at the terminals of the dynamo. Since the current taken by the car motors is variable, the difference of potential E at the terminals of the dynamo must vary in the inverse sense so as to keep constant the product $W = C E$. This regulation is brought about in practice by acting upon the dynamo field by a winding known as series-differential. In the Krieger car the field is the resultant of three factors: First, a winding placed in shunt whose power varies according to the difference of potential at the terminals; second, a demagnetizing winding produced by a few turns in series with the total current, whose power is directly proportional to the values $W = C E$ of this current; third, an independent excitation furnished by a small battery weighing 60 or 70 pounds.

This constant and magnetizing excitation has the effect of guarding against the accidental demagnetizing of the machine with the other windings at moments when a sudden and heavy overload makes the electromotive force at the terminals fall. It also serves, at the time of starting, to set the dynamo group in movement. A suitable arrangement allows of throwing the battery upon the dynamo which now works as a motor. The demagnetizing winding of the dynamo, which has a few more turns than are needed, has its action limited by a low resistance, upon which we can act so as to vary the value of the demagnetization and therefore of the automatic regulation of the power.

The electric motors may be coupled in series when the car is climbing up hills. To vary the speed of the automobile independent of the automatic regulation we may act upon the gas inlet of the engine when the power is lowered as also the dynamo's electromotive force. This voltage may just balance the circuit losses, in which case the electric motors will stop, but the generating group keeps on running, and the least increase of voltage or of gas inlet to the engine will produce the starting. By this arrangement we profit by the great advantage of gas throttling as used in ordinary automobiles—that is to say, a great ease of handling the car, which is one of the good results obtained in modern practice. Moreover, in the Krieger car, owing to the suppression of mechanical transmission devices, the ease of running is still further increased. The electric transmission does not change and has a much higher efficiency. Experiment is said to show the efficiency of the present car to be 80 per cent., against 60 per cent. for the usual automobile transmission where gearing is employed.

The accompanying pictures give a general idea of the new automobile. In principle it contains, first, a gasoline engine direct-coupled to a dynamo. Current from this machine is sent by the controller to two electric motors, each geared to one of the front wheels. The storage battery is con-

nected normally in parallel upon the dynamo field circuit. It is charged from the dynamo when the car is running on a level and can be brought in as an extra aid as above stated.

The car has a Georges Richard-Brasier gasoline engine of the four-cylinder type mounted in front, in the usual position under the front hood. Connected upon the main shaft of the engine and lying just back of the flywheel is the dynamo, which occupies a position near the middle of the chassis. It is quite accessible from the inside of the car by merely removing the flooring, which is hinged for the purpose. This dynamo or motor, as the case may be, is designed in the present case to give about 25 horsepower as a standard, or nearly 20 kilowatts. The normal running speed of the dynamo is quite variable, according to the speed at which it is desired to run the automobile upon the road. It may be said to lie between the limits of 600 and 1,400 revolutions per minute. Built in a cylindrical form, the field contains six poles, and there are consequently six brushes on the commutator. Owing to the use of the dynamo as a motor and under different conditions of load and speed the fields have been provided with no less than three sets of windings. There is first a series winding, then a shunt winding and finally a demagnetizing coil which is connected upon the battery circuit so as to cut down the strength of the field.

The storage battery is mounted in the rear of the chassis and gives about 40 volts on the usual run. This battery is constantly coupled in the circuit of the dynamo. After passing by the controller the circuits of the dynamo lead to the electric motors of the car. These motors are supported by the front axle and on either side lying quite near the front wheels. Spring suspension of an improved kind gives electricity to the motors. Each of the small motors is connected to one of the front wheels by a single reduction gearing of a high ratio. The large gear is mounted directly against the car wheel, being bolted on to it, and a small pinion which the motor shaft carries is placed in gear with it. About 1,200 to 1,600 revolutions per minute is the speed at which the electric motors are run, as a general rule. Each of the motors is designed to give from 16 to 20 horsepower, making a maximum of 40 horsepower for the car. The motors are of the four-pole square type and carry four carbon brushes on the commutator. Naturally they are well enclosed, seeing that they lie very near the ground and need therefore to be well protected.

Electrolytic Process for the Production of White Lead.

A process for the production of pigments by electrolytic processes, invented by Clinton P. Townsend of Washington, D. C., has a direct bearing upon the production of hydrated carbonate of lead, or white lead. Mr. Townsend says that prior to his discovery, described in a United States patent issued on March 12, 1907, electrolytic pigments were found to be irregular in composition and quality and deficient in covering power.

The inventor declares that by his method a pigment of uniform grade and exceptionally high covering power may be produced in an electrolytic cell, the condition essential thereto being a definite circulation of the electrolyte successively past the respective electrodes, and preferably in the direction from the anode past or through the cathode.

Any type or form of cell may be employed to carry out the process. One type of cell which may be employed is built up of a series of sections secured together by bolts, the sections clamping between them plates, which may be formed of perforated metal or of wire-gauze, and which constitute the cathodes of the apparatus. The sections are so formed as to provide between them and between them and the sides of the cell a series of channels. The anode, which may be a plate of lead, is placed above the central channel and the electrolyte is introduced at the bottom of the cell immediately below the anode. The lateral channels are connected with outlets, these outlets being prolonged to re-enter the central channel.

A filter press of any preferred type communicates with the outlet pipes through a pipe and connections. For this filter press a settling tank or other separating device may be substituted. The filtered electrolyte passes from the press into the tank, and is thence returned to the cell through a pipe and casing. As a means for effecting the circulation of the electrolyte a propeller is mounted upon a shaft and driven by a pulley. The shaft is preferably hollow, and through it carbon dioxide may be introduced into the cell, thereby assisting in the circulation of the electrolyte and regenerating the same. A pipe is used for introducing water into the electrolyte. Such water is preferably introduced through the filter press and employed for washing the pigment. Valves are provided in the pipes, and by opening them to a greater or less extent a rapid and repeated circulation may be secured through the cell, a portion only of the circulating electrolyte being continuously drawn off through the filter press.

In another form the cell is provided with a bottom section in the form of an inverted wedge in order that no pigment may collect in the lower portion of the cell. The electrodes are plates placed, respectively, in the neighborhood of the inlet and outlet of the cell. In another type of cell a tank is provided with a false bottom, which serves to support the divided anode. The cathode is in the form of a perforated plate transversely of the tank at its upper portion. The electrolyte overflowing through the cathode is collected in a trough and conducted through a pipe to the separating devices. The clear electrolyte is returned to the cell by a centrifugal pump. In this construction the carbon dioxide required for regeneration of the electrolyte is preferably introduced at the axis of rotation of the centrifugal pump through a pipe. Introduced at this point it serves to aid the circulation of the electrolyte. The anode consists of lead in divided form, and may be in the form of bars or fragments of lead or of lead sponge or lead in any intermediate form of subdivision.

Not only does the electrolyte circulate from the anode past or through the cathode, but the pigment or insoluble compound formed at the anode detaches itself therefrom and is carried upwardly by the electrolyte past or through the cathode and thence to a region outside the field of electrolysis. The reduction of the area of the cathode as compared with that of the anode aids in preventing the formation of lead sponge by reduction of the pigment, not only because the speed of circulation through the cathode is thereby increased and the pigment prevented from adhering to it, but because the electrolytic reduction itself proceeds more slowly when the cathode area is relatively small and the current density at the cathode relatively high.

In operation a lead anode is employed and an electrolyte consisting of any salt the acid radical of which forms a soluble compound with lead. To this solution is added a soluble carbonate. A mixture of sodium nitrate or acetate and sodium carbonate, in proportions approximating 10 to 1, constitutes a satisfactory electrolyte. The current density depends to some extent on the speed of circulation of the electrolyte, a higher current density being employed as this circulation is more rapid.

To generate the electrolyte, it is necessary to add thereto continuously or at intervals carbon dioxide and water in quantity equal to that removed by the pigment. The carbon dioxide may be employed to aid or as the sole agent for effecting the circulation of the electrolyte.

Proposed Model Contract for Street Lighting.

A meeting of the committee of the National Electric Light Association to consider street-lighting specifications and new methods for street illumination was held on March 30th in New York. Mr. Dudley Farrand of Newark, N. J., is chairman of the committee, and the other members are Messrs. Louis A. Ferguson of Chicago, Paul Spencer of Philadelphia, C. P. Steinmetz of Schenectady, and A. E. Kennelly of Boston, all of whom were present.

It is the intention of the committee to frame a model contract between municipalities and central-station companies doing street lighting, and to include therein the relative illuminating values of the several types of illuminants now in use for such purpose, so that if a company wishes to change over from one system to another there may be no difficulty in settling the question of relative efficiencies.

This is a subject regarding which many inquiries have been directed to the office of the association, and the report of the committee will be greatly appreciated by the members.

Electric Sign and Decorative Lighting in Peoria.

The business section of the city of Peoria, Ill., is brilliant at night because of the presence of many special lighting effects added to the regular street lighting. The accompanying illustration shows the most lavish use of electricity for advertising purposes in the city. The firm of P. A. Bergner & Co. occupies the building as a retail dry goods store and has had the outlining done at its own expense.

CONSPICUOUS SIGN AND DECORATIVE LIGHTING IN PEORIA.

The work on the building shown is of a permanent character. A board strip four inches wide is used upon which to attach cleat receptacles. This board is covered with metal pierced to receive the lamps, a rubber washer being screwed down against the metal to make a water-tight joint around the head of the lamp. The building has an 85-foot front and is 170 feet deep and five stories high. In the outlining there are 1,090 eight-candlepower lamps.

The sign on the roof is made of seven-foot grooved letters, mounted upon an angle iron frame, and makes a good sign by day as well as at night. In the sign are 304 eight-candlepower lamps.

The whole installation burns six nights a week from sunset to 10:30 p. m., and Saturdays, when the stores are all open evenings, until 11 p. m. The sign can easily be seen and read from the Bluffs or residence portion of the city, which is a mile and a half away.

This entire installation is on a flat rate, the Peoria Gas and Electric Company carrying it on its patrol system with other signs. The central-station company attends to turning the current on and off.

To the right in the picture may be seen one of a series of alternating-current arc lamps spaced 22 feet apart for the balance of the block. These are on ornamental iron poles and the merchants along the block pro-rate the cost according to frontage. These are on the same schedule, the company making a flat rate, payable monthly, and attending to turning them on and off, trimming and all repairs.

The reflection from the lights on the store from a distance gives the impression of a large fire. The firm is well satisfied with the installation and is considering adding to it.

The lighting company has some 15 flaming arcs on outside work. This, together with the various electric signs, makes the business section very attractive at night.

Radio-telegraphy for Railroad Signaling in Germany.

By Dr. Alfred Gradenwitz.

After more or less successful attempts made in the course of the last few years, the Company for Wireless Telegraphy, in conjunction with Dr. Scholl of Munich, in the month of February, 1906, took up actively the problem of using radio-telegraphy for railroad signaling purposes. The Prussian Railroad Department, taking the most lively interest in the question, placed the Berlin-Belitz. line at the disposal of the experimenters, whose intention it

FIG. 1. WIRELESS SENDING STATION IN RAILROAD WORK.

was mainly to develop a simple arrangement that might be operated even by unskilled men.

A car of standard type was equipped as receiving station, containing a readily exchangeable receiver. Instead of operating a Morse key, an alarm bell was to be actuated for giving certain signals, such as "Stop," "Slacken Speed," "Go on," etc. The amount of energy given out from the sending station had to be sufficient to warrant an absolute safety of operation.

The maximum range to be covered by the wireless apparatus was to be nine kilometers, the greatest distance between two immediately adjacent railroad stations in Germany being 18 kilometers. The aerial was arranged permanently on the roof of a car, a satisfactory insulation and permanence of contacts being warranted by the small damping of the electric radiations, which practically precluded any disturbance due to bad insulation, breakdown of relays, etc.

The sending station was installed in a guard's cabin on the Berlin-Sangershausen line. It is shown in Fig. 1. The receiving station was located in a special four-car train shown in Fig. 2. Fig. 3 gives a detail view of the sending apparatus, while Fig. 4 shows the receiver box.

The train being at rest, the distance between the

FIG. 2. TRAIN EQUIPPED FOR WIRELESS SIGNALING.

two stations was 5.6 kilometers, while distances up to 12 kilometers had to be covered with the train in motion. The distance between the train and the telegraph wires running alongside the track was 20 meters.

Referring to the diagram Fig. 1, the sending antenna was strung out between the telegraph poles at 30 centimeters distance from the telegraph wires, porcelain insulators (b) and a hemp rope (c) be-

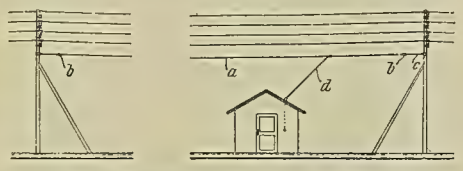


FIG. 5. AERIAL AT SENDING STATION.

ing inserted. The total length of the antenna was 59 meters, to which the connections, six meters in length, leading to the apparatus, should be added. A rail connected to the apparatus by a conductor 12 meters in length served as ground.

In Fig. 6, (a) represents the sending antenna, (e) a self-induction of 7,250 centimeters, (g) a single spark-gap of three millimeters, (h) a capacity of 3,600 centimeters, comprising eight Leyden jars connected in parallel, and (i) is an induction coil fed with intermittent direct current from a portable accumulator battery (m). A voltmeter (n) serves to ascertain the voltage of the battery, which in normal working order was 16 volts, about three amperes being derived, with a spark length of three millimeters. As regards the fundamental vibration of the open sending circuit, this, inclusive of the coupling windings, was 350 meters, the own vibration of the closed circuit being likewise adjusted to 350 meters.

The receiving apparatus was arranged on the ceiling of a steam motor car, the phosphorus-bronze antenna being fixed to porcelain insulators with bayonet openings. From one transverse side (Figs. 2 and 7) of the antenna a conductor was branched off to the receiving apparatus arranged inside the car, to which conductor the ground was connected, the longitudinal girders of the car body communicating through a wire with the primary transformer receiving coil. While the ground thus served as earth as long as the rails were free from rust, the longitudinal girders constituted an artificial earth (or electrical "counterpoise") whenever the rails possessed any considerable transition resistance.

In Fig. 8, (a) is the antenna strung out on the

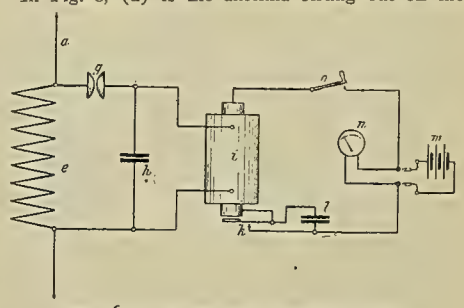


FIG. 6. CONNECTIONS AT SENDING END.

roof of the car, (b) the primary-transformer receiving coil (with a self-induction of 23,000 centimeters, (c) the ground. A self-induction (d) of 288,000 centimeters and a condenser (e) of 40

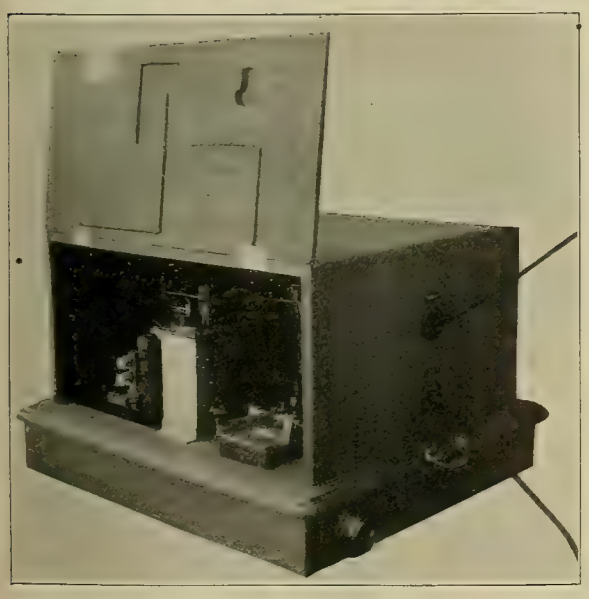


Fig. 3. Sending Apparatus.

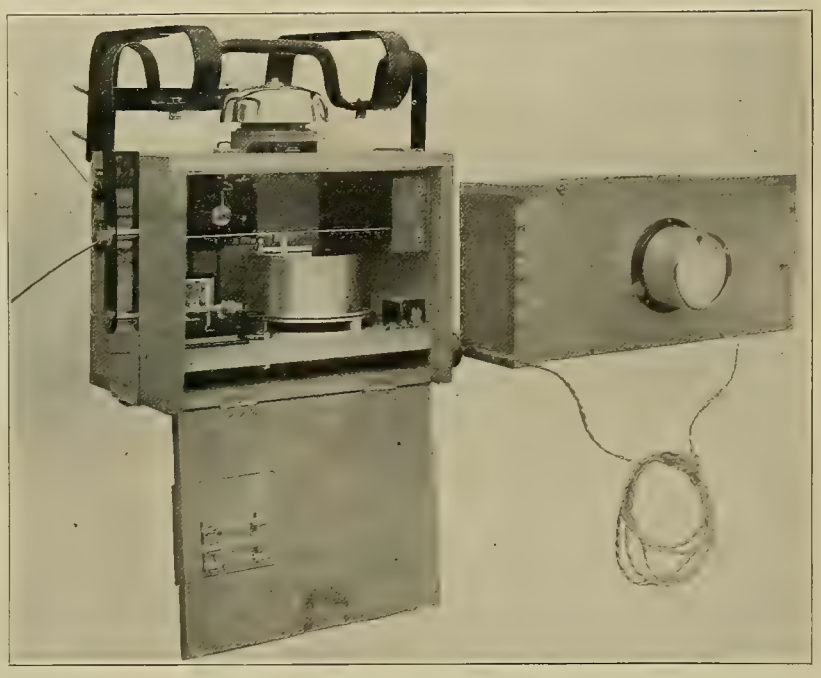


Fig. 4. Receiving Apparatus on Car.

RADIO-TELEGRAPHY ADAPTED FOR RAILWAY SIGNALING.

centimeters constituted the resonator circuit, in parallel to which there was arranged the coherer (f) and a blocking condenser (g), from which the hammer (h), the relay coils (i) and a dry cell (k) were branched off. The high-intensity receiving circuit closed by the relay tongue comprises a resistance (m) of about 90 ohms, the hammer coils (n) of about 10 ohms, the polarization cells (o) and the alarm bell (q), in addition to an exchangeable dry-cell battery (r) and a voltmeter (s).

The receiving apparatus, including reserve co-

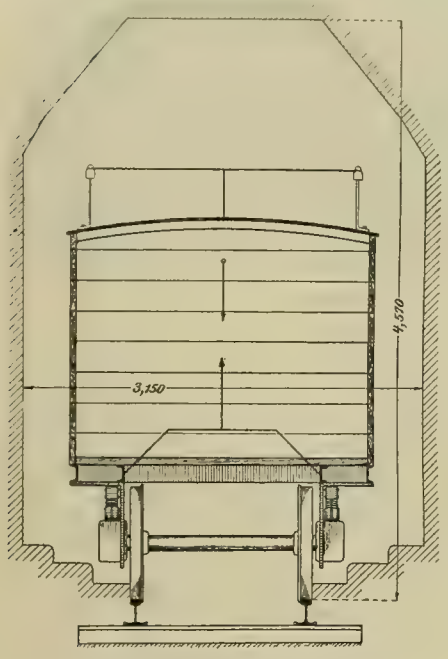


FIG. 7. GROUNDING OF RAILROAD CAR FITTED FOR WIRELESS SIGNALING.

herers, was arranged in a resilient box. By a special adjusting device any displacing of the coherer in the hammer bearing was made impossible. By altering the distance of the receiving antenna from the roof of the car, no material effect was produced on the receiving intensity, while shortening the sending antenna would exert a very marked influence. The receiving intensity was further found to augment as the distance between the sending antenna and the telegraph wires was reduced.

While both the train at rest and in motion, up to a distance of 12 kilometers, a perfectly clear reception was obtained, the signals would cease quite abruptly as this distance was exceeded. As the returning train traversed the 12-kilometer limit the signals again became perceptible with the same distinctness.

On account of these satisfactory results the Royal Bavarian Railroad Department in turn undertook to test this new signaling method on the Munich-

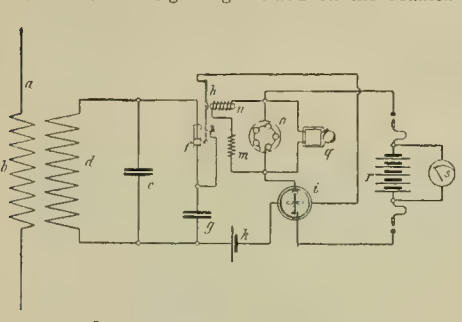


FIG. 8. CONNECTIONS AT RECEIVING END.

Tutzing-Murnau line under far more difficult conditions than the above. As these trials also gave satisfaction, it may be safely stated that radiotelegraphy allows a perfectly reliable signaling service to be maintained up to a distance of 12 kilometers (7½ miles). Apart from the train signals, telegrams could be transmitted to the train with the same satisfactory results.

No disturbance of the telegraph lines by this wireless service could be noticed.

[Dr. Gradenwitz's brief account is interesting, but one would like to know how, on a two-track road, wireless signals could be conveyed to trains on one track without affecting those on the other. This difficulty has perplexed experimenters with wireless train signaling in the United States.—Ed. W. E.]

New Fluid-pressure Regulator.

An improvement in fluid-pressure regulators has been invented by Walter J. Richards of Milwaukee, Wis., on which he has been granted a United States patent. Novel means are provided for maintaining a given range of fluid pressure by automatically starting and stopping the motor compressor at predetermined minimum and maximum pressures in the system. The result is accomplished by a solenoid-operated main switch for the motor circuit whose solenoid is energized and de-energized indirectly by means of a primary switch sensitive to the pressure of the fluid-pressure system, the primary switch co-operating with motor-starting and supplemental switches, the motor-starting switch for energizing the solenoid of the main switch serving to short-circuit the primary switch and its own actuating solenoid, and the supplemental switch for de-energizing the solenoid of the main switch serving to short-circuit said solenoid of the main switch.

The inventor says that, whereas heretofore devices for somewhat similar purposes have been provided with a primary switch, which, though making only a weak touching contact, is relied upon to carry a heavy current for starting the motor and which is only short-circuited on the completion of the operation of the main switch, it is one of the principal objects of this invention to relieve the primary switch of the necessity for carrying more than a very small amount of current, insufficient for the operation of the motor and even for the operation of the main switch, by providing motor-starting and supplemental switches which alone are actuated by the contacts made by the primary switch and which have the function of energizing and de-energizing the solenoid of the main switch.

Another object of the invention is to produce a motor-starting switch for energizing the solenoid of the main switch having means for holding it closed until the main switch has completed its operation.

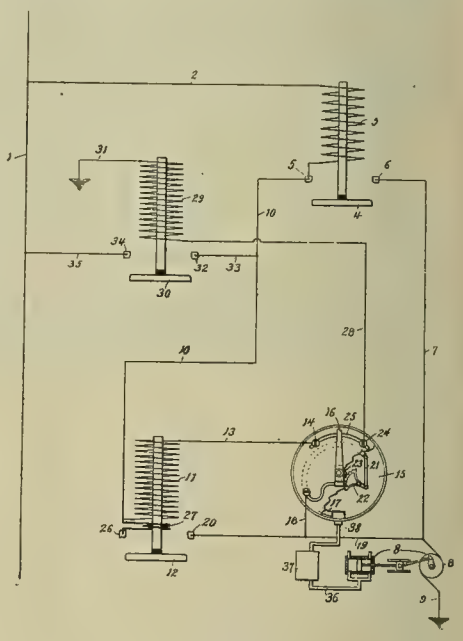
In the accompany drawing (1) represents a line wire, which is here shown to be of a grounded circuit, but which may equally well be for a metallic circuit, and (2) is a wire connecting it with the solenoid (3) of a main or motor switch (4), the solenoid (3) being connected to a contact (5), which is engaged by the switch (4) when its solenoid is energized. Another contact (6) is engaged at the same time by the switch (4) and is connected with the contact (5) by means of the switch (4) when the switch is closed and is connected by means of a wire (7) with a motor compressor (8), which has its other terminal connected by a wire (9) with the ground.

A wire (10) connects the contact (5) with a high-resistance solenoid (11) of a motor-starting switch (12), and a wire (13) connects the solenoid (11) with the minimum contact point (14) of a primary switch (15). This primary switch has a contact arm (16) capable of movement toward and away from the contact (14) as the result of varying pressure in a Bourdon tube (17) connected with the fluid-pressure system, and the arm (16) is connected by a wire (18) with a wire (19), which extends from a contact (20) of the motor-starting switch (13) to the wire (7), where it connects with the motor (8).

The operation of the system is as follows: When the fluid pressure reaches the minimum the contact arm (16) of the primary switch engages with the minimum contact (14) and completes a primary circuit from the line wire (1) by way of wire (2) and solenoid (3), through wire (10), solenoid (11) and wire (13) to contact (14), and by the contact arm (16) in engagement therewith, wires (18) and (19), through the motor (8) and wire (9) to the ground. The current through this primary circuit is comparatively small by reason of the fact that the circuit includes the high resistance of the solenoid (11) of the motor-starting switch (12) and is insufficient for the purpose of actuating the main switch (4), though it is capable of closing the motor-starting switch (12).

The closing of the motor-starting switch (12) has the effect of short-circuiting the primary switch connection to prevent its arcing and also short-circuiting the solenoid (11) of such motor-starting switch, but establishes a motor-starting circuit through the series switch-retaining coil (27), which will hold the motor-starting switch (12) in engagement with the contacts (26) and (20), notwithstanding the short-circuiting of solenoid (11), until the main switch completes its closing, when the series coil (27) is short-circuited by the main switch. Another function accomplished by the closing of the motor-starting switch (12) is by the short-circuiting of the resistance of the solenoid (11) and the connection of the primary switch to pass a greater amount of current through the main switch solenoid (3) and cause the closing of the main switch (4), which the current of the initial circuit was incapable of doing. When the main switch (4) is closed the solenoid (27) is short-circuited, allowing the motor-starting switch to open, and the motor circuit is established from line wire (1) through wire (2) and solenoid (3) of the main switch, across the main switch (4) from contact (5) to contact (6), through wire (7) and motor (8) and by wire (9) to the ground.

The motor compressor (8) is started in its operation on the completion of the motor-starting circuit by means of the motor-starting switch and continues in its operation after the closing of the main switch, increasing the fluid pressure in the fluid-pressure system until the main switch is opened by the primary switch, indicating the maximum pressure in the fluid-pressure system by means to be now described. When the pressure in the fluid-pressure system reaches the maximum for which the primary switch is set the contact arm (16) engages with the maximum contact (24) and completes a circuit through the solenoid (29) of the supplemental switch (30) by current passing from wire (7) through wires (19) and (18) to the contact arm (16) and the contact (24) engaged thereby by way of wire (28) to the solenoid (29) and from there by wire (31) to the ground. This



CONNECTIONS OF FLUID-PRESSURE REGULATOR.

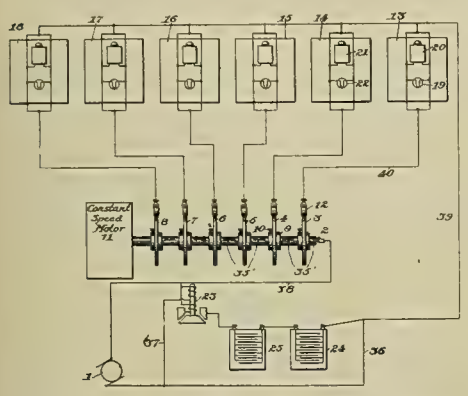
has the effect of closing the supplemental switch (30) to produce the short-circuiting of the main switch solenoid (3) by connecting the contact (5) thereof with the line wire (1) by way of wires (10) and (33) across the supplemental switch (30) in engagement with the contacts (32) and (34) and by wire (35). The solenoid (3) of the main switch (4) being short-circuited, the switch opens and breaks all circuits, so that the system is restored to its original condition, the motor compressor (8) coming to rest until the pressure in the fluid-pressure system again reaches the minimum, when the operation above described is repeated.

A prime object of the motor-starting switch is to enable the full flow of current to pass through the motor-starting switch between the time of its closing and the time of the operation of the main switch, so that if for any reason the main switch is not closed immediately the motor compressor will be started by the motor-starting switch and kept in operation until the main switch closes. This being true, should the primary switch make its minimum pressure contact at a time when the current upon the motor is insufficient to close the main switch the motor-starting switch will nevertheless close a circuit through the motor to start the motor in operation and continue this function until the current upon the motor rises sufficiently to operate the main switch.

It is also obvious that this system is applicable to other purposes than that for which it has been described, and may be relied upon for automatically supplying electric current for any purpose where automatic control is desired from the influence of any equivalent of the primary switch, which is capable of making contacts as the result of changing conditions.

Electric Signal System in Cotton-seed Oil Production.

Robert S. Woodward, Jr., of Washington, D. C., has invented an improved cotton-seed cooking system which employs an interesting electric signal system for which he has been granted a patent. In the cooking of cotton-seed "meats" in a battery of heaters as at present practiced the charging, cooking and discharging of the heaters is successive and so regulated by the cook, mainly by reference to a common clock, that the greatest amount of work may be accomplished in a limited time; also,



ELECTRIC SIGNAL SYSTEM IN COTTON-SEED COOKING.

in order to obtain a maximum yield of oil it is necessary to operate upon successive batches of meats in as uniform a manner as possible.

The new invention relates to an electric signaling system adapted automatically and successively to operate for definite intervals at certain predetermined periods a series of audible and visual alarms; and the objects are to enable the cook or others in charge of the operation of a battery of heaters to control the heaters uninterruptedly and thus insure against any irregularity due to the temporary stoppage of one or more of the heaters and greatly increase the yield of oil obtained from the meats.

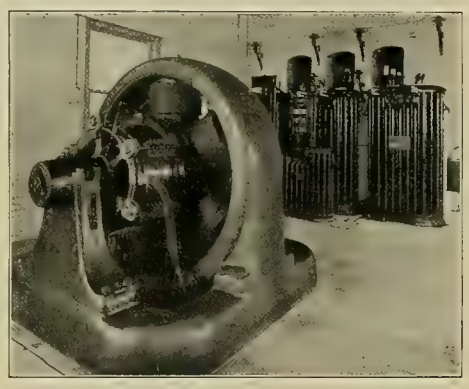
Referring to the accompanying diagram, a generator (1) supplies an electric current to the shaft (2) of the commutator and thence to the commutating disks (3), (4), (5), (6), (7) and (8). The shoulder (9) of the disk (3) which is typical of the others is provided with an adjusting screw (10), whereby the disk may be adjusted relatively to the shaft and held in any desired position. A constant-speed motor (11) of any common type is adapted to revolve the shaft (2) designated as a "time-shaft," in definite periods which may be varied at will. A brush (12) is in circuit with a lamp (19) and a bell (20) arranged in parallel. Numerals (22) and (21) designate corresponding bells and light upon heater (14). The numerals (13) (14) (15) (16) (17) (18) designate the respective heaters, which preferably have a series of electric lights to correspond to each heater either mounted thereon or adjacent thereto.

From habitual practice it has been determined that about two minutes is sufficient time to allow for the discharging and recharging of a single heater. If, therefore, the time-shaft is caused to revolve at a known speed—for example, one revolution in 17 minutes—then a large commutator bar is of a length sufficient to make the contact for two minutes and thus flash a light and simultaneously operate an electric bell. For a 17-minute cycle each successive disk is adjusted upon the shaft so that a large commutator will contact with its respective brush just 2¼ minutes later than the next preceding commutator. Then for a series of six heaters, which is the customary number operated by a single cook, there will be a light, preferably red, flashed to indicate the particular heater which is to be discharged and recharged, a bell signal will simultaneously be operated, and both preferably are caused to remain in circuit continuously throughout the two-minute period. Exactly one-quarter of a minute later the signals upon the next heater will flash in a similar manner, and thus the heaters may be charged and discharged with exact uniformity. In operating with a 17-minute period it is obvious that a period of 3¾ minutes will elapse between the starting of the cooking period of the sixth heater and the expiration of the 17-minute cooking period of the first heater, and this period affords a brief rest for the cook, which is essential in the practical working of such operations.

The relatively minute commutator bars are for the purpose of operating reminder or warning alarms, and in practice the adjustment and length of such signals are preferably such that they will operate one-half minute prior to the main alarm and continue for one-quarter of a minute, thus affording both an indication of the approaching expiration of the two-minute period and also of the longer resting period.

Elgin-Belvidere Electric Railway.

The Elgin and Belvidere electric railway, a 36-mile interurban road in Northern Illinois, was formally opened in February. Details of the construction of the line were given in the Western Electrician of July 7, 1906. At Elgin the road connects with the Aurora, Elgin and Chicago Railway, a third-rail line. At Belvidere connection is made with the Rockford and Interurban Railway running from Rockford to Freeport, Ill. A line north from Rockford is operated by the Rockford, Beloit and



SUB-STATION INTERIOR, ELGIN-BELVIDERE ELECTRIC RAILWAY.

Janesville Railroad. It is proposed to extend this road to Madison, Wis. It is possible that a line will be constructed from Marengo to Harvard connecting with the Chicago, Harvard and Geneva Lake Railway, thus connecting Chicago with Geneva Lake.

The Elgin and Belvidere Railway touches a number of small cities and villages located in a very prosperous and thriving part of Illinois. It runs almost parallel with the Chicago and Northwestern Railroad tracks, and it is built almost entirely on private right-of-way, 50 feet wide. The country as a rule is level. There are several long tangents, one being seven miles long, which will aid materially in maintaining a fast schedule. The maximum grade of the road is two per cent. The track is composed of 70-pound T rails in lengths of 33 feet, resting upon 6 by 8-inch by 8-foot ties, mostly of cedar.

A feature of the road construction is that there are no grade crossings with railroads. One of the accompanying illustrations shows a subway at the Chicago, Milwaukee and St. Paul Railway crossing, near Almora. It is of concrete construction and is 43 feet long and 14 feet wide. The trolley is supported from mine hangers attached to a wooden trough. The trolley feeders and telephone lines in the subway are arranged on brackets attached to the walls near the roof, the high-tension lines being carried over the track and telegraph lines of the railroad company.

ELGIN-BELVIDERE ELECTRIC RAILWAY.—SUBWAY AT RAILROAD CROSSING.

A picture of the bridge over the Kishwaukee River is given. This bridge is of the ribbed concrete-steel type. It has four arches, each of which is 87½ feet long.

Electric current for the operation of the road is obtained from the power house of the Aurora, Elgin and Chicago Railway at Batavia. The current is taken from that company's Clintonville substation, located about four miles south of Elgin. Three-phase 25-cycle alternating current at 26,400 volts is carried over the high-tension transmission system to the sub-stations along the line at Gilberts, Union and Garden Prairie, where the current is transformed to 600 volts direct current, distributed through low-tension feeder wires.

The overhead construction is of the bracket type, except through towns where it is necessary to employ cross suspension. The high-tension feeder, telephone and trolley wires are all carried on the same pole, the poles being 40 feet high and spaced 100 feet apart. The high-tension cables are equivalent in conductivity to No. 6 hard-drawn copper and are attached to Locke insulators of glazed porcelain. The low-tension feeder cable is of 300,000 circular mils section. The telephone line is of hard-drawn copper wire of No. 12 B. & S. gauge. Transposition of the telephone wires is effected at every fifth pole.

A lightning arrester is installed on every twentieth pole and mounted in a weatherproof box.

Approximately the same electrical equipment is used in the three sub-stations along the line. Each sub-station contains one 300-kilowatt 25-cycle three-phase General Electric rotary converter, which receives the current at 370 volts alternating and delivers it at 600 volts direct current. Three 110-kilowatt transformers are installed in each station. An oil-cooled reactance coil of 45 kilovolt-ampere capacity is part of each equipment. The switchboards comprise an outgoing panel, a direct-current rotary converter panel, two direct-current feeder panels, a direct-current voltmeter, a starting panel and two lightning-arrester apparatus. In one of the accompanying illustrations is shown the rotary and transformer in the Garden Prairie sub-station.

The passenger cars used on the Elgin and Belvidere line are of the Pullman double-truck single-ended vestibule type and are approximately 47 feet long, 8½ feet wide and 9 feet 4 inches high. The heating apparatus in each car is located in the smoking compartment. The motor equipment consists of four 74-horsepower motors, with parallel controllers. The lighting consists of 25 incandescent lamps.

The running time between Elgin and Belvidere (36.5 miles) is one hour and 45 minutes, and this is expected to be reduced to 1½ hours. An hourly schedule is now being maintained in both directions. The operating office of the company is at Marengo, Ill., superintended by Mr. George F. V. Faber.

The engineering and construction work for the road was in charge of The Arnold Company, Chicago, under the supervision of George A. Damon, managing engineer; George Weston, civil engineer; E. N. Lake, electrical engineer, and W. H. Rosecrans, superintendent of construction.

KISHWAUKEE BRIDGE, ELGIN-BELVIDERE ELECTRIC RAILWAY.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Iowa Electrical Association (annual meeting), Lafayette Inn, Clinton, Iowa, April 18th and 19th.

Iowa Street and Interurban Railway Association (fourth annual convention), Lafayette Inn, Clinton, Iowa, April 19th and 20th.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4-7, 1907.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

ASH-HEAPS may turn to gold mines, figuratively speaking, if all the newspaper stories about processes for "burning ashes" are true. Of course, if ashes can be burned, they must have a commercial value as fuel, and so their fortunate owner may exchange them for coin of the realm. But the prosaic and old fashioned idea is that one can no more burn ashes than grind with the water that has passed. The fuel value of the coal has been extracted already to the full by combustion, for it is ashes, not cinders, that are mentioned. Of course it is an old story to bank fires or economize coal by the use of ashes, but that is not burning the ashes by any means. How to burn that which has been burned already is certainly a puzzle.

X RAY application to the human body for the investigation or cure of abnormal or diseased conditions should be surrounded by more precautions for safety than are now employed. The X-ray, with its remarkable penetrating power, has a peculiar effect on the tissues of the body after repeated applications, as those who have worked with it know to their sorrow. It should be used only by persons who have studied it and are familiar with its characteristics. It is reported that the German Roentgen Society has taken action declaring it advisable to prevent unlicensed persons from making diagnoses by means of the X-ray, owing to danger to life and limb. The New York Times has been making an investigation in that city, and finds that physicians approve the action of the German society. The X-ray, while extremely useful, may cause dangerous burns and ulcers, which are particularly obstinate in healing. Like carbolic acid, it should only be used by trained, authorized persons. The subject is one which the medical societies will do well to investigate.

DESPITE the fact that last year's convention was at Atlantic City, the National Electric Light Association will meet this year in Washington, D. C., which, from the viewpoint of the West, is in the same "neck of the woods." However, the western members will ratify the choice of the officers and executive committee with unmurmuring loyalty, especially as Washington is the most beautiful city in the United States and always a charming place to visit—if the weather is not too hot. We shall expect the Washington convention to be a great success, although it must needs "go some" to outstrip the gatherings at Boston, Denver and Atlantic City.

It may not be amiss, while mentioning conventions, to call attention to the annual meetings of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association, which will be held at Clinton, Iowa, on April 18th to 20th, inclusive. The electric-light association will meet on the 18th and 19th and the street-railway body on the 19th and 20th. These are energetic, progressive societies, and they have a record of holding good conventions. We feel warranted in saying that all electrical men who attend will be well repaid for doing so.

MR. DEXTER MARSHALL'S article entitled "The History of Municipal Telephony in Glasgow," printed elsewhere in this issue, may be contrasted with that by Mr. G. P. Hutchins on "The Municipal Lighting and Power Plant of South Norwalk, Conn.," given in the Western Electrician of March 23d. In one case municipal ownership is apparently a success; in the other it was a failure. And, curiously enough, it is the American municipal plant, which, as Mr. Hutchins thinks, has "made good," while it is a European experiment which Mr. Marshall's impartial account shows to have belied the hopes and promises of its promoters. The conditions under which the plants were operated were quite different: one was in a large city, the other in a small one; one was governed by British traditions, thoughts and habits, the other is American; one was a telephone-exchange system, and the other an electric-light installation. Nevertheless, the question of the desirability of municipal ownership is the essential issue in each case. In Glasgow the city-owned telephone plant was a failure, while in the Connecticut town the municipal electric-light plant is apparently a success, owing, no doubt, to the unselfish efforts of one man, whose work, as Mr. Hutchins admits, is not likely to be paralleled elsewhere.

Judging by the recent Chicago election and other indications, the tendency toward municipal ownership in this country has been checked. But the electors in the various cities and states have had their attention forcibly directed to the great importance of the relation of the public-service corporation and the community. They have become, to a great extent, students of the question; and in the form of municipal ownership, municipal control, profit-sharing or some other plan, they are likely to demand that the public interest be more faithfully safeguarded in settlements of this character in the future. Therefore, it is still useful to discuss the problems involved in a fair, dispassionate manner and to study examples presented by one side or the other. The articles by Messrs. Hutchins and Marshall will be helpful in this direction.

THE CHICAGO TRACTION ordinances, reviewed at some length in this issue, have several interesting features, including the payment of 55 per cent. of the annual net profits (to be determined in a manner set forth in the ordinance) "forthwith by the company to the said city." But particularly noteworthy is the sweeping provision that "all of the construction, reconstruction, equipment, re-equipment, extensions and additions to plant and property provided for or required by this ordinance or the exhibits thereto, including underground trolleys, new lines, extensions and other additions to plant and property (but not subways or extensions thereof) shall be done, performed and acquired by the company under the direction and supervision of said Board of Supervising Engineers; and the cost and expense thereof shall be borne and paid by the company; but no contract, sub-contract or payment therefor shall be made without the written approval of the said Board."

Thus the great work of rehabilitating the surface street-railway system of Chicago is entrusted to a board of engineers standing between the company and the city, and, as a body, responsible to neither, although each is represented upon it. This is an ideal arrangement with men of the right stamp on the Board; with corrupt or incompetent men it would be a highly dangerous plan. This point seems to have been given due weight in the framing of the ordinance, for it is provided that the company and the city shall each have an engineer on the board and further that "Bion J. Arnold is hereby selected and appointed the third member of said Board." It is unusual to "name names" in municipal ordinances in this downright fashion, but in this case Mr. Arnold's appointment (which has been ratified by the voters with the rest of the ordinance) is a guaranty of the honest and capable and energetic performance of the work which is of great value to the city of Chicago.

Acting together, the city and the company may remove the third engineer, and, also acting together, may select his successor. But if only one party desires his removal, or if both wish him removed but cannot agree on his successor, the matter is referred to the judges of the (main) Appellate Court for the First District of Illinois.

It is further provided that the third engineer shall be ex officio chairman of the Board and shall also be chief engineer of the work contemplated in the ordinance during the period of "immediate rehabilitation." During this period his salary shall be $30,000 a year—$15,000 each as chairman of the Board and as chief engineer. The other members of the Board are not to receive more than $10,000 a year. The two companies may be represented by separate engineers on the Board, but in that case each one will have only half a vote in matters in which the companies are jointly interested.

We believe that this unique arrangement is well adapted to the situation in Chicago. Mr. Arnold is pre-eminent in it, but he is peculiarly well fitted for the position; and in case of his disability the manner of choosing his successor seems to be amply safeguarded, while provision is also made for the unlikely contingency that it may be necessary to remove him.

Fires in San Francisco and New York.

As briefly stated in the Western Electrician last week, fire on the night of April 2d in the San Francisco Gas and Electric Company's main plant (station A), now owned by the Pacific Gas and Electric Company, crippled the plant and cut off most of the light and power of the city all night. The entire roof of the boiler room was burned off and the burning and falling of trusses damaged the steam pipes and boilers to about 60 per cent. The wooden roof over about half of the main building was destroyed and the steel trusses of the other half were warped in places. Station A is a large brick building located in the Potrero district.

While most of the generators were probably not damaged seriously by the fire in the southern section of the building, where the fire started, the falling debris broke and warped the smaller gear of the direct-connected vertical engines. It will require many weeks of work and much expense to rehabilitate these engines and the steam pipes. The main steam header was broken off. The scarcity of steam pipe and the high cost of labor in San Francisco will make the rehabilitation difficult and tedious. Five of the generating units in the station were again operating on April 4th.

A loss of nearly $400,000, with small insurance, is estimated on the plant by some authorities. An officer of the company thinks it will not exceed $150,000. A force of men was set to work changing connections so as to draw upon the gas-engine generating units at Martin Station, six miles from the city, the next day, and an uncertain supply was drawn from that source. Two of the gas engines ran together in the morning, but stopped later in the day. The United Railroads had to reduce its car service on account of losing the supply that the San Francisco Gas and Electric Company is under contract to supply either from its hydro-electric transmission plants or from the gas-engine reserve station.

President Britton of the San Francisco Gas and Electric Company said that owing to the fact that the high-potential transmission lines from the mountains are now in good shape, everybody was being supplied with power on April 4th. At present the company is receiving power from the De Sabla power house in Butte County, the Colgate in Yuba County and the Electra power house in Amador County.

One theory as to the cause of the fire was that the dropping of a high-tension cable in the neighborhood of the Polk Panhandle in the morning had resulted in a puncture of the insulation on the 11,000-volt mains where they passed out of the power station under the roof. When the heavy night load came on an arc may have formed that fired the wooden roof about 7 o'clock. It was also reported that the boilers had been fired very hard for some weeks past and that it had been observed for some distance around the station that the lower parts of several of the smokestacks had been red hot. It is said that a watchman of a neighboring factory saw flames pouring from the stack and turned in an alarm before the wooden roof was actually ablaze. This is the third serious fire the company has had since January, 1906.

Fire on April 8th destroyed the combined car barn and power plant of the New York City Railway Company, covering the greater part of a block, at One-hundred-and-forty-sixth Street and Lenox Avenue. More than 300 open or summer cars were burned and the plant, except the electrical department, was destroyed. The loss may run as high as $1,500,000. The fire started in the repair room.

The company is successor to the Interurban Street Railway Company and leases the Metropolitan Street Railway Company, thereby controlling all surface street-railway lines in the Borough of Manhattan.

The Faraday Society.

Following is the list of nominations for the officers and council of the Faraday Society of England (which, it is hardly necessary to say, is devoted to electrochemistry), to be elected at the forthcoming annual meeting:

President, Sir William Perkin: vice-presidents, G. T. Beilby, R. A. Hadfield, Prof. W. Hittorf, Sir William Huggins, Prof. A. K. Huntington, Prof. A. Schuster and Prof. J. J. Thomson; treasurer, F. Mollwo Perkin; council, A. C. Claudet, S. Z. de Ferranti, F. W. Harbord, R. S. Hutton, T. M. Lowry, W. M. Morrison, James Swinburne, N. T. M. Wilsmore, Prof. E. Wilson and J. L. F. Vogel.

At the ordinary meeting of March 19th at 92 Victoria Street, S. W., London, these papers were read: "The Potential of Hydrogen Liberated from Metallic Surfaces," by H. Nutton and H. D. Law; "Electrode Potentials in Liquid Ammonia," by N. T. M. Wilsmore and F. M. G. Johnson; "The Impedance of Solutes in Solvents as Manifested by Osmotic Pressure," by John G. A. Rhodin, and "The Electrolytic Deposition of Zinc, Using Rotating Electrodes" (Part II.), by Dr. T. Slater Price.

Lightning Protection in Ohio.

Thunderbolts are increasing in frequency and in force, says State Fire Marshal Creamer of Ohio. The number of days in which thunderstorms occur in the Ohio Valley is still about 30 each summer, but the loss of life and property has increased much more rapidly than the population or the number of buildings. The advance in price of farm products is not great enough to account for the increased lightning loss on stored crops.

The increase in destructiveness of lightning has been said to be the result of sun spots, of underdraining, of the electrical disturbance from earthquakes and of the removal of trees which are nature's lightning rods. But these are assertions rather than explanations.

Scientific persons and commissions in the four most powerful countries of Europe have at the instance of their governments investigated the matter of protection by lightning rods. These investigations all have been made since the world has had experience in handling electrical discharges of high voltage, taming them for domestic service.

It is believed that the lightning rods now in common use, run from moist earth over the buildings and down to moist earth, with points near chimneys and gables, will protect from any ordinary stroke. But all authorities appear to argue that there occur rarely strokes which on account of enormous power or unusual direction cannot be guarded against. The lightning-rod expert of the United States Weather Bureau says: "While absolute security from danger of lightning is obtainable only with great difficulty and considerable expense, a reasonable degree of protection can be secured by very simple means."

In order that he might know positively the degree of protection furnished to farm buildings by rods, the fire marshal investigated the last 500 lightning fires reported. The persons who occupied the buildings at the time they were struck by lightning were asked by letter the following questions: "Did your building which was struck by lightning have a rod on it? If rodded, how long had the rod been up? What kind of metal was it? Whose make was it? What agent put it up? Was it in good repair? How was it grounded? Did it have two ends in the ground?"

Eighty of these letters addressed to tenants in houses struck two or three summers ago were returned "unclaimed." Four hundred and twenty persons filled the blanks. From these replies it is learned that of all the buildings struck not one had a modern rod, i. e., a rod made within 20 years. The writer of the report of the British Lightning Research Committee says that in 1888 "the discovery of electrical inertia and momentum" showed "that the old views about protection from lightning were in many respects erroneous and in all respects inadequate."

Nine buildings in the 420 struck had rods, but every one of them dated back to the lightning-rod crusade of about 30 years ago, when the world had no experience in controlling large loads of electricity. In no case could the person who occupied the building say in what year the rod was put up, who put it up, or what make it was. Two were said to be in good repair. Only one of the nine rods was properly grounded. It is said that all lightning rods now on sale in Ohio protect.

Smoke-prevention Crusade in Chicago.

Investigators of the City Club of Chicago have brought before the Civil Service Commission charges of laxity and incompetency in the city department for the inspection of steam boilers and steam plants. Stationary plants which violate the ordinances are classified by the committee as plants which are capable of being operated smokelessly, but violate on account of carelessness in firing, and plants which are either out of repair or are not properly designed to be operated without violating the ordinance.

The club recommends compelling stationary plants to install the best smoke-eliminating devices within reasonable time, subject to the approval of the supervising mechanical engineer and the persistent fining of those who violate the ordinances by carelessness. The committee believes "that the prevention of smoke in all stationary plants is practical; that the ordinance of the city of Chicago is broad and ample to accomplish such smoke prevention, and that the incompetency, inefficiency and laxity of the chief smoke inspector and the supervising mechanical engineer are alone responsible for the deplorable prevalence of smoke in the atmosphere. The civil service commission will investigate the charges.

Progress in Wiring Inspection.

The city of Terre Haute, Ind., has just appointed an electrical inspector in connection with the Board of Public Safety. The office will be maintained by fees collected for the inspection of new wiring.

At La Crosse, Wis., an ordinance modeled largely after one submitted by the Underwriters' Electrical Bureau, providing for the appointment of an electrical inspector and describing his duties, has just been adopted by the City Council.

At Joliet, Ill., the city electrician, with the co-operation of local electrical contractors, has demanded a more strict observance of the provisions of the electrical inspection ordinance, and it has been necessary to arrest one or two journeymen for installing wire without a permit.

A bill has been introduced into the Missouri state Senate providing for the licensing of electrical contractors and journeymen, together with compulsory inspection in cities of over 100,000 population. The bill also increases the authority of the inspector and will, if adopted, greatly facilitate the work of the municipal inspector in the larger cities.

The engineers of the National Board of Fire Underwriters in their report on the city of Nashville, Tenn., severely criticise the wiring condition there. Some of the streets are badly congested and overhead obstructions due to electric wires are said to be serious. However, electric wires in the business district, now overhead, are to be placed underground as soon as possible, the work of constructing the conduits having been commenced.

Two bills are before the Illinois Legislature to improve electrical conditions. The first provides for a state commissioner to examine persons who desire to become master electricians. All electric work must be done by them or under their supervision. At the present time anyone can get a permit to do electrical work. A fee of $25 is required for a license and a $5,000 bond. For a renewal license the fee is $10. Another bill requires the National Code rules to be used where there are no municipal requirements.

At Superior, Wis., the date set for the removal of overhead wires and poles from Tower Avenue, the principal business street, is approaching and plans are being formulated to comply with the ordinance. At a conference arranged by the chief of the Fire Department, including all parties in interest, a joint-occupancy pole line was established to carry fire-alarm wires, low-potential light and power wires and one set of telephone wires and cables. The isolation of high-tension primary wires from close proximity to signal wires was agreed to after considerable discussion. The opposition telephone company now maintains a heavy pole line on one side of the alleys in the business district, and it is planned to locate the joint-occupancy pole line on the other side. In order to make this arrangement practicable it will be necessary to cable the heavy telephone lead so as to permit service wires from the other line to be carried above or below them to adjoining buildings. It will also be necessary to change the service entrances for lighting and power wires, and arrangement will be made to bring them into basements by means of iron pipes so that when wires are ordered underground there will be a minimum of expense to consumers.

Official Aspects of Radio-telegraphy.

Further evidence before the House of Commons committee dealing with the Berlin radio-telegraph convention (see Western Electrican of April 6th, page 306) goes to prove that all the British departments at all interested in the use of radio-telegraphy are emphatically in favor of Great Britain officially accepting the terms agreed upon at Berlin at an early date, so that all the necessary details may be gone into before July, 1908, the date fixed for the convention to come into force.

There seems to be a certain amount of solicitude on the part of some members of the committee for the welfare of the Marconi company, but the Admiralty officials appear to be quite clear as to the interpretation of the agreements that have been entered into.

In 1903 the Admiralty entered into an agreement to use the Marconi system and no other, and not to exchange messages with any station using other systems. But in 1904 a further agreement was drawn up by which the Marconi company agreed not to sue for compensation in the event of Great Britain accepting the terms of any convention that might be held, and to that extent the company has accepted the principle of intercommunication.

It is interesting to note that the technical experts of the navy prefer the Marconi magnetic detector to any other similar piece of apparatus, although it is not regarded as the most sensitive, but favor any of the transmitting apparatus used in other systems to that used by the Marconi company.

The Chicago Traction Ordinances.

Now that the Chicago street-railway franchise ordinances have become law, having been approved by referendum vote on April 2d and all previous steps having been taken, their provisions may be again reviewed, for the settlement is in many respects unique and comes after ten years' agitation, in which municipal ownership proposals cut a prominent figure.

There are two ordinances—one to the Chicago City Railway Company (South Side) and one to the Chicago Railways Company, covering the lines now operated (North Side and West Side) by the receivers of the Chicago Union Traction Company, with certain extensions. Generally speaking, two-fifths of the street-railway equipment of the city is needed for the South Side and three-fifths for the North and West sides combined.

Following is a brief summary of the provisions of the ordinances:

The city and the companies agree that the value of the present tangible and intangible property of the Union Traction system is $29,000,000 and of the City Railway system $21,000,000.

The companies agree that they will proceed at once to rehabilitate and re-equip their entire street-railway systems and put them in first-class condition, in full compliance with specifications for such work and under the supervision of a Board of Supervising Engineers created under the ordinances.

The Board of Supervising Engineers is to consist of three persons, one selected by the companies and one selected by the city, and the third to be Mr. Bion J. Arnold, who has been the expert engineer representing the city of Chicago in traction negotiations during the last five years. Mr. Arnold is also selected as chief engineer in charge of the preparation of the plans and specifications for the entire work of rehabilitation and of the supervision of such work. He is, in fact, the chief figure in the practical part of the work of rehabilitation, being ex-officio chairman of the board. He will receive a salary of $30,000 a year during the period of "immediate rehabilitation" (three years) and $15,000 a year thereafter.

The city or any other company authorized by it is given the right to purchase the entire property of the two systems, or either of them, upon the payment of the agreed price of the present property of each company, respectively, and the cost of rehabilitation and extensions, including fair allowances for construction, profit and brokerage.

If the street railways are to be so acquired for operation by a private corporation, for its own profit, the purchase price is to be increased 20 per cent.

The companies are limited, during their operation, to an interest return of five per cent. upon the agreed value of their property, plus the cost of rehabilitation and extensions.

The net profits from the operation of the street railways are to be divided between the city and the companies in the ratio of 55 per cent. to the city and 45 per cent. to the companies.

The ordinances require the setting aside of six per cent. of the gross receipts for maintenance and repairs of the systems.

The ordinances further require the setting aside of an additional and separate fund of eight per cent. of the gross receipts to cover renewals and depreciation.

Whatever portion of the two funds above mentioned is not actually devoted to the purposes specified remains in the funds and passes to the city or its licensee upon purchase.

In case either of the above funds should in any event be insufficient for the proper maintenance, repair and renewals of the entire street-railway system and its equipment the companies are obligated to supply additional funds for these purposes.

The ordinances provide for a comprehensive system of transfers and through routes by means of which passengers can ride over all connecting lines, within the city limits, covered by the Chicago Union Traction system, the Chicago City Railway system, the Chicago Consolidated system and the Chicago General Railway system, for a single fare, in any one general direction.

Twenty-one through routes over the lines of those systems are specified in the ordinances, and provision is made for such additions thereto as the traffic may warrant or require at any time hereafter.

Numerous extensions of the existing lines are specifically provided for, and the companies agree to construct and equip additional extensions amounting to six miles of double track or 12 miles of single track for the Union Traction system, and four miles of double track or eight miles of single track for the City Railway system, in each year, after the third year.

The companies also agree, under certain conditions named in the ordinances, to construct whatever additional extensions may be required by the City Council.

The companies agree, upon demand of the city and at the city's option, to furnish funds to the amount of $5,000,000 for the construction of a central subway, to be built and owned by the city, the plans for which are to be approved by the Board of Supervising Engineers.

The companies also agree to furnish to the city the funds for the construction of extensions to this subway on the terms stated in the ordinances.

The Chicago Railways Company agrees to lower and reconstruct the tunnels under the Chicago River at Washington, La Salle and Van Buren streets.

The city is also authorized to require the installation of the underground trolley system in place of the overhead wires.

The capacity of the surface lines within the Loop district will be largely increased by the through routes and rearrangement of the existing terminals.

Within three years the Chicago City Railway Company must have in operation on its lines at least 800 double-truck cars, of modern type and design, to be approved by the Board of Supervising Engineers, and the Chicago Railways Company must have in operation on its systems at least 1,200 such cars.

The city has full power to require whatever additional cars or other equipment may be necessary.

Within at least one year cars in trains can no longer be operated, and all cars must be operated singly.

The ordinances contain ample requirements for grooved rails and for the cleaning and sprinkling of streets and for the paving of the right-of-way.

The ordinances contain a complete reservation by the city of all its police powers, including the right to make all regulations which may be necessary to secure adequate and sufficient street-railway accommodations for the people and to insure their comfort and convenience.

The books and accounts of the companies are to be kept according to forms subject to the approval of the city comptroller, and are subject to the inspection of the city's accountants at all times.

The companies are required to make sworn annual reports to the city, and there is provision for an annual audit of their books by public accountants.

Electricity is to be used as motive power.

Cars must be double-truck and have center aisles and be without running footboards on the sides. All closed cars shall be vestibuled.

No advertisement shall be placed on the outside of any car, and only the space between the top of the windows and the transom shall be used for "ads" on the inside.

Nickel fares are charged, with the usual provision for children.

All new track construction shall be laid with 129-pound grooved rails.

All joints shall be cast-welded, electrically welded or of a type which will give an equally smooth and even joint.

Bonding must be thoroughly done to guard against electrolysis as much as possible.

Span-wire construction is provided for the overhead work. Poles shall be of iron or steel, weighing about 900 pounds each, set in concrete and painted. They shall be spaced from 100 to 115 feet apart. The trolley wire shall not be less than No. 00 B. & S. gauge. It shall be suspended not less than 18½ feet above the rails, except in special cases. There shall be at least two insulations between the trolley wire and the span-wire pole.

All transmission wires carrying 1,000 volts or more must be placed underground. In addition, in certain specified districts, as the central portion of the city, all feeder and transmission wires, without qualification, must go underground.

The company shall build such power houses and auxiliary buildings, together with the necessary machinery and appurtenances as may be determined upon by the company, with the approval of the Board of Supervising Engineers to supply whatever electric power may be required (in addition to such power as the company may acquire by lease or contract with such approval from sources other than its own plants) to enable the company to operate at all times its street-railway system efficiently and continuously.

The high-tension switches shall be entirely enclosed in fireproof material and shall be operated by levers, compressed air, auxiliary currents, or by such other means as will, as far as practicable, prevent personal contact with high-tension current.

All feeders leading out of power plants and substations shall be provided with some form of safety switches or automatic circuit-breakers designed instantaneously to open the circuit in case of a short-circuit occurring on the feeder or on the trolley which it feeds.

Cars must be provided with heaters and power brakes.

In further elucidation of these ordinances an extract from an address delivered before the City Club on March 2d last by Mr. Walter L. Fisher may be quoted. Mr. Fisher is the special traction counsel of the city and a man of high character. He framed the ordinances and has been a student of the situation for several years. Among other things he said:

"Frankly recognizing that from whatever point of view the subject may be approached the furnishing of the best possible service is the thing to be attained, these ordinances have been so drafted that first and before all else they provide for the best possible street-railway service. The service features dominate and control the entire ordinance, but while this is so, it is a cardinal principle upon which the ordinances have been drafted that street-railway service will not be or continue to be first-class unless there is adequate and efficient public regulation and control, both of construction and equipment and of operation, and that no public regulation or control can be either adequate or efficient unless coupled with the right of the city at any time, upon fair terms and reasonable notice, to take over the property either by itself or its licensee. The municipal-ownership features of these ordinances are as much an integral and essential part of them, from the point of view of service, as are the powers of the Board of Supervising Engineers or the police powers of the City Council.

"But what sort of service will these ordinances provide? What are the definite and specific provisions by which first-class street-railway service is to be secured and maintained?

"First, the ordinances provide that the companies shall proceed at once to reconstruct portions of their track and roadbed and put their entire street-railway system, plant and equipment in first-class condition, in full compliance with the specifications and provisions for such work.

"A certain portion of this work is specifically designated as 'immediate rehabilitation.' The work of immediate rehabilitation must be commenced immediately upon the acceptance of the ordinances, must be diligently prosecuted and be fully completed within three years. This work of immediate rehabilitation includes the removal from the streets of all of the present cable tracks, slots and conduits and the substitution therefor of first-class, modern electric track construction and equipment; the rebuilding of at least 150 miles (single track) of the present electric tracks of the two systems; the acquisition of the necessary supply of electric power, the construction and equipment of the necessary system of distribution and sub-stations; the rebuilding and re-equipment of the carhouses so as to provide for the proper cleaning and maintenance of the cars; the increase of the number of double-truck cars until at least 2,000 such cars are put in operation; the abandonment within one year, or as much sooner as it can possibly be done, of the operation of cars in trains and the substitution of operation by single cars only; the establishment of 21 through routes and of a complete system of transfers under which, in connection with these through routes, passengers are entitled to ride for a single fare in any one general direction over all of the connecting lines of the two systems and of the Chicago General and of the Chicago Consolidated Traction systems, within the present or future limits of the city, with appropriate provision for the extension of these transfers to the lines of the Calumet and South Chicago companies upon the expiration of their present franchise.

"I may say in passing that the provision in respect to transfers with the Consolidated Traction system is so drastic that when at Atlantic City the gentlemen were asked how they were going to comply with it they agreed that in order to do so they might have to station a man at the end of the line with a basket of nickels and give the passengers five cents, because if they did not and there was any failure in this respect their rights would absolutely cease and their stocks would be forfeited.

"Appropriate provisions are made for placing transmission and feeder wires underground, for filling, grading, paving, keeping in repair, sweeping, sprinkling, keeping clean and free from snow the portion of the streets occupied by the tracks.

"The most liberal provisions have been inserted for the future extension of the system into the outlying territory and for the establishment of new and additional through routes whenever the traffic warrants or requires.

"The river tunnels are to be reconstructed and adapted to use as a part of the future subway system, and ample provision is made for the construction and extension of such system.

"All of this work is to be done and maintained under the direction and supervision of a Board of Supervising Engineers, consisting of three members, of which the city is to select one and the companies one, and Mr. Bion J. Arnold is to be the third and the chairman of the board.

"The integrity and capacity of Mr. Arnold need no defense and no extended statement from me. He is confessedly the most competent and reliable engineer in this country who is available for municipal street-railway employment. Chicago is to be profoundly congratulated that such a man is available and is willing to undertake the duties of this responsible position. For the last five years he has been the traction expert and engineer upon whose advice the city government and the community have confidently relied. His appointment was made at the suggestion of the representatives of the city, and was made a condition of the city's acceptance of the financial compromises which were made with the unanimous concurrence of the entire committee on local transportation and of Mayor Dunne.

"With the immediate representative to which the city is entitled on this board the interests of the public will be absolutely protected by a majority vote upon all questions.

"I do not mean to intimate that any decision

will meet the concurrence of Mr. Arnold which is not fair to the financial interests involved, but I do mean to assert with absolute confidence that no proposition will receive his concurrence which does not fully protect the rights and interests of the public. Mr. Arnold is made not merely the chairman of the Board of Supervising Engineers, but under the precise terms of these ordinances he is made the chief engineer in charge of the preparation of the plans and specifications and the supervision of the work of reconstruction and equipment. The city is therefore in all respects as advantageously situated as if it were undertaking this work of reconstruction itself—nay, it is far more advantageously situated, for under these ordinances the work of reconstruction, of equipment, of maintenance and of operation will be done with the money and at the financial risk of the street-car companies, but under the same sort of supervision and control that the city would exercise if it were itself furnishing the funds and doing the work.

"In this connection it is well to call particular attention to the provisions with regard to the construction and extension of the municipal subways.

"The subway provisions of these ordinances are based upon a report made by Mr. Arnold, accepted without dissent by the committee on local transportation and the mayor, which set forth in convincing form the absolute necessity for the immediate construction of at least that amount of central subway which will take care of the traffic passing through the river tunnels and provide a connection with the City Railway system.

"The fundamental proposition is that the limit of capacity upon the surface of the down-town streets has already been reached under the present system of divisional operation and that it will not suffice to take care of the growing necessities even under a system of through routes and unified operation; that the north and west divisions cannot be adequately served by means of bridges alone, and that the river tunnels must be reconstructed and utilized; that, to bring the cars passing through these tunnels to the surface of the street in the center of the city is uneconomical and unwise from every point of view; and that, therefore, a sufficient amount of central subway should be constructed in the immediate future to take care of the traffic passing through these tunnels; that, by connecting this system with the City Railway system by means of a connecting subway and the necessary loops, provision can be made for relieving the congestion on the streets, for more rapid transportation than could possibly be provided upon the surface and for complete universal transfers within the subway to all parts of the city.

"The estimated cost of such a subway as would be necessary for this purpose is something less than $5,000,000, and this amount of money the companies agree to advance to the city of Chicago at its option upon the passage of an ordinance by the City Council and the approval of the plans and specifications by the Board of Supervising Engineers. If the city decides not to exercise this option the companies acquire no rights whatever in subways which the city may construct by other means, and the city expressly retains unimpaired all of its powers with respect to such subways. The companies concede that the city shall have full right to construct subways in all streets, the surface of which may hereafter be occupied by them.

"The title to the subway provided for by these ordinances is to be in the city of Chicago, and the work of construction is to be done by it. The companies receive nothing for their money but an allowance of five per cent. for brokerage and an annual interest return of five per cent. In return for this contribution the companies are given the right to operate their cars through that portion of the subway which is to be devoted to street-car traffic. Upon the purchase of the street-railway system by the city or its licensee, the money advanced by the companies for subways is to be refunded to them. In addition to this the companies expressly agree that they will at all times advance to the city whatever additional moneys may be necessary for future extensions of the subway system.

"It is conceded that the sewer system in the central part of the city must be reconstructed in the near future. This is an imperative necessity and cannot be avoided. It must be clear to everyone that it would be the height of folly to tear up the down-town streets for this purpose and not take advantage of the opportunity to start the construction of subways. It must be equally obvious that the underground trolley should not be laid in the central district until the work of constructing the subways and sewers has been definitely undertaken. Underground trolley construction is extremely expensive and would of course have to be torn up and rebuilt if now constructed upon streets which are hereafter to be excavated for subways or sewers. For this reason the construction of the underground trolley is postponed under definite provisions authorizing the city to require it in the future. There are no limitations whatever as to the extent of the underground trolleys or the extensions of the subways or the extensions of the surface lines, except the provision that the companies shall not thereby be required to increase their total capital investment to such an extent that the return thereon, over and above the interest charge of five per cent. would be reduced to an inadequate or unreasonably small amount. The question of what would be inadequate or unreasonably small return is properly and necessarily left to the courts to determine in case of controversy."

Mr. Arnold has already taken up the outlines of construction work, which will come up for ratification after the Board of Supervising Engineers is organized and the companies have fulfilled their promises of accepting the ordinances. In connection with these plans Mr. Arnold is reported to have expressed the hope that eventually the city would have underground subways running to the north, west and south city limits, which in time would complete the proposed subway scheme to care for the central district.

There is renewed talk of consolidation of the surface lines. It is said that the effort to bring about consolidation will soon be redoubled and that the outlook for a complete united traction system in Chicago is good. It is admitted, however, that the success of the plan depends wholly on the outcome of the reorganization of the Union Traction Company.

BOOK TABLE.

Mineral Resources of the United States. By David T. Day, Chief of the Division of Mining and Mineral Resources, United States Geological Survey. Washington, D. C.: Government Printing Office. 1906. Pp. (5¾ by 9 inches), 1,403.

Among the subjects exhaustively treated are: "Iron and Manganese Ores," by John Birkinbine; "Gold and Silver," by Waldemar Lindgren and others; "Copper, Lead and Zinc," by Charles Kirchhoff; "Steel-hardening Metals," by Joseph Hyde Pratt; "Platinum," by F. W. Horton; "Electric Smelting," by G. Howell Clevenger.

A graphic illustration showing the development of the cement industry since 1890 appears on page 941.

Modern Polyphase Machinery. By Andrew Stewart, A. M. I. E. E. London: S. Rentell & Co., Ltd. (D. Van Nostrand Company, New York city, agent). 1906. Pp. (4¾ by 7⅛ inches), 296, with 181 illustrations. Price, $2.

This book has been written with a view to giving a fairly comprehensive survey of the principles, design and construction of modern polyphase machinery without the introduction of mathematical methods of investigation and explanation. Among the subjects treated are: "The Elementary Alternator," "Magnetic Properties of Iron and Steel," "Insulators and Their Properties," "Electromotive Force of an Alternator," "Armature Windings," "The Field Magnet," "Methods of Excitation and Compounding," "Output and the Factors Which Influence It," "Waves and Wave Forms," "Parallel Running and Synchronizing," "Single Exciting Coil and Inductor Alternators," "Turbo Alternators," "Rotatory Converters," "The Induction Motor," "Testing Polyphase Generators and Motors." Twenty-six valuable tables appear in the book.

Modern Steam Engineering. By Gardner D. Hiscox, M. E., with chapters on electrical engineering by Newton Harrison, E. E. New York: The Norman W. Henley Publishing Company. 1907. Pp. (6 by 9 inches), 487, with over 400 engravings. Price, $3.

It has been the aim of the authors to meet the wants of the student and engineer in all the practical requirements for obtaining a mastery in the application and use of steam for power and other purposes in the full range of its usefulness. A further object has been to treat the mathematical side of steam engineering in such a manner that the engineer or student may be able to grasp the whole subject with ordinary arithmetical acquirements by means of the figured repetition of the formulas.

In 42 tables included in the work will be found a ready reference, covering all conditions of the properties of steam and its application for the production of power, ratios, engine parts and proportions, most useful in the service now devolved upon the duties of a successful engineer.

Exhaustive treatment is given the subject of superheated steam and the practical operation of the plain slide and piston valves and their gear, the Corliss valves and valve-gear, the triple and quadruple expansion engine and the work of the indicator as well as the steam turbine which is now coming to the front as a power producer.

The duties of an engineer who is entrusted with the management and use of steam in a private or public capacity are given, as well as chapters on refrigeration plants, elevators and electric-light plants.

Questions as asked by the examining board are included, as well as their answers, which should prove of great help to those preparing for and desiring to procure licenses as steam engineers.

The contents of the electrical section contain dissertations on the following subjects: "The Dynamo and Its Regulation," including its operation, generation of electromotive force, use of the commutator, regulation of dynamos variously wound, etc.; "Testing and Motors," including causes of sparking, use of pole spray, cause of heat in the armature, the back electromotive force of a motor humming and other noises in a motor, etc.; "The Switchboard and Storage Batteries," comprehending centers of distribution, classification of circuits, the ground detector, difficulties with plates of storage batteries, efficiency of storage cells, etc.; "Lighting and Lamps," comprising the various types of electric lamps, vacuum tube lighting, etc.

Considerable space is devoted to the treatment of steam electric plants, net result in light from coal consumption, waterpower plants, gas-engine electric plants, etc. Much time and care has been taken in the preparation of the work.

Electrically Driven Paper Mill in Japan.

Representatives of the Oji Paper Company of Tokio, Japan, have for some time been inspecting various electrical properties in the United States with an eye to installing a modern electrically equipped paper mill in Japan. As a result of their investigations, orders have been placed in the United States for a complete electrical and mechanical equipment, which will cost over a million of dollars.

The new Japanese paper mills, which will be operated by the electric drive, will include, in addition to the motor equipment of the paper-making machinery, a new hydro-electric plant, with a 15-mile transmission line and sub-station. The electrical equipment will be furnished by the General Electric Company.

At the power station there will be installed four waterwheel-driven three-phase 3125-kilovolt-ampere units, generating current at 3,450 volts, the frequency being 60 cycles. Current for exciting the revolving fields of these generators will be furnished by the usual twin exciting units, consisting of two 150-kilowatt generators, driven respectively by an induction motor and a small waterwheel. Generator regulation will be effected by a Tirrill regulator.

Twelve water-cooled step-up transformers will be arranged in sets of three to raise the generator voltage for transmission. Each transformer will have a capacity of 1,050 kilowatts, and the primary voltages will be arranged with Y connections for either 46,000, 45,000 or 44,000 volts. An eight-panel switchboard will be installed in the main station.

At the sub-station, near the mill, 12 step-down transformers will be employed to reduce the transmitting potential to 2,200 or 2,100 volts. The switchboard will be arranged to distribute power at the desired voltage directly to the motors.

In the paper mill five 750-horsepower 2,000-volt induction motors will be used to drive the pulp grinders. These motors have an external resistance in the armature circuit and controllers to vary the speed. Each motor will have an extended shaft and will be so placed between two pulp grinders that both grinders can be driven directly without belting.

Each of four beater machines will be driven by a 350-horsepower induction motor, operating at a potential of 2,000 volts. A fifth will be driven by a 200-horsepower induction motor, and all will be operated on the rope-drive system.

The Oji paper mill will be situated at Hokaido, on the seashore, facing the Pacific. It will be an excellent example of modern engineering practice, of which there are coming to be so many typical installations in Japan.

Electrical Contractors Will Meet in New York.

The seventh annual convention of the National Electrical Contractors' Association of the United States will be held in New York city, July 17th, 18th and 19th. Even at this early date, all indications point to this convention being the most largely attended and probably the most interesting and entertaining in the history of the association. The convention committee is composed of J. C. Hartzel, 571 Fifth Avenue, New York city; F. J. Miner, Detroit, Mich., and W. I. Patterson, Pittsburg, Pa. Mr. Hartzel is chairman.

The Columbus (Ohio) Railway and Light Company has voluntarily increased the wages of all conductors and motormen, numbering nearly 600, one-half cent per hour. The higher cost of living is given as the reason for the company's action.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XI.—Dynamo-electric Machinery.

Series-wound Motors.

The most familiar use of series-wound motors on constant-potential circuits is in direct-current street railway motors, which operate at a pressure of about 500 volts. In these machines the field windings and the armature winding are in series, so that the same amount of current passes through both of them. Their chief characteristic is their very high torque. We have seen that the torque of a motor varies with the amount of armature current, and also with the strength of the field. In the series motor, when the armature current is increased, the field current increases by the same amount, which greatly increases the magnetic flux of the field. Therefore, in this type of motor, we have the torque varying with both the armature current and the field strength, so that when the fields operate below their point of saturation, the torque increases as the square of the current. If the fields have become saturated, it is evident that an increase in the field current cannot increase the magnetism any further, so beyond the point of saturation of the iron the torque varies only directly as the armature current.

The speed characteristics of a series-wound motor also differ entirely from those of the shunt-wound motor. We have seen in the previous chapter that the speed of a shunt-wound motor tends to remain constant at all loads. In the series motor the speed tends to vary inversely as the load; that is to say, under full load the motor operates at its lowest speed, and as the load decreases the speed of the motor increases, and if the load is entirely removed, the speed tends to become destructively high. This is due to the fact that as the load is removed, the current becomes less, and the fields are therefore weakened, which causes an increase in the speed.

In addition to their very large use in railway work, series motors are also well adapted to the operation of cranes, hoists and other machinery which require a very large starting torque, and for which a constant speed is not essential. It is especially valuable in starting loads which have a great friction of repose.

There are several methods of controlling the speed of series motors on constant-potential circuits, but the most common way is to vary the electromotive force applied to the machine by means of inserting resistances in the circuit. In street-railway work, where two motors are always used on a car, the method of control employed is to throw the two motors first in series and afterward in parallel.

Throwing the motors in series has the effect of cutting down the applied electromotive force on each motor one-half of the voltage of the supply circuit, while throwing them in multiple leaves them both on the full voltage of the supply circuit. Even in the case of street-railway motors, with the series-multiple control, a number of resistances are used to bring the car gradually up to speed. These resistances are inserted at the starting point and are gradually cut out until they are all out at full series connection. After this they are again inserted, and gradually cut out up to the full multiple connection. The method of street-car control, however, will be treated more fully under the head of electric railways.

There are a number of other ways of varying the speed of series motors, such as varying the field strength; winding the field coils in several series, and gradually changing the connections of the field coils from series to multiple. Some of the turns of the field winding can also be cut out, or a tap may be inserted at some point of the field winding which will shunt the current around part of the winding, thus greatly increasing the speed. A change in the position of the brushes would tend to change the speed. Also the number of armature wires could be varied by connecting them first in series and afterward in multiple, by means of two commutators. But, in general, the method of varying the electromotive force applied to the machines by means of resistances is the most practicable method of speed regulation of this type of motor.

Compound-wound Motors.

Compound-wound motors are of two types, known as the cumulative and the differential compound winding, depending upon the direction in which the series winding is placed upon the fields. The compound-wound motor is wound exactly similar to a shunt-wound motor, with the addition of a few turns of series windings, which may be either in the same direction or in the opposite direction to the shunt winding. If in the same direction, the winding is called cumulative; if in the opposite direction, it is known as the differential winding. In either case the shunt winding furnishes the principal magnetizing current, and the series winding, which carries the whole armature current, serves to further regulate the speed of the motor.

The cumulative compound winding is very largely used for starting heavy loads, as, for example, electric elevator or electric crane work. In such cases it is common practice to use the series coil only while the motor is starting, and to cut it out after the motor has attained full speed. As the series winding in such a machine is in the same direction as the shunt winding, and a large current is used in starting, the field strength, and consequently the starting torque, will be very large. As the speed increases, the armature current, and consequently the field magnetization, decreases, and by cutting out the series coil at the time full speed is attained, a comparatively constant speed with rapid acceleration is obtained.

The special use for compound-wound motors is in starting and stopping under heavy loads; but a variation of the load will result in a variation of speed, especially at the maximum speeds, because the series ampere-turns will be much greater than the shunt ampere-turns. If the load on such a motor is very much less than its normal capacity, the motor is liable to attain an excessive speed when a large portion of the load is thrown off.

The differential compound winding is but little used, although it gives very constant speed. If such a motor, however, is overloaded to any great extent, the large amount of current in the series coil is apt to overbalance the action of the shunt coils, so that the field is liable to become demagnetized, which will result in the motor slowing down and burning out.

Motor-generators.

A combination of a motor and a generator is frequently used, and is known as a motor-generator, or a dynamotor. The use of this machine is obtained through a higher or a lower voltage distribution than that of the supply circuit. Where the ratio of voltage is constant, this machine may be made with a single field common to both the generator and the motor. The usual arrangement, however, is merely a motor coupled direct to a dynamo, and both mounted on the common bedplate.

Characteristics and Uses of Alternating-current Generators.

The use of alternating-current generators, the commercial introduction of which dates only from about 1886, has become very widespread, on account of the great advantage which the alternating current offers for distribution of energy over large distances. While in the early days of electric lighting and electric railways, direct-current generators were used almost exclusively, they are but seldom found at present, except in industrial plants and for central-station distribution in cities where the distances to which the current is carried are insignificant. Even in the large cities, where the distribution covers a comparatively large area, direct-current generators are being displaced by alternating-current machines for electric-lighting services, and in electric power stations alternating-current generators are used almost exclusively.

The reason for this gradual change from the use of direct to that of alternating current is on account of the vast saving in copper conductors which is secured by the use of alternating current. In electric-light work (incandescent) 220 volts direct current is the highest practicable working pressure, and in direct-current railway work from 500 to 650 volts is the usual working pressure. In order to distribute current at either of these voltages, large copper conductors are required, and the greater the distance, the greater the amount of copper necessary. In direct-current distribution, therefore, only a comparatively short distance can be covered before the cost of copper becomes absolutely prohibitive.

On the other hand, when alternating current is used, it may be transmitted at vastly higher potentials than are feasible with direct current; 16,000 and 33,000 volts alternating current are quite commonly employed in long-distance work at the present time. Even 60,000 volts pressure is in commercial use, and is entirely feasible as an engineering practice. At these voltages, a very few amperes represent a large amount of power, and this small current at an enormous pressure can be transmitted over great distances, and with very insignificant transmission loss, upon very small wires. For this reason, wherever the length of the transmission lines is more than a few miles, the practice today is to generate alternating current at a comparatively low voltage, to raise the voltage of this current to any pressure desired by means of static transformers, which have no moving parts and therefore require but little attention; to transmit this high-potential current over comparatively small wires to point of distribution, where other transformers reduce it to any required working pressure.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Polishing Hard Rubber.

W. D. T., Madison, S. D.: What is the method of polishing hard rubber, such as is used in the making of telephone receivers, etc.?

Answer.

Hard rubber may be polished in several ways. One method which has been applied with considerable success consists of the following operations:

First, plane down the surface of the hard rubber. This is generally done by fastening a piece of coarse emery cloth to a perfectly flat surface and moving the piece of hard rubber across the emery so as to give the surface a very smooth finish.

Second, fasten a still finer grade of emery cloth to a flat surface and moisten the emery with ordinary machine oil, keeping it moist while moving the piece of rubber to and fro on the flat surface.

A third operation consists in using the finest grade of emery cloth which can be secured, moistening this cloth with machine oil and adding a little of the polishing compound used by electroplaters.

After these different operations have been performed, a piece of thick felt, say one-quarter inch in thickness, should be fastened to a plane surface, and the final polish may be given to the surface of the rubber by pressing it down on the felt and moving it to and fro until the desired degree of polish has been obtained.

It will be observed that the polishing of hard rubber is accomplished by a gradual smoothing of the surface, commencing with a coarse cutting surface and ending with the finest-grained surface.

If it is desired to polish receiver shells, proceed in the same manner with the exception that the use of a plane surface is impracticable. Here it is necessary to apply the emery cloth while the receiver shell is rotating at a comparatively high speed, and the final polish is, of course, made by applying a substance like felt to the already smooth but dull-finished surface.

The Integrating Wattmeter Defined.

H. D., Chicago: What is the meaning of the word "integrating" when used before "wattmeter"?

Answer.

This apparently simple question leads to an investigation of considerable interest. Mr. R. C. Lanphier of Springfield, Ill., who is a specialist on the subject, and whose paper on "Meters," read before the Illinois State Electric Association last fall and later published in the Western Electrician, attracted much attention, kindly furnishes the following answer:

"There are several new books just out on the subject of instruments and meters, among them 'Electric and Magnetic Measurements' by Mr. F. W. Roller. Mr. Roller is an electrical instrument man of high repute, and I quote his definition:

"'Integrating meters are devices for registering the product of the mean value of current or power, supplied through a given circuit during any given period of time, by that period.'

"Abroad integrating wattmeters are usually referred to as 'electricity meters,' and in the book by Mr. H. G. Solomon with this title, which was published last year, the author says that electricity meters are devices which register 'the amount of the electrical energy consumed in a given period, in terms of the supply unit. The supply unit is usually taken equal to one kilowatt-hour or 1,000 watthours.'

"These definitions seem to me quite good, but I

may be able to put it in a way that may be clearer to some of the central-station men.

"The term 'recording wattmeter' is not really correct as applied to a meter which shows on a dial the amount of electrical energy which has been used in a given time, for a recording wattmeter is really one that traces a curve on a sheet so as to show the variations in the amount of power passing through a circuit, at all times. That is to say, a recording wattmeter is, strictly speaking, a graphic instrument.

"The term 'integrating wattmeter' means, literally, a wattmeter which integrates or sums up the variable amount of electrical energy used in the circuit to which it is connected, during any period of time. This integration or summation is obtained by the motor device of any meter running at a speed which varies from instant to instant with the number of watts of power in the circuit, and this variable rate of motion being transferred to a train of gears, the total amount of rotation or motion of the motor device is evidently summed up by the reading of the dial, so that when the device is properly adjusted to some assumed rate of motion for the motor device, watt-hours or kilowatt-hours can be read from the dial.

"In my opinion a more correct term than 'integrating wattmeter' is the expression 'kilowatt-hour meter,' or 'watt-hour meter,' for it is really not watts but *watt-hours* that an integrating meter shows. Therefore I think one of these latter terms might be preferable, but is hardly likely to be generally adopted on account of the wide and general use of the term 'integrating wattmeter.'

"The expression 'electricity meter,' as used abroad, is good from some points of view, but may be occasionally confused, as this might apply to other electrical meters than watt-hour meters."

Exhibition Plans for the National Electric Light Convention.

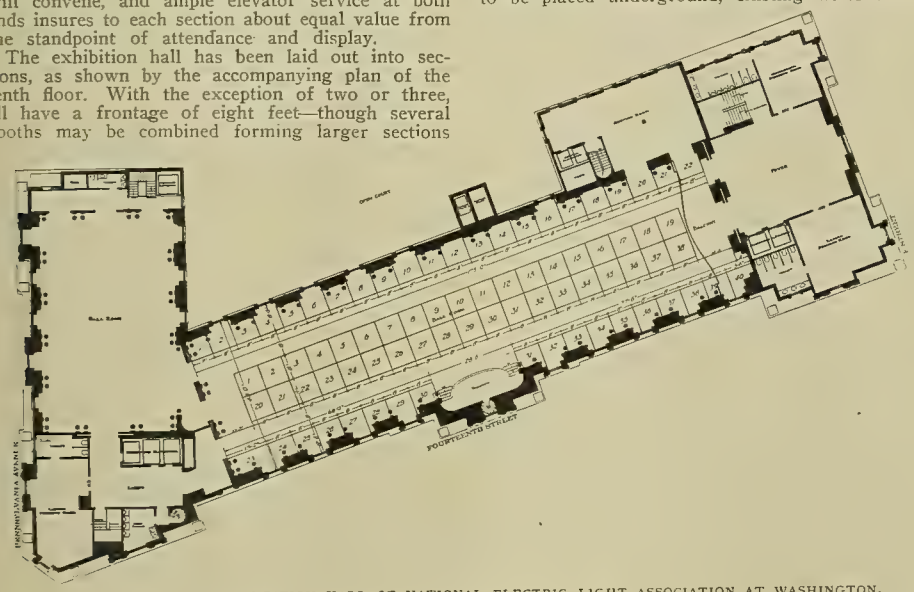
Following the plan of last year, arrangements have been made for an exhibition by the associate members at the Washington convention of the National Electric Light Association of June 4th to 7th. For this purpose the large ballroom of the New Willard, having a floor area of nearly 10,000 square feet, has been secured. This room is on the same floor with the hall in which the delegates will convene, and ample elevator service at both ends insures to each section about equal value from the standpoint of attendance and display.

The exhibition hall has been laid out into sections, as shown by the accompanying plan of the tenth floor. With the exception of two or three, all have a frontage of eight feet—though several booths may be combined forming larger sections where this is desired. Departing from last year's practice, the prices for sections will include the erection of complete booths, wiring and lighting. For additional current for demonstrating purposes, separate arrangements will be made. The charge will be based on the cost to the association, and favorable terms and the fairest kind of treatment are assured, both from the local company and the management of the hotel.

Public attendance and interest promise to be so great, in the judgment of the management of the New Willard, that it has been proposed to issue, through various agencies, special admission tickets for attending the exhibition. Of the population of Washington a large percentage will be naturally interested in electrical matters and this year's exhibition.

For the convenience of those who desire to take part in the exhibition a blank stating the number of sections desired and providing for a first, second and third choice of the desired location is being sent to associate members.

Mr. L. E. Sinclair, Fourteenth and East Capitol streets, Washington, is chairman of the exhibition committee. The assignment of spaces will be made through the office of the vice-chairman, Walter Neumiller, 55 Duane Street, New York city. The prices of sections range from $75 to $125, including rental of space, erection of booth complete, painting and lettering, lamps, wiring, connections and current for the lighting of booths.



MEETING ROOM AND EXHIBITION HALL OF NATIONAL ELECTRIC LIGHT ASSOCIATION AT WASHINGTON.

Underwriters' Report on Electrical Conditions in Milwaukee.

The National Board of Fire Underwriters, in reporting on the electrical conditions of Milwaukee, Wis., advises that there is practically no municipal supervision maintained. By an old city ordinance the assistant superintendent of fire-alarm telegraph is required to supervise the construction and operation of all electric wires. The Milwaukee Board of Fire Underwriters maintains one electrical inspector. Mr. Oscar D. Kleinsteuber is assistant superintendent of fire-alarm telegraph. Mr. H. E. Bloomer, the insurance electrical inspector, was appointed to his present position in 1902.

Owing to the pressure of his other duties, the assistant superintendent of fire-alarm telegraph is able to give but little time to outside wiring and none at all to inside work. From time to time he makes recommendations to the chief of the fire department to have overhead wires and poles removed from certain streets and alleys, but no inspections are made. The underwriters' inspector devotes most of his time to new inside work, inspecting all new equipments which come to his attention, depending for knowledge of such equipments largely upon the filing of applications for inspections by contractors. Inspections are made during installation and on completion, the National Electrical Code being enforced. No certificates of approval are issued, but in some cases a letter of acceptance is given. Old inside work receives little or no attention except when in connection with new work or an inspection is requested. No attention whatever is paid to outside work. No fees are charged for inspections.

The only municipal regulations for the installation of electric wires require that all concealed wires for electric light and power be in incombustible and non-conducting pipes; that lighting companies provide proper switch at entrance to all buildings, and that all wires be installed in a manner safe to life and property, and to the satisfaction of the assistant superintendent of fire-alarm telegraph. There is also an ordinance requiring all overhead wires within a two-mile radius of the postoffice to be placed underground, existing wires to have been placed underground by January 1, 1907. Electricians are not examined or licensed.

The Milwaukee Board of Fire Underwriters has adopted the National Electrical Code in its entirety as a standard. A graded charge is made in the insurance rate for defective installations, but no clause requiring the approval of the board is ordinarily attached to insurance policies, nor is there any agreement with the lighting company whereby current will not be supplied to defective installations.

In May, 1906, 32 new and 72 old representative inside installations were inspected by the National Board engineers to ascertain the quality of new work and the general condition of the old wiring. In the new work inspected, a total of 308 defects was found, or an average of 9.6 per equipment. There were 38 violations of the National Electrical Code, 17 of which were due to the use of unapproved material and 21 due to poor workmanship or other causes.

Among the most prominent deficiencies found, according to the underwriters' investigators, were: Fuses too large for circuit; porcelain-base link-fuse cut-outs; cut-out cabinets not standard; unapproved flexible cord used for portables; flexible cord too long or used as line wire; stranded wire not properly soldered at connections; wires not properly bushed through walls, floors, etc.; insulating tubes at gas pipes, etc., not securely fastened in position; wires not properly protected from mechanical injury; bad work around meter; rheostat or starting box not properly separated from inflammable material; unapproved rosettes; snap switches improperly mounted; and others, more or less serious, but occurring only a few times. Most of the defects could have been remedied through proper inspection.

In the old work inspected, 1,064 defects were found, or an average of 14.7 per equipment. In addition to the deficiencies noted under new work the following were frequently found: No individual cut-outs for arc lamps; unapproved plug and cartridge fuses; no cut-outs or cut-outs not properly located at service entrance; wires not properly arranged back of insulating joint or at canopy; unapproved flexible cord used for pendants; flexible cord not properly suspended; joints not properly soldered and taped; wires in contact with or not properly separated from gas pipes or other metallic or conducting bodies; wires not properly supported; live bare ends; underground wires not properly arranged at service entrance; unapproved sockets; improper switch, or none, or switch not properly located at service entrance, and unapproved knife and snap switches. Grounded street-railway current is used in a number of buildings. Many other defects occur, but each only a few times. No high-tension series arc-light circuits were noted in buildings.

Outside work receives very little supervision, say the underwriters. The law requiring all overhead wires within a two-mile radius of the Postoffice to be placed underground, has been poorly enforced. In practically all blocks, especially in the business section, there exists a network of low-tension wires which are carried over roofs, across alleys, and in some cases across and along streets. The Fire Department reports these as a bad obstruction to its operations. The principal light and power company runs individual underground service to each building supplied from its underground system in the business district, except for a few cases, in which a single connection is used to supply a feeder run overhead through several basements. Some of the minor companies, supplying a part of a block or a smaller group of blocks, make a practice of running service from building to building—an undesirable feature at best, while, in addition, these lines are generally poorly installed.

In residence districts distribution is generally from poles. In conduit work telephone wires are mainly distributed from poles, along walls or across housetops. Light and power circuits are in separate conduit systems from low-tension circuits, but in overhead work high-potential wires are often on the same poles with telephone and telegraph wires.

In the congested-value district overhead trolley wires are on Grand Avenue, Wisconsin, Mason, East Water, West Water, Third and State streets. Overhead light and power wires are triple-braid weatherproof, in fair condition, on poles 100 to 125 feet apart. Transformers are all oil-cooled, and are located in manholes in streets or on poles. All overhead light and power circuits are protected by lightning arresters. Overhead low-tension circuits are mostly protected with one-half to 10-ampere fuses and lightning arresters.

The neutrals of the three-wire system are not grounded. The secondaries of transformers are grounded. The negative side of the street-railway circuit is connected to the rails at the power houses. The return-feeder circuit of the street-railway circuit contains about 23 miles of cable, ranging from 200,000 to 4,000,000 circular mils.

The Milwaukee Electric Railway and Light Company operates the street-railway service and supplies the major portion of the commercial light and power. Street-railway current is three-phase, 25-cycle, 13,200 volts alternating current, converted at sub-stations to 600 volts direct current. There is also 600-volt direct current generated direct. This circuit is used to a small extent for commercial power (grounded circuit).

Commercial light and power is from three-phase, 60-cycle, 2,300-volt alternating-current circuit stepped down at transformers to 110-220 volts; also a 110-220-volt direct-current circuit. Series arc street lighting is from 5,000-volt direct-current and alternating-current circuits. The extra-high-tension lines are underground within the city limits. About 15 miles of 2,300-volt lines and 45 miles of 5,000-volt lines are overhead, six miles of each being within the prescribed underground district.

Several small plants supply current for light and power to adjacent buildings or blocks. Wires are generally run from basement to basement.

The following-named companies maintain low-tension or signaling systems: Wisconsin Telephone Company, Western Union Telegraph Company, American District Telegraph Company, Postal Telegraph-cable Company, Chicago-Milwaukee Telegraph Company, Merchants' Police Association and the municipal fire-alarm and police-signaling systems.

The wires of the telephone company, one telegraph company and the municipal signaling system are partly underground.

In 1900 the gas company and in 1903 the traction company made complete electrolytic surveys. These surveys showed high positive areas of the gas and water pipes at a number of localities, but since these tests were made the location of the power houses has been changed and an additional return feeder has been installed, whereby the paths and volume of stray earth currents have been altered, and no tests have been made to determine as to how great an extent. The city has investigated only isolated instances of trouble. A number of cases of the destruction of lead service pipes and of the lead sheathing on underground cables are alleged. On June 8, 1906, a six-inch water main burst on Eleventh Street, between Cherry and Galena streets, and it is asserted that this was due to electrolytic action.

The History of Municipal Telephony in Glasgow.[1]

By Dexter Marshall.

There seems to be little doubt that the national government will secure control of all the municipally owned telephone systems in Great Britain some time before 1911, when, under an agreement with the Postoffice Department, the National Telephone Company is to be purchased at a fair value and its lines combined with the postoffice lines. Then the telephone as well as the telegraph will become a government monopoly.

There were municipal telephone systems in the five cities of Glasgow, Hull, Brighton, Portsmouth and Swansea at the beginning of the year 1906. The sale of Glasgow's system to the Postoffice Department last August attracted attention on this side of the water because it had been widely published here that the system was a noteworthy success. Soon after its practical transfer from municipal to government control the Brighton system was taken over by the Postoffice. Negotiations are now in progress for the similar transfer of the systems in Swansea and Portsmouth. Hull is the only one of the five cities that has decided to go on with a municipally operated telephone system for a time at least.

With certain variations the history of the Glasgow system has been paralleled by the history of all the others. In each case the municipality has entrusted the operation of its system to "experts" who were not up to the times; in each case the expenses both of establishment and operation have exceeded the estimates, and in each case, instead of turning in profits for the reduction of local taxation, the surplus over actual operation, less proper deduction for sinking fund and depreciation, has been so small that drafts upon the municipal funds, instead of contributions to them, would be necessary if the systems were continued as municipal enterprises. Here is the story of the Glasgow system in brief:

After a long period of discussion and one or two expensive parliamentary inquiries, permission to establish a telephone exchange in that city, asked by the municipality of Glasgow, was granted by Parliament in 1900. The system was opened in June, 1901.

As a business proposition it was not a success, and in August of 1906 it was sold to the British Postoffice, which began to operate it as a part of the department on September 10th. Until 1911 it will be operated in connection with the company's local lines as the government and company lines are now jointly operated in London.

The price paid by the Postoffice Department for the system was $1,464,000. From the establishment of the plant to the date of sale it had cost the city $1,732,164, or about $268,800 more than the selling price. Serious as this loss was, the municipal authorities were glad to get out of the experiment as easily as they did, and the "ratepayers," who had footed the bills, are still wondering why the experiment was ever tried.

The municipal system had 1,500 subscribers in August, 1901. At that time the subscribers in Glasgow to the National Telephone Company's exchanges numbered 11,996. When the city system was sold it had only 12,900 subscribers, while the company had 28,069. The increase in the number of stations served by the municipal system was rapid until the beginning of 1904 when there were 10,700 stations on the municipal lines as against 14,242 on the lines of the National company. The early increase of municipal telephones had been about 700 per cent., as against the company's increase of a little more than 10 per cent.

During the next year and eight months and to the date of sale the increase of municipal telephones was only 20 per cent. In the same time the company's list of subscribers had grown almost 100 per cent.

The difference in the volume of business done by the two systems is by no means fully indicated by these figures, unfavorable to the municipal enterprise as they may appear. During the year 1902 the calls per subscriber on the municipal system averaged only 6.6 a day; in 1903, 6.7; in 1904, 6.4; in 1905, 6.6.

In these four years the average of daily calls per subscriber on the company's lines varied from 13 to 16, or between two and three times as many.

There is no doubt that there was a general popular demand for a municipal telephone system in Glasgow before it was established. Nor is there any doubt that the public supported it loyally for some time. This is shown by the early increase in the number of stations. That the public was thoroughly dissatisfied with the municipal service after the beginning of 1904 is shown by the low rate of increase from that time on until the sale.

The difference between the early rapid growth of the municipal system and its later slower growth was not due wholly, however, to poor service.

Some of the early growth was the result of extraordinary pressure brought to bear by members of the municipal government upon people who had not yet put in municipal telephones. At the very beginning of the experiment many business firms as well as many individuals who had been expected to subscribe promptly to the new system failed to do so. But the officials of the exchange and the councilmen who had been most active in bringing about its installation were not long in finding a way of forcing their telephones upon a large number of the reluctant firms and individuals.

To the canny Scot the methods employed looked very like the methods of Tammany. Municipal ownership and operation have been carried so far in Glasgow that the city's employes are more numerous in proportion to the population than in any American city, or almost any other British city, and it is by far the largest local purchaser in more than one important line. The supplies needed for the manifold municipal enterprises of Glasgow are very large. Manufacturers and dealers in a surprising number of commodities would be seriously handicapped were they to lose the city as a customer.

When it was found that a business man, a firm or company having large dealings with the city had not hastened to install a municipal telephone, he was importuned by canvassers especially detailed to drum up trade among the recalcitrant. If the hired canvasser was not successful an official of the city government followed him up. In some instances this was none other than a member of the council committee on telephones, when the conversation was likely to be something like this:

Councilman: "I am surprised that you have not taken on the municipal telephone. Why is it?"

Recalcitrant Business Man: "To tell the truth, we don't see the need of it. You have a small list of subscribers and only a few of your telephones are so placed as to be useful to us. We have a National telephone in our office and can reach practically every one we wish to talk with, already. We should have to keep it even if we took on the municipal telephone and therefore we can't see why we should. Besides, adding a second telephone would make the conduct of our business just so much more complicated."

Councilman (musingly): "Ah! Let me see. Mr. So and So, the municipality bought goods worth so and so many pounds from your concern last year. Now it asks you to spend a ridiculously small sum yearly to support a public enterprise which has been established to fight a grasping private company's extortion. Isn't 'turn about fair play?' Suppose you think that over a few days. Good morning, Mr. So and So."

It is not difficult to understand the mental processes by which a large proportion of those to whom this suggestion was made concluded that it would be well for their business if they were to subscribe before it was everlastingly too late. That the methods indicated were employed in a large number of cases there is no doubt. A conversation almost exactly the duplicate of that reported above took place between a city councilman and the largest "warehouseman"—dealer in general merchandise—in Glasgow, before the municipal system was three months old.

Nor were the dealers in supplies needed by the city the only ones upon whom pressure of this sort was brought to bear. In every city many citizens have favors to ask of the city government, and during the first two years and six months of the municipal telephone system's life every man desiring a favor from the municipality in Glasgow who had not yet subscribed was asked significantly: "Why don't you take on a municipal telephone?" By the beginning of 1904 practically all of those who could thus be forced to do so had taken on municipal telephones.

By that time, too, the National Telephone Company, which meanwhile had increased its subscribers by less than 1,500, as against the municipal system's increase of over 9,000, got its second wind, so to speak, and began its period of most rapid and unprecedented extension. This was helped materially by the bad management of the municipal telephone. The city's system had the better of the company in several ways. It had the privilege of putting its wires underground, which the company was never able to get, although it put in its first petition to be allowed to do so seven years before the establishment of the municipal lines. Thus all its wires, except a few which it was able to carry through the tunnels of the railroad companies on payment of high rentals, had to be carried overhead. The action of the council regarding the placing of the company's wires underground was long baffling and unsatisfactory. The privilege was neither granted nor definitely refused.

Under the circumstances the company allowed its wire installation to deteriorate. There was always the chance that permission might be given to put the wires underground, in which case much that had been done to improve their condition overhead would be wasted. The company naturally hesitated about throwing away thousands of pounds in making overhead improvements which would later be of no account.

Meanwhile, and quite naturally, the service given by the company fell off somewhat in quality. Complaints from this cause were general. It was not the company's high rates, but its poor service, to which the people of Glasgow most objected. It is doubtful whether public sentiment for a municipal telephone would ever have been strong enough to warrant its establishment had the company's service been kept to the proper level. This the company now freely admits, excusing itself solely on the ground that, in the absence of a definite refusal to allow the wires to go underground, there was always a chance that permission might yet be granted.

The municipality went still further in what the company managers consider unfairness to them. It not only refused to allow the company's wires to be put underground, but it objected to the erection of telephone poles on the streets or other public property. This was grudgingly allowed in a few instances; nevertheless, it was necessary for the company to rent the right-of-way for most of its wires from private property holders; to carry them over houses and support them on poles and standards attached to the roofs. The company's wires were thus a source of a continuous and heavy expense from which the municipal managers were largely exempt. The cost of maintaining underground wires is comparatively small, and the municipality had no right-of-way rent to pay. And, as a matter of course, extension of the company's lines was opposed, officially, whenever there was the slightest excuse, while the extension of the municipality's wires was always made as easy as possible.

But the city made a blunder of the first magnitude when it put in its plant, a blunder which undoubtedly hastened the end of the experiment. Instead of installing a thoroughly up-to-date system, it made use of the old-fashioned "call-wire" system. This was good enough so long as nothing better had been devised, but it was considered by first-class experts to be obsolete by the time it was put in, and the National Telephone Company had discarded it some time previously.

The mistake was a natural one for the municipality to make, however. It was of the same kind that has been made by the municipal authorities in London, who, in erecting an electric generating plant, have installed engines, dynamos, etc., that have become quite out of date at much larger expense than a plant of the same capacity could now be installed. The mistake made by the Glasgow municipal telephone authorities was due to the advice of an alleged expert, whom they hired away from the company, but who was either incapable or unwilling to keep up personally with the progress of telephone invention and practice. In order to work its Glasgow telephones in connection with the company's, the Postoffice Department will now be obliged to install a practically new system at heavy cost.

According to the original estimates of the city authorities, it was to cost $576,800 to establish 5,250 lines, or $112.80 a line. By the end of 1902 5,479 lines were working. They had cost $924,926, or an average of $168.80 a line. During 1903, 3,643 new lines were added at a total cost of $374,571, the average cost being $103.02, which was somewhat less than the original estimate. The average cost of the lines established to the end of 1903, however, had been $142.56, more than $28.80 in excess of the original estimate.

In the next year 2,282 new stations were established on the municipal lines, at a total cost of $240,240—$105.22 a station—or an average for the total number of stations to that time of $135.06. But stations are not lines. Several stations may be placed upon the same line, so that the cost per line to the municipality in 1904 is not clear from its report. In 1905, when the rate of increase in municipal extension had woefully fallen off—there were one or two months during which the number of telephones served by the municipality actually decreased—only 957 new stations, not lines, were installed at a total cost of $141,556, or an average of $147.90 a station. The total average cost of the city's stations was $136, fully $24 a line more than the original estimate.

At the beginning of the competition between the telephone company and the city, the company's flat rates ran from $48 to $120 a year. The city established a rate of $25.20, and a toll rate made up of a rental of $16.80, with a tax of two cents for every conversation originating with the subscriber. The company did not reduce its flat un-

1 The author is a well-known New York journalist, who has made an especial study of the subject of public ownership. In the present article he gives the readers of the Western Electrician the benefit of an unprejudiced personal investigation which he made last year during a trip abroad.

limited rates, but adopted the city's toll rate, and established the plan of charging $24 for 600 originating "talks," charging $4.80 for each additional 300 talks up to 1,800 talks for $43.20, with a still lower rate for private houses.

Besides, the company followed the American telephone practice and put in party lines, charging $6 for each telephone on lines of 20 stations each. This innovation made great inroads upon the municipal system. Its subscribers gave up the latter's telephones to go back to the company. In one year the city lost about a thousand subscribers in that way. That was a year of genuine "cut-throat" competition, and the city met the company's fighting by modifying its own charges.

At the last the company's charge for an unlimited number of calls on a line with two subscribers was $30.24 a year, while the city's charge for the same service was $20.16. At one time during the period of greatest competition the city forced the company to remove about a hundred of its poles which stood on city property and shift them to private property. Public sentiment would not stand for that, even in Glasgow, and this form of competition was finally dropped.

It was because of the greater number of improvements introduced by the company and the better service resulting that the company's growth was so much faster than that of its municipally owned competitor all through the latter part of the experiment. It is asserted in some circles that without the competition of the municipal telephones the company would never have brought its service up to its present level, and the company's friends have admitted that healthy competition stimulates healthy endeavor to excel. At the same time, it must be remembered that many of the telephone appliances now in use and which have improved the service notably had not been invented at the time Glasgow's municipal telephone system was installed.

Despite the many advantages possessed by the municipally owned enterprise—its freedom from rent and taxes; the practically unlimited capital of the city of Glasgow; the early enthusiastic support of the people, etc.—it was not possible for it to maintain a service which approximated that which, under competition, was rendered by the company.

The men who brought about the establishment of the municipal telephone in Glasgow ran no personal risk. They simply had to pledge the credit of the city and increase the public debt in order to carry out their scheme. They do not admit their losses to be as large as the figures given at the beginning of this article would indicate, but they do admit the loss of $72,000. This loss must now be paid from the "rates," which were to be "relieved" by the experiment. This experiment was also to furnish much better telephone facilities than Glasgow had ever enjoyed—a promise that was never fulfilled.

Government-owned Telephone System for Winnipeg.

Under date of April 5th the Winnipeg (Man.) correspondent of the Western Electrician sends the following:

"The service given by the Bell Telephone Company in Winnipeg, Man., has proved so unsatisfactory that it was decided to hold a special meeting of the City Council to discuss the matter. The result was most unexpected, for the council decided unanimously in favor of asking the provincial government to construct at once a municipal system. Some weeks ago the government had offered to construct such a system, and the offer was rejected, but since then the Bell company's service has gone from bad to worse. It is estimated that Winnipeg will require about 10,000 telephones.

"At an interview between a committee of aldermen and government representatives, Hon. J. H. Howden, minister of railways and telephones, promised to at once make arrangements for the construction of such a system, which will be built and operated by the government. If there is a deficit, the government will meet it, and if there is any profit, it will be taken by the government. However, it is the intention to conduct this system at the smallest possible cost to the subscribers, and if after a year of operation a profit remains the price of telephones will be reduced to wipe out this profit."

An application for the York (Pa.) Telephone and Telegraph Company for a charter to operate in 18 counties has been made by Congressman D. F. Lafean, George B. Rudy, William F. Eisenhart and George S. Schmidt. The company would also connect with the lines of similar companies in the states of New Jersey, Delaware, Maryland, West Virginia and Ohio. Local and long-distance service is proposed in the counties of Philadelphia, Montgomery, Delaware, Chester, Lancaster, York, Dauphin, Adams, Cumberland, Franklin, Huntington, Fulton, Allegheny and others.

Engineers Report on Telephone Franchise in Chicago.

The report of the three telephone experts, Prof. Dugald C. Jackson of Boston, William H. Crumb and George W. Wilder of Chicago, employed by the committee on gas, oil and electric light of the Chicago City Council to give detailed opinions on the franchise proposals presented by the Chicago Telephone Company and the Manufacturers' Telephone Company, has been presented to the committee.

With a cursory history of telephony as a prologue, the report is divided into sections treating of the Manufacturers' company proposal, a comparison of flat and measured rates, the Chicago Telephone Company proposal, universal toll connections and a summary of conclusions.

Though the plans of the Manufacturers' company are characterized as incomplete and the entire project called impracticable, partly by reason of the fact that it would require four years in which to get a new plant ready for operation, the Chicago Telephone Company, whose franchise expires in less than two years, is not spared from criticism. One of these criticisms is that the company is too "accommodating," instance being made of the operator's time used in giving the subscribers the time of day. Maximum rates in the city limits are recommended at five cents. For two minutes within a radius of 15 miles from the City Hall, but outside the limits, the rate should be 10 cents, say the experts.

Abolition of flat rates for the measured-service plan of charges, a share in the gross receipts for the city and a provision for municipal ownership, limiting the net earnings of the company and requiring any excess of net earnings over the limit to be paid to the city, are among the principal recommendations. The commission also recommends that an ordinance be passed under which the Chicago Telephone Company may continue to operate, and suggests that the company be obliged to furnish subscribers unlimited service at a fixed price until it is able to install a meter system that cannot register unless a connection actually is made.

The commission finds that the Chicago Telephone Company has a creditable plant in use and can give good service. It approves as reasonable for the present a schedule of rates embodied in the report, but thinks these rates might be reduced in the near future. It recommends that the city retain in some manner the right to lower rates when further reductions are shown to be reasonable. It particularly recommends methods of accounting that will enable the public authorities to act with knowledge in seeking to fix reasonable charges.

The rates recommended are on the measured-service basis, except in case of telephones for private residences. The minimum charge for a single-party business telephone is made $60 a year, with 300 calls, and additional calls at three and two cents. Party lines should be proportionately less, according to the commission. Ten-party lines are forbidden, but four-party-line service is fixed at the present price of service on 10-party lines. Three-party-line residence telephones at $51 per year for each telephone are recommended for trial as an addition to the schedule of rates proposed by the Chicago Telephone Company, in case that company is granted a franchise. The commission recommends the trial of the three-party-line flat-rate residence service in the belief that it gives reasonably satisfactory service.

The commission finds, after having studied the toll situation within a radius of 100 miles from Chicago, that this area, under present conditions, is well provided with telephone connections entering Chicago. The reduction of calls per telephone following the general use of measured rates, the report states, results in a great reduction of the unavailing calls, which are now approximately one-third of the total calls in Chicago, and it thereby reduces the expenses of operating, and this makes a general reduction in the rates practicable.

It is asserted that the semi-automatic mode of operation proposed by the Manufacturers' Telephone Company is substantially untried as a commercial arrangement for use on a large scale. It is conceded that it bears indications of being a desirable method of telephone operation, but it has not yet been fully developed, and the commission suggests that it would be unwise to make an experimental trial in so large a plant as that required to give service to the entire city of Chicago. Even if the apparatus adopted ultimately proved successful, the confusion resulting from defects which always appear in new and untried apparatus would, in the opinion of the commission, probably produce confusion for many months after the plant was put in operation.

The report further states that the methods of charging and rates proposed by the Manufacturers' company are not adapted to enable the company to give first-class service throughout the city and pay ordinary interest on the investment, after setting aside reasonable reserves for depreciation and contingencies, and the company's operations, if extended throughout the city, would, in the opinion of the commission, ultimately result in financial difficulties or an application to the council for the privilege of changing its schedule of rates.

The backers of the Manufacturers' Telephone Company have declared that they would not accept as final the report of the expert commission that their proposition is not feasible, but would continue in the field as a competitor with the present company.

"The arguments of the experts that we should not be given the franchise because we cannot complete our plant in two years is a weak one," said Secretary John M. Glenn of the Illinois Manufacturers' Association.

Bell-Independent Amalgamation in Ohio.

A "deal" has just been completed in Marion, Ohio, whereby the Marion County Telephone Company will take over the local plant and business of the Central Union Telephone Company (Bell). Under the same contract the Marion County company buys the Central Union plant at Waldo and consummates the purchase stopped by litigation at Morral, Wyandot and Kirkpatrick. The local company sells its plants at Caledonia, Agosta and La Rue to the Central Union interests. Every exchange in the county excepting one is involved in the deal. The contract of sale provides for the retirement of the Central Union company from the telephone business in Marion, except for the maintenance and operation of its toll lines, with a toll-line exchange operated in connection with the Marion County plant, thus making available to the subscribers of the local exchange the long-distance lines of the Bell company.

At the time of the merging of the two systems the Independent company controlled over 2,000 local telephones and the Central Union company 1,000. All duplicate telephones will be cut out, and it is said that after this has been done Marion will have at least 3,000 telephones in use. All long-distance calls over the Bell lines will be transferred to the wires of the local company.

Negotiations for this deal were begun two years ago and the closing of it has come only after much work. It is expected that it will be probably 90 days before the home company will get control of the consolidated lines. New switchboards will have to be installed and there will be a great amount of construction of all kinds made necessary by the deal.

Indiana Telephone Items.

The New Paris Mutual Telephone Company has increased its capital stock $10,000, to extend the lines and to install new equipment.

Complaints are being made in many parts of the state that boys with target rifles are causing the telephone companies endless trouble by shooting bullets into the cables and putting many of the lines practically out of service. One cable at Danville, having 52 telephones, was so badly riddled that it required the work of three men two weeks to repair the damage.

The Central Union Telephone Company of Greenfield has disconnected long-distance service from the Hannah-Jackson Company, recently sold by the receiver to Charles H. Hannah, and has connected with the Morrison board, giving the Morrison company long distance both with the Central Union and the New Telephone Company.

S. B. Cook of Hope has secured a franchise for the Hope Telephone and Light Company. It is said that he is backed by the Central Union, and that he will enter into competition with the Hope Independent company, which is controlled by O. W. Bowman.

The city of Knightstown is now without competition in the telephone business, R. L. Harrison having sold his local interest to the Knightstown Telephone Company, an Independent line. Mr. Harrison retains his long-distance franchise, and he operates with the Central Union.

In commemoration of her 18 years' connection with the Central Union Telephone Company at Indianapolis, 26 of the employes in the toll department of the company gave a surprise party to Miss Frances Mitchell at her home. A handsome cut-glass dish and a ring were presented to her by her fellow employes.

The rural telephone companies have increased so rapidly in Indiana and entered into long-distance arrangements that the problem of distributing the pro rata fee for long-distance messages among the numerous companies has become somewhat complex. It is now proposed to organize a telephone clearing house to take charge of the money paid in for long-distance messages going over the line of more than one company and make the settlements. Such a clearing house could also issue "mileage books," which would be receivable by any

telephone company in the state for long-distance messages.

According to information given out by A. C. Lindermuth, president of the Richmond Home Telephone Company, and also president of the Indiana Independent Telephone Association, an unofficial proposition has been made by representatives of the Central Union Telephone Company to turn over all exchange business in Richmond, Logansport, Fort Wayne, South Bend, and several other cities to the Independent systems therein, to be managed by the latter on a percentage of the business done. Mr. Lindermuth said that during a conference held at Logansport between the Independents and the Bell representatives, the proposition was made by the Bell representatives to turn over Bell property in certain cities in exchange for the toll-line business. S.

Telephone News from the Northwest.

The North Dakota Independent Telephone Company will install a local exchange at Cleveland, N. D.

C. D. Carter, manager of the Northwestern Telephone Exchange Company at Crookston, Minn., has resigned.

The Eastern Minnesota Telephone Company of Constance, Minn., has been incorporated with a capital stock of $50,000.

A franchise has been granted at Alden, Iowa, to George Stringer and W. E. Trousdale for a telephone system.

The Badger Telephone Company of Oconomowoc, Wis., has increased its capital from $5,000 to $25,000.

The Iowa Telephone Company is planning extensive improvements to its system, $100,000 to be expended at Burlington and the same amount at Clinton, $60,000 at Des Moines and $10,000 each at Iowa City, Atlantic, Carroll and Cedar Falls. R.

De Forest's Wireless Telephony.

Under date of March 31st, referring to his wireless-telephone work, to which brief mention has been made in the Western Electrician, Dr. Lee De Forest of New York writes that he is now transmitting perfectly audible speech and clear music for a distance of four miles without wires. He has been doing this for a month in New York and Brooklyn. It is said that every intonation of the voice is transmitted with as much fidelity as over the ordinary telephone circuit. Dr. De Forest is using inventions covered by recent patents issued to him, including the "audion" receiver. He is confident that he will soon succeed in covering distances up to 30 miles, over water, with good articulation.

GENERAL TELEPHONE NEWS.

Edward W. Hines has secured a franchise for a new telephone system in Sulphur, I. T.

The following-named telephone companies have been incorporated recently: Sickles Telephone Company, Binger, Okla.; Conde (S. D.) Telephone Company; Hooker (Okla.) Telephone Company; Wild Cat Telephone Company, Galena, Okla.; Richland (Neb.) Telephone Company; Thornburg (Kan.) Telephone Company; Citizens' Mutual Telephone Company, Holden, Neb.

At the recent annual meeting of the American Telephone and Telegraph Company held in New York the retiring board of directors were reelected, with the exception that Sylvanus L. Schoonmaker succeeded Charles P. Bowditch. An attorney appeared for J. S. Fay, Jr., said to be the fifth largest stockholder, and made a protest against the financial operations connected with the floatation of the $100,000,000 four per cent. bonds and of the subsequent issue of $25,000,000 three-year five per cent. notes.

Information on Lightning Troubles Wanted.

The committee of the National Electric Light Association which will report on "Protection from Lightning During 1906," wishes to obtain statistics this year which will show how much reliance is to be placed on the figures collected last year. To obtain reliable statistics replies must be received from all members. Therefore the committee is sending out a blank form showing the information which it requires. Among the questions asked are the following:

Number of lightning arresters injured; number of transformers, meters, generators injured; number of poles split; number of insulators broken; What other apparatus was injured; the number of times any service was interrupted by lightning, together with description of any noteworthy accidents of which there are fairly complete records. Other questions are: Are you satisfied that your apparatus is as fully protected as you would wish? What suggestions have you to offer for improving your protective apparatus? What experience have you had with overhead ground wires?

Alex Dow, Detroit, is chairman of the committee. Communications should be addressed to Robert S. Stewart, 814 Penobscott Building, Detroit.

Electrical Possibilities of Wisconsin Water Powers.

At the recent convention of the Northwestern Electrical Association in Chicago Mr. Ernst Gonzenbach of Sheboygan, Wis., read an instructive paper calling attention to the possibilities in manufacturing and transportation afforded by the waterpowers of the state of Wisconsin, and stated that the natural condition of the rivers is most favorable to profitable development. Mr. Gonzenbach called attention to the important place held by the New England states in manufacturing, and said that this prominence was derived principally through the utilization of cheap waterpowers. If, then, he said, the state of Wisconsin wants to take its place with such states as Massachusetts, Pennsylvania and Illinois, it must develop its manufacturing possibilities.

Following are some extracts from Mr. Gonzenbach's paper:

I think it probable that the real reason the waterpowers of Wisconsin have not been developed as much as they deserve to be is on account of the use of the streams and rivers for logging purposes. Lumbermen and associations of lumbermen have built and maintained dams on the various rivers and regulated the flow of the rivers in such a way as to produce sufficient depth for floating logs, regardless of the value of that water when turned into power. I believe it cannot be disputed that the lumber industry of Wisconsin is on its deathbed. Of course, the loss of this industry is a loss to Wisconsin, but it will mean that the numerous waterpowers of the northern part of the state can now be utilized for manufacturing purposes, either on the spot or for transmission at long distances. It is perhaps fortunate that the powers have remained undeveloped for such a long time, because we can now harness them, and send them anywhere we may wish to use them. In fact, we can yoke them together and have a network of powers covering the northern part of the state, which, for the purpose of comparison, we may consider the root of a system. These powers may be combined into trunk lines, and branch into the southern part of the state to all its cities from Milwaukee to La Crosse. We have the powers in the northern part of the state going to waste for lack of a market. In the northern part of the state we have an unlimited market for power, which is there produced at considerable cost, paying tribute to the "coal barons."

There are eight rivers of considerable magnitude in Wisconsin. In addition to these eight, there are quite a number of small rivers which flow northward into Lake Superior, and which do not carry any great volume of water, but these rivers are very important as waterpower-producing streams, because, as a rule, during their short runs they have a tremendous fall, and while they would not be available for immediate development, they will always form a very valuable reserve for development at a later date, after we have exhausted the possibilities of the powers which are directly under our noses.

Fox River.—The upper Fox presents very few possibilities for development, and the lower Fox has been so fully developed for manufacturing purposes that there is not much possibility for speculation. There are only two dams on the lower river which are not now turning wheels.

Menominee River.—This river has some waterpower developments, and its total fall is approximately 500 feet between its mouth and its uppermost possible power. Some large lumber and pulp mills are located on it. The amount of power which it is possible to develop is not sufficient to warrant its being transmitted any long distance, and it is too far from any available market to be at the present time considered one of the waterpower assets of Wisconsin—at least in so far as electrical development and power transmission are concerned.

Peshtigo and Oconto Rivers.—These are two short rivers, emptying into Lake Michigan at Green Bay. Both have a very rapid fall and are capable of producing considerable power. The Peshtigo has a fall of over 1,000 feet from its mouth to its headwaters, a distance of approximately 140 miles. The Oconto has a fall of 945 feet in a distance of 87 miles, which presents many opportunities for very profitable waterpower utilization. Both of these streams are extremely valuable for manufacturing purposes. For electrical utilization they are very much handicapped by the absence of storage facilities.

Wolf River.—This stream empties into the Fox, just west of Oshkosh. It has a total length of approximately 160 miles, in which distance it has a fall of 812 feet. Some of the powers have been developed in the way of local manufacturing. The amount of power still available for development is in small lots and will practically eliminate this river from the situation.

Black River.—This river is very peculiar, on account of the fact that its watershed is extremely long and extremely narrow, with the natural result that the variation in flow is rather great. It has a total fall of approximately 560 feet in a distance of 125 miles, and its flow is somewhat unreliable for strictly electrical purposes. It is a comparatively short distance from a good market for power, part of which is already being developed electrically for transmission to La Crosse, Wis., and Winona, Minn. A great deal may be expected from the river in the way of future development.

Chippewa River.—Here there is a fall of about 750 feet in a distance of 178 miles. It is one of the most valuable assets of the state of Wisconsin. With its two branches and its sources among thousands and thousands of little lakes in the woods of Northwestern Wisconsin, it is one of the best and most reliable waterpower streams in existence today. Natural sites for dams and other opportunities for development appear along its course. The average flow of water and average run-off per mile of watershed are as good as, if not better than, those of any other river in the country, and are on a close par with the Wisconsin River, referred to below. The combined waterpowers of the Chippewa and Wisconsin rivers, if properly developed, would furnish power enough to run every street railway and electrical plant in the state of Wisconsin. Some day it will be done.

St. Croix.—Part of the boundary between Wisconsin and Minnesota is formed by this river, which cannot be considered as coming within the limits of this paper. There are some very interesting possibilities on this stream, but its market is outside of the state of Wisconsin.

Wisconsin River.—This is the Rhine of Wisconsin. Like the Chippewa River, it rises in a mass of tangled lakes and swamps. The drainage area of the Wisconsin River is very large in its upper region. The one distinct advantage of the Wisconsin River lies in the fact that natural possibilities exist along its headwaters for the storage of tremendous volumes of water by means of building comparatively small and inexpensive dams. In fact, the power sites for the dams have been already located by the United States government, which has had careful surveys of the situation made, and it is amazing to find that capitalists have so far not taken advantage of the investigations so carefully put to their disposal by the government.

The Wisconsin River has a length of 429 miles from its source to its mouth, and in that distance it has a total fall of 1,046 feet, most of which is concentrated in the upper part of the river. In fact, a fall of 600 feet occurs in the upper part of the river. This river used to be the main highway for floating logs from the pine woods of the north to the Mississippi River, and remnants of the old logging dams may be seen along its entire course.

A number of its waterpowers are developed in a small way, but the possibilities are so great that sooner or later these isolated developments must give way to one grand development, utilizing the full power of the magnificent stream in a series of developments for local consumption and transmission to a distance.

The state of Wisconsin is particularly favored in the matter of geological and topographical conditions. The northern sections of the state have an annual rainfall of approximately 44 inches, and the country is topographically so formed that the rainfall does not run off rapidly into the rivers and from them into the sea. On the contrary, the numberless swamps form a most excellent storage basis and retain a very large portion of the total rainfall, which is given off gradually, and serves to maintain a uniform flow in the rivers, particularly the Chippewa and Wisconsin rivers.

Almost all the rivers emptying into the Atlantic Ocean from the eastern watershed of the United States reach an extremely low run-off; in fact, the minimum flow is 0.1 second-foot per square mile of drainage area. This low figure is reached principally by the southern streams from the state of Virginia south to the state of Alabama. From Virginia north the minimum run-off is somewhat higher, and averages in the neighborhood of 0.2 second-foot per square mile of watershed area. Rivers in the extreme West differ radically from eastern rivers and from rivers in the Mississippi Basin, and it would be useless to go into their intricacies in this paper. The minimum run-off of the Wisconsin rivers, without artificial storage to help in maintaining its flow, is as high as 0.4 second-foot per square mile of drainage area, and with the storage facilities which have been referred to which have been surveyed by the United States engineers, the minimum run-off can be maintained at approximately 0.8 or 0.9 second-foot per mile of watershed, a figure which I doubt it possible to reach in any other section of the Middle or Atlantic States.

Discussion.

Several members took part in the discussion. On motion of Mr. Wheeler, the secretary was instructed to have the paper printed for distribution to members and central-station men. Mr. Korst of Janesville stated that detailed information on the subject discussed could be obtained from the government, and the president added that by asking for reports No. 156 the United States Geological Survey would send papers on the subject gratis.

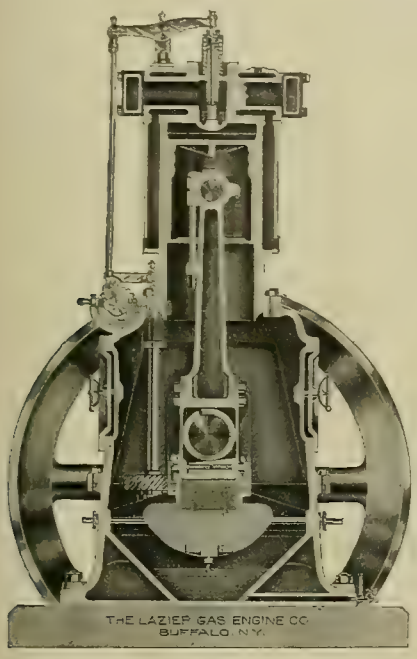
Mr. Utley of Watertown said that the State

Legislature should be urged to pass a law giving power companies the right to get the flowage. There is no such law now. "There are laws giving logging companies such rights," he said, "but when a power company wants to build a dam or get the right it cannot do it. In some other states, as in Minnesota, they have a law which gives power companies the right of eminent domain, but in Wisconsin there is no such law. A simple amendment to the general charter law now on the statute books would give that right."

Mr. Gonzenbach said the paper was intended to arouse the association to do something to secure to the electrical industry of the state of Wisconsin this right of eminent domain. He urged co-operation to this end.

New Lazier Gas Engine.

Mr. Arthur A. Lazier, one of the pioneers of gas-engine deevlopment, has recently disposed of his entire interest in the Lazier Engine Manufacturing Company and organized the Lazier Gas Engine Company of Buffalo, N. Y., to enter upon the manufacture of what the designer believes to be the perfect gas

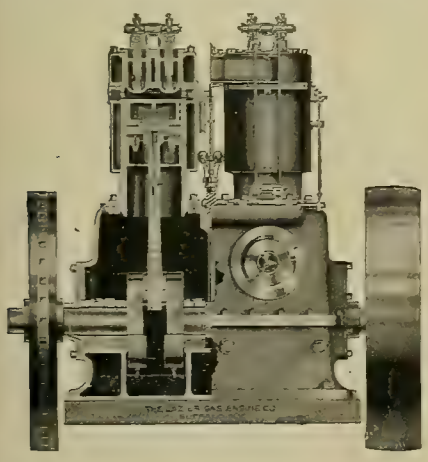


LAZIER GAS ENGINE.—SECTIONAL SIDE VIEW.

engine. Mr. Lazier has associated with him a staff of mechanical engineers which includes some of the best-known gas-engine experts in the United States. Two large plants are now in operation producing the Lazier gas engine.

The Lazier engine is simple in construction, and all the mechanism of the machine, instead of being on the inside of the engine, is on the outside, where inspection and repairs can be made without taking the entire engine to pieces. In this engine the valves are operated mechanically, and it is said that they cannot get out of order.

It has been the experience in gas-engine opera-



LAZIER GAS ENGINE.—SECTIONAL END VIEW.

tion that if the igniter should fail to work or fire the gas, the engine comes to a stop and remains at a stop until repairs have been made. In the Lazier, a double system of ignition, which can be run either separately or in combination, has been provided, and is so arranged that the time of firing the charge can be changed while the machine is in operation. The cams and cam shaft are run in oil, but are still in plain sight of the operator at all times. The system of operating this cam shaft is also new, there being but four gears to the entire machine, and these, being spiral gears and running in oil, make the operating almost noiseless. The usual objection to a vertical engine has been in the lack of a suitable method of taking up the lost motion in the connecting rod. In the Lazier this is eliminated by the extended take-up, as shown in the cross-section, end view.

The "splash" system of lubrication, which oils the engine automatically, is used, and all Lazier engines are provided with automatic self-starters, enabling the operator to start the engine two minutes after stepping into the gas room. One of the main features is that the Lazier engine operates on almost any kind of fuel—alcohol, kerosene, distillate, illuminating gas or producer gas. With coal at $3 a ton, it is said that a horsepower is produced for $4 a year, running constantly for 10 hours a day. The Lazier is made in sizes from two to 300 horsepower.

Weston Electroplaters' Voltmeter.

A reliable voltmeter is a necessity in an electroplating establishment, as the amount of current consumed in a bath is governed by the quantity of work being done, and the current flow, of course, is dependent upon the voltage. Too much current (too high a voltage) results in burned work, while too little current (too low a voltage) results in a thin deposit, which comes off under the buffing wheel and necessitates replating. With the aid of a voltmeter all guessing is eliminated and it becomes possible to operate any bath at its maximum efficiency.

Owing to the apparently high first cost of furnishing each tank with a reliable and accurate voltmeter, platers have hesitated properly to equip their plants. Realizing the importance of first cost from the plater's viewpoint, the Weston Electrical Instrument Company of Newark, N. J., has designed a voltmeter specially adapted to this work, which obviates the necessity of having an instrument for each tank and enables the plater to avail himself of an accurate and reliable instrument at low cost.

The instrument is shown in the accompanying cut, and consists of an accurately calibrated Weston voltmeter, contained in an air-tight waterproof case (which adequately protects the internal mechanism from the action of fumes usually present in the plating room) mounted on a small wooden switchboard containing 15 binding posts and a 14-point switch. One of the binding posts, marked plus, is to be attached to the positive side of the plating generator or line, while the remainder are to be attached one each to the cathode side of each tank. After the connections are made the voltmeter is thrown in circuit with any desired tank by

WESTON ELECTROPLATERS' VOLTMETER.

turning the switch handle to the numbered point corresponding to the tank it is desired to test.

The instrument, designated as model 131, is designed to accommodate 14 tanks, which is considered the maximum that can be conveniently operated from one point. Any lesser number of tanks may be connected in circuit, however, as each binding post is entirely independent.

Dinner of the New England Street-railway Club.

The New England Street Railway Club held its seventh annual dinner at the Hotel Somerset, Boston, on March 28th. Henry C. Page of Springfield, Mass., president of the club, presided, and Major Guy Murchie was toastmaster. John I. Beggs of Milwaukee, president of the American Street and Interurban Railway Association, Hon. George Tate Blackstock, K. C., of Toronto, Ont., and Rev. Willard Scott of Worcester, Mass., were speakers. There were 350 members and guests present. President Page announced that the club had 630 members.

Mr. Beggs said that the national organization would have been pleased to hold its next meeting in Boston, but the only hall of sufficient size in the city was not available at the date set for the meeting. He declared that the street-railway business was the greatest business in the country and that it was growing faster than any other business. This made Vice-president Van Etten of the New York Central Railroad Company, who was a guest, signify his surprise.

CORRESPONDENCE.

Continental Europe.

Paris, March 26.—A German firm, the Gutehoffnungshütte of Oberhausen, recently finished a floating dock at Tsing-tau for the Chinese government. It is one of the largest docks yet to be built, and one of the features is the electrical outfit. The dock is some 410 feet in length and 140 feet in width, with a draught of 18,000 tons, thus exceeding the heaviest battleships in weight. The dock is made up of five pontoons, which are entirely separate from each other, and of lateral caisson construction placed upon the pontoons and extending for the whole length of the dock. Current for operating the machinery of the dock is brought from the central plant of Tsing-tau by means of cables. The great pumps are among the heaviest of the motor-driven machines. There are 10 centrifugal pumps, which are used for controlling the water ballast for the immersion of the dock. All the machines are operated from a control platform. The electric-lighting arrangements are of the most modern kind. The dock was built on shore and was launched by means of 30 railroad tracks.

At the Brunswick mines at Helmstedt, Germany, will soon be erected a steam-turbine plant of some size, which is designed to furnish these and the surrounding mines with power, the lines extending over a considerable territory. About 3,000 kilowatts is the capacity of the plant in the present design. When completely finished the dynamo room will contain two turbo-alternators of the Brown-Boveri pattern, each built for 800 kilowatts, and a larger steam turbine of the same make designed for 2,000 kilowatts. Each of these units comprises a steam turbine, which operates with steam at 9½ atmospheres and 275° C., coupled to a three-phase alternator working at 5,500 volts, besides an exciter. Each of the turbines has a separate surface condenser installed in the basement of the dynamo room, with the pumps placed in an adjoining space.

The Société Industrielle of Mulhouse, Alsace, is to hold a concourse of electric and mechanical devices this year, which bids fair to bring out some interesting machines. Prizes in the shape of medals and cash awards are to be offered to inventors of new apparatus. Among the devices wanted, I may mention an apparatus which will enable the use of a three-phase motor in connection with a printing press so as to work the latter at greatly varying speeds, keeping the motor at a constant voltage. Another prize is awarded for the comparative data regarding the efficiency of electric as compared with mechanical driving of spinning or weaving machines. An automatic circuit-breaker is wanted which will support for fifteen or twenty seconds some three or four times the standard current, and then act with precision after a time not exceeding ten minutes for a current 30 per cent. in excess of the normal.

Industry in Japan has developed considerably since the recent war, and during the year ended last July there were no less than 183 new companies formed, representing a capital of $130,000,000, and the 214 existing companies increased their capital which figures at $90,000,000. Among the new companies there are 20 for electricity, 16 for railroads and 11 for mines. The electrical industries are flourishing, and new electric plants are in construction at present.

On account of the expiration of the Heroult patents, the aluminum industry will have an increased development in France and elsewhere on the Continent, and this may lead to a drop in prices. Bauxite is the mineral which is used in France to produce the metal, and the Var region near the Mediterranean coast has the most extensive deposits. The production of the mineral was about 70,000 tons in 1905, against 58,000 in the preceding year. As to the annual production of aluminum in France, it is estimated at 160,000 tons. In Italy the Societa Italiana is working the large deposits of Lecce dei Marsi. A. DE C.

Great Britain.

London, March 30.—The Midland Railway Company has adopted a system of train lighting which has been evolved by one of its technical staff, in conjunction with a firm of electrical manufacturers. The system is known as the Verity-Dalzrel, and in it the electrical regulation of the voltage is brought about by auxiliary machines running independently of the dynamo, but driven by the dynamo through a small motor. The dynamo is an ordinary shunt-wound machine fitted with a pole-changing switch to deliver current always in the same direction. An automatic switch containing two electromagnets, and a battery, complete the special arrangements for this system. The battery is used for supplying the necessary energy for lighting when the train is either at rest or running at too slow a speed for the dynamo to generate. The auxiliary machines referred to for regulating the voltage consist of three small motors, all the armatures being on one shaft. The arrangement of the windings and the connections definitely limits the possible variations of the dynamo pressure. The lamp voltage is 50, and the normal dynamo voltage 58 or 59. The system has not been extensively used yet, but some very satisfactory trials have

been made, and it is understood that the Midland company will adopt it extensively.

An attempt was made a few days ago—by the introduction of a private member's bill in the House of Commons—to render the use of the metric system of weights and measures obligatory in Great Britain. But it was unsuccessful, the bill being rejected probably—in the main—owing to the disapproval of the Board of Trade. The opinions of a large number of electrical men were quoted in favor, and the chief opinion from the electrical industry quoted against the proposal was the expression from the vice-president of the Westinghouse company, who not only, it was stated, thought the compulsory use of the metric system would do no good, but would actually do harm. Of course, the use of the metric system was legalized in Great Britain many years ago, and it is a fact that quite a large number of electrical manufacturing firms use it to some extent.

In a paper before the Institution of Electrical Engineers on rail corrugation, the author, Mr. J. A. Panton, of the Liverpool Overhead Railway, blamed the adoption of American practice in the design of tramway trucks as responsible for much of the trouble on electric tramways in Great Britain. There is a remarkable difference of opinion among engineers here as to the cause of this trouble, the chief opinions being defective rolling stock, and the use of too soft rails. There are one or two eminent experts cautious enough not to hazard an opinion, on the ground that too little is known of the phenomenon.

The Swansea Corporation has definitely decided to transfer its telephone undertaking to the National Telephone Company, the terms being the whole of the capital expenditure—about $140,000—and the payment of the legal expenses incurred in the litigation that has taken place between the parties on the question of intercommunication facilities.

No expression of opinion has yet been given with regard to the attitude of the new London County Council concerning the electric power bill introduced by its predecessors. Strong representations are being made that the bill should be dropped, but if this were to be done it is pretty certain that the advanced party in the House of Commons would move for the appointment of a royal commission with the object of preventing either of the companies' bills passing. The companies' bills will be considered in the House of Commons on April 10th.

It is stated by the London Fire Brigade officials that 105 fires have occurred in March due to electrical reasons.

The Channel Tunnel bill has been withdrawn from Parliament by its promoters. Quite recently the government decided not to support the measure. The interest in the bill to electrical engineers was that it was proposed to run the trains through the tunnel by electricity. G.

Dominion of Canada.

Ottawa, April 6.—The Canadian General Electric Company's net earnings for the last year were $853,675, or fully 18 per cent. on the capital, as compared with 16 per cent. for 1905.

The Provincial Light, Heat and Power Company has practically passed under the control of the Montreal Light, Heat and Power Company, as the latter has consented to guarantee the first-mortgage bonds of the former company in order to develop the Soulanges canal power, as well as other points on the St. Lawrence River.

The annual report of the Canadian Westinghouse Company shows that during the year 1906 the capital stock of the company was increased from $2,500,000 to $5,000,000, and $1,000,000 of this increase was sold at par to the shareholders. The gross shipments during the year increased approximately 40 per cent., compared with the previous year, and about 100 per cent. as compared with 1904. The unfilled orders on hand January 1, 1907, aggregated $1,037,658.

The town of Berlin, Ont., has decided, by vote of the ratepayers, to purchase the Berlin and Waterloo street railway. As soon as arrangements for the sale of debentures can be made Berlin will own and operate the railway system, together with the light and power plant and the waterworks system. The lighting plant is making profits amounting to over $500 a month, while at the same time providing the lowest rates in the province.

The Dominion government has announced that it proposes to extend the principle of iron bounties to iron and steel smelted by electricity from Canadian ore. This is the direct result of the investigation of electric smelting in Europe made by Dr. Haanel, Dominion superintendent of mines, and is expected will lead to a revolution in the iron industry in Canada. The bounties will be extended for two years longer than the limit set for ordinary smelting bounties, and will last until 1912. The bounty rates to be paid are the same under both processes.

It is said the Pittsburg Reduction Company, manufacturer of aluminum, will further extend its works in Canada. The company has a power plant at Niagara Falls and large works at Shawinigan Falls, Que., and is said to have purchased Barnhardt's Island, on the St. Lawrence, near Mille Roches, Que. It is the intention to develop the power in the canal by deepening Hoop Pole Creek, thereby diverting a large quantity of water into the canal, thus making it available for power purposes. It is said the company will establish a big plant near Mille Roches, which can be run under the same management as controls the plant at Massena Springs, N. Y., which is just across the river from Mille Roches. It is estimated that the dealings in connection with the contemplated power improvements and developments will mean an expenditure of several million dollars. W.

Winnipeg, Man., April 6.—The municipalities of Wallace and Miniota, Man., have commenced active work on the proposed rural telephone system. Canvassers are now out getting subscribers at $15 per telephone, and it is expected construction will be commenced in both municipalities within a month.

John Galt, C. E., Toronto, Ont., has presented a report to the Vernon City Council regarding the possibilities of utilizing the Shuswap Falls for the generation of electricity. The suggested location of the plant is at Shuswap Rapids, 26 miles east of Vernon. The estimated cost of the plant is $179,000.

The Winnipeg Electric Company has ordered all the machinery required for the electrical equipment of the Winnipeg, Selkirk and Lake Winnipeg Railroad. Two sub-stations will be placed along the route for transmitting electricity. A high-voltage wire will be run from Winnipeg to these stations, where the current will be transformed to offset the loss of voltage incidental to the transmission of current over a long distance of trolley wire.

The Holden and Vegreville Telephone Company has been formed for the purpose of building a long-distance line from Holden to Vegreville, Sask., a distance of 25 miles. At Vegreville the line will connect with the Vegreville and Northern Saskatchewan Telephone Company's line. Norman M. Smith is president of the company. Tenders for construction will be called during the present month.

The ratepayers of Claresholm, Sask., are organizing for the purpose of constructing a municipal telephone system.

At the annual meeting of the Northwest Electric Company, Yorkton, Sask., a dividend of five per cent. was declared and the following officers were elected: W. D. Dunlop, president; R. H. Lock, vice-president; Robert Lamb, Thomas Paul, J. A. M. Pattrick, J. M. Clark and T. A. Waterfield, directors. R.

New England.

Boston, April 6.—The Massachusetts Gas and Electric Light Commission has held a hearing on the Public Franchise League's request that the Edison company be required to furnish in detail the theory or system on which its charges are based, with information regarding its operating expenses and an analysis of its income from the different classes of rates. Joseph B. Eastman, secretary of the Franchise League, said that the company's published statements show that some Boston customers pay a higher rate than others. At the request of E. W. Burdett, counsel for the company, the hearing was adjourned until April 22d, when he will reply to Mr. Eastman.

P. J. Kennedy, wire commissioner of Boston, sailed for Europe April 2d. Archbishop O'Connell has arranged an audience with the pope at Rome for Mr. Kennedy.

The Holyoke Street Railway Company obtained control of the Amherst and Sunderland street railway last week. This road is 15 miles long and connects the Holyoke road with Sunderland and West Pelham, Mass. Its acquisition gives the Holyoke company a through line between Holyoke and Amherst, Mass. The Amherst and Sunderland company has a capital of $120,000, and it is stated that the Holyoke company obtained the stock for $45 per share.

After experimenting for three years, Hubert E. Smith, a Tufts College sophomore, has perfected a radio-telegraph system which he has established at Ballou Hall on the college grounds. By its means he has communicated with the Charlestown Navy Yard, Brant Rock, Wellfleet and Cambridge, Mass., and with vessels 150 miles at sea.

The Massachusetts Gas and Electric Light Commission has issued an order sustaining the Haverhill Electric Company's appeal from the Haverhill aldermen's decision by which C. H. Hayes was granted the right to lay and maintain electric wires or conductors across Main Street in Bradford and Washington Street in Haverhill. In his individual capacity and as the C. H. Hayes Corporation, Mr. Hayes has been supplying electric power to concerns whose places of business adjoin his. He is to move to Bradford, and he applied for this permission in order to continue to supply this power. The commissioners state that it was not shown that the Haverhill Electric Company's service is inefficient or that the company has been unable or refused to supply the inhabitants of Haverhill with electricity at reasonable rates and without discrimination.

At the Dedham (Mass.) town meeting this week it was voted to appoint a committee to consider the advisability of buying the control of the Edison company's electric-lighing plant. B.

New York.

New York City, April 6.—Assemblyman Young has introduced a bill at Albany to regulate the telephone and telegraph companies, especially with respect to the rates and service, making them subject to the same control as the railroad, local transportation and the gas companies.

During the last week the three engineers, Messrs. Stockhausen, E. Meyer and Paul Rheindorf, who were sent by the German government to study the tunnel work in progress here, have been examining the tunnels, now approaching completion, under the North and East rivers, also the terminal work being prosecuted by the Pennsylvania Railroad Company. The cause of the German investigation of American methods in tunnel building is the city of Hamburg's intention to build a tunnel under the River Elbe. The attention of the Germans is directed particularly toward the problem of installing and operating elevators.

The architects for the McAdoo Tunnel Company have filed plans for the twin office buildings of the great terminal on Church Street. These buildings together are to form the largest office edifice in the world and are to be on the east side of Church Street, extending from Cortlandt to Dey Street and from Dey to Fulton Street, respectively. They are each to be 22 stories high, or 275.9 feet above the curb, and will extend 75 feet beneath the street level. The Cortlandt Building will have a frontage of 214 feet and a depth of 186 feet, and the Fulton Building a frontage of 155 feet and a depth of 179 feet. The elevator equipment for the Cortlandt Building will consist of 21 elevators. The Fulton Building is provided with 17 passenger elevators and one elevator for transporting safes. The arrangement of space below the sidewalk comprises, first, the concourse promenade, with passenger, waiting, ticket and baggage rooms; next, the track floor, and below that the sub-station and power equipment. There are to be five lines of track for each building. The total cost of the buildings is estimated at $5,000,000.

Engineers for the Bridge Department have completed their plans for the temporary terminal of the Manhattan end of the Brooklyn Bridge. They will be submitted to the Board of Estimate and Apportionment and probably be passed by them this week, so that the effort at relief of the bridge crush may be furthered as much as possible. The terminal will cost about $300,000 and will cross Park Row and Center Street.

Announcement is made that the New York, New Haven and Hartford Railroad has purchased the Poughkeepsie and Eastern Railroad, extending from Poughkeepsie to Boston Corners, for a consideration of $400,000. It is expected that the line will be electrified. It parallels a portion of the New Haven's present road.

The rapid-transit commissioners are about to advertise for bids for the construction of the tri-borough subway from the Bronx to Coney Island. The proposed subway is a series of connective subway routes approved by the board and providing for connection with Brooklyn over the new Manhattan Bridge. The idea of such a tri-borough route originated with Borough President Coler.

E. C. Behr, the inventor of the Behr monorail system, has requested immediate action by the rapid-transit commissioners on his application for a franchise to build a road from South Ferry to Coney Island. A public hearing will be held on the matter in a few days. D. E. P.

Southeastern States.

Charlotte, N. C., April 6.—The dam of the Electric Bond and Share Company of New York at its electrical power development on Cape Fear River, at Buckhorn Falls, near Fayetteville, N. C., will have to be rebuilt on account of a defect in the original construction, the loss thereby incurred being close to $50,000. About $100,000 worth of electrical machinery, ordered some months ago, is declared to be practically ruined by exposure, and will be sent back to the General Electric Company, the manufacturer. The plant will be in partial operation by June 1st, it is stated, if the new machinery arrives on time.

The North Georgia Electric Company, owning an extensive development at Gainesville, on the Chattahoochee, will soon be in the field with power for lights, etc. The franchise of the company stipulates a maximum rate, which is said to be lower than the existing rate in Atlanta. The rate is not over 10 cents per kilowatt-hour for light and heat, and not exceeding six cents for power purposes, with a reduction of 10 per cent. for prompt payment of bills.

The stockholders of the Georgia Railway and Electric Company, in Atlanta, have voted to add $2,500,000 stock to the capitalization, making the total $8,500,000. Of the new issue, $2,000,000 goes to the stockholders and the remaining $500,000 will be held in the treasury for the uses of the company. President Arkwright states that this is given instead of a dividend, which has been with-

held for the purposes of making improvements in the company's holdings. It amounted practically to a 33⅓ per cent. dividend. The company has enjoyed a large degree of prosperity, and many important improvements have been added to the system, with a line to Marietta.

Henry L. Parr and associates have asked for a franchise for an electric street railway in the town of Newberry, S. C., the lines to be built in 18 months.

The Swift Spinning Mill Company has contracted for 450 horsepower from the Columbus Power Company, Columbus, Ga., from the Chattahoochee development. The power will be used in the new cotton mill of the Swift Spinning Company.

Messrs. Frank Armfeld, J. A. Bivens and others are a committee from the town of Monroe, N. C., to confer with the Southern Power Company, Charlotte, N. C., relative to bringing power to the town. The power company asks that 1,000 horsepower be contracted for to warrant it in building transmission lines, etc.

E. J. Maxwell, superintendent of the Cape Fear Electric Company, with power plant at Buckhorn Falls, promises to have about 3,500 horsepower in the city by June 1st, for use in the manufacturing establishments and cotton mills.

A number of new industrial enterprises are promised in the town of Statesville, N. C., as a result of the coming of electric power, which will be brought by the Southern Power Company.

The American Machine and Manufacturing Company has been chartered at Charlotte, N. C., with a capital stock of $300,000, to furnish and manufacture electric, hydraulic and steam power-transmission machinery. D. A. Tompkins, S. B. Sargent and J. W. Conway are the stockholders. Mr. Tompkins, who is one of the foremost manufacturers in the South, will be consulting engineer. The new company will succeed in a large measure the D. A. Tompkins Company of Charlotte.

The town of Bristol, Va., is interested in the development of a waterpower on Holston River, for electrical development. Prof. C. E. Farris of the University of Tennessee has been employed to make estimates. The Bristol Board of Trade is backing the movement.

It is stated that a dam will be built across the Etowah River in Georgia, where 9,000 horsepower is available. The line may be built from Cartersville to Atlanta, and another branch from Cartersville to Rome. It is declared that the people of Rome have become desirous of better freight and passenger facilities and favor an electric line to Atlanta for that end. D. N. L.

Ohio.

Toledo, April 6.—Throughout the state of Ohio electrical business continues to boom. There is the greatest of activity in all branches of the industry from the ordinary house wiring to the installation of power plants. Particularly active is the electric-railway field, and if the money market, which at this time is hopelessly tight, will ever loosen up, any number of contemplated projects will receive a positive impetus. The telephone industry is also experiencing a great deal of activity.

From Paulding comes the report of the installation of an electric plant with the municipal waterworks. At present the city is supplied with light and commercial service by a private concern. The new plant, which the city proposes to build, will be of sufficient size to care for 50 arc lights and 200 incandescents. The Board of Public Service, through E. H. Cooper, its clerk, is asking for figures on two dynamos, three engines, wire, poles and other supplies.

At Lake Brady, a summer park about two miles east of Kent, an electric-light plant and pump station is to be installed. G. Hartman, manager of the Lake Brady Development Company, with offices in East Liverpool, is about ready to award contracts for the installation of this plant.

There is a well-defined rumor in Elyria to the effect that a large iron industry is knocking at its doors for a site. If the plan materializes, much electrical work will be done there.

The Malloy Electric Company will soon erect a factory at Bucyrus, Ohio. This company has been reorganized and will manufacture two patented electric-railway articles, the creations of Peter Malloy. The articles to be manufactured are the Malloy trolley base and the Malloy retriever. For the present, these articles are being put on the market from the plant of the American Clay Machinery Company at Bucyrus.

Guy D. Kendrick, who held controlling interest in the Lima Novelty Sign Company, has completed the organization of the Ohio Novelty Sign and Electric Company, and within a few days will start the erection of a factory in Marion, Ohio. The new company is organized with a capital stock of $10,000 and will make a feature of turning out electrical signs. It will take over all the property and business of the Lima Sign Company and greatly enlarge the old plant. In addition to the electric-sign and advertising work, the new company will also have a department for the repairing and rewinding of motors, and will conduct a general electrical repair department.

The West Unity Electric Light Company elected the following-named officers at its last meeting: President, A. M. Miller; vice-president, J. A. Hollington; secretary-treasurer, L. G. Ely.

The Fisk Electric Company of Toledo, representative of the Western Electric Company of Chicago, has moved its offices and storerooms from Jefferson and Huron streets to 326 North Erie Street.

The Lucas County Infirmary is having plans prepared for a new power plant. This matter has not definitely come before the commissioners as yet, but a Toledo engineer is preparing the plans and doing the preliminary work, so that an estimate of the probable cost of the project can be obtained.

Bids are being taken by the Indiana, Columbus and Eastern Railway Company for a new power house and station, to be erected this summer at Etna, near Newark. The building is to be a one-story brick, 50 by 60 feet, and the principal use of the plant is to supply power for the Buckeye Lake line.

At a meeting held in Columbus last Tuesday the organization of the Findlay-Marion Railway and Light Company was perfected by electing the following-named officers: President, R. P. Hankey of Detroit; secretary-treasurer, G. W. Meeker of Columbus. This line is to connect at Findlay with the Toledo, Bowling Green and Southern, and at Marion with the Columbus, Delaware and Marion, thus making a through line from Toledo to Columbus. The capital stock of the company was voted to be increased from $250,000 to $1,250,000. H. L. S.

Indiana.

Indianapolis, April 6.—Ambrose Petty of Detroit, who recently purchased the holdings of the New Castle (Ind.) Light, Heat and Power Company, has purchased a new site upon which he will erect and equip a large power plant for the purpose of generating electricity for commercial purposes. Work on the new plant will begin about May 1st.

The Galveston Town Board is considering a proposition by local men for the construction and equipment of an electric-light plant. The board is anxious to steer clear of municipal ownership of such a plant.

The City Council of Greenfield has authorized the mayor to contract for nearly $30,000 worth of new machinery and equipments for the electric-light plant, also for the complete reconstruction of the plant.

The Board of Public Works of Lebanon is planning to rebuild the present waterworks system and add machinery of much greater capacity. A. J. Coulson is city engineer.

The Board of Public Works of Kokomo has awarded a contract for a 20-box electric fire-alarm system to the Gamewell Company of New York on its bid of $4,450.

The Danville Light, Heat and Power Company has incorporated with a capital of $36,000 to construct a plant to supply heat, light and power to the town of Danville and also to adjacent villages and the immediate community. James F. Lynch, G. E. Varney and R. P. Van Camp are directors.

A natural-gas pipe line is being laid from the Robinson (Ill.) gas field to Terre Haute, a distance of 50 miles. The Citizens' Gas and Light Company of Terre Haute is taking contracts to furnish natural gas for cooking, heating and lighting by October 1st.

R. W. Palmer, representing the General Electric Company, is in Connersville preparing estimates, etc., for the building and equipment of a street-railway system, with a branch interurban line to Milton. A franchise has been granted to local capitalists.

The Indianapolis, Huntington, Columbia City and Northwestern Traction Company, recently placed in the hands of a receiver, will, it is announced, pass into the hands of the Eastern Traction interests, represented by Hugh J. McGowan. The company endeavors to build a line from Vawter Park to Syracuse and Goshen and spend $100,000 in the construction of five miles. W. M. Self of Syracuse is receiver.

Leases and deeds were filed in the office of the county recorder at Indianapolis during the week by which the Terre Haute and Eastern Traction Company comes into possession of six important interurban roads in central Indiana. This act completes the merger of these lines under the McGown-Schoepf syndicate.

Work has been begun on the Decatur-Portland division of the Fort Wayne and Springfield Railway Company, which has a line in operation between Fort Wayne and Decatur. The new line will make connection at Portland with the Muncie and Portland Company's new line and will thereby establish a third through line between Indianapolis and Fort Wayne.

The J. C. Dunn Company of Indianapolis has incorporated to construct water, heating, lighting and power plants and systems. John C. Dunn is president.

The City Council of Crawfordsville, Ind., has passed an ordinance requiring all electricians to procure a license before proceeding to do any wiring. The license fee is $25.

Captain Harry D. Baldwin was inspecting the roof of the new transmission house of the Evansville electric-light company when he received a shock and fell against the wires which carry 13,000 volts. He was thrown into convulsions and his left arm was burned so badly that it had to be amputated. S. S.

Michigan.

Grand Rapids, April 6.—Electrical interests in Michigan, particularly street railway, are interested in a bill before the Legislature which would permit of one electric company owning stock in another. The bill was introduced by Senator Cady of Port Huron and has been referred to the judiciary committee, where it is yet unreported. Senator Cady presented another street-railway bill which provides that when companies have a run of more than 20 miles through village, township or city (interurban systems), they shall have the right to set and establish their own stopping places, and shall not except in cities of more than 20,000 inhabitants, be obliged to stop at any other points.

W. A. Foote, president of the Grand Rapids-Muskegon Power Company, has been asked by the Grand Rapids council to submit figures on the cost of installing and operating an electric plant to pump water from Lake Michigan to this city through a 48-inch pipe, figuring on a 250-foot lift, the power to be furnished by the company. He is also preparing a franchise proposition to be submitted by his company to the city.

G. H. Stephenson of Philadelphia, president of the Owosso and Corunna Electric Company, is expected to close a deal whereby his property will be sold to the proposed Saginaw, Owosso and Lansing electric line, backed by Detroit capital. Negotiations have been pending several weeks, but there was a difference of $15,000 on the price. Stephenson demanded $100,000. The property includes five miles of street-car lines, a well-equipped power house and the street-lighting system of Owosso.

Work on the Chandler-Dunbar power plant at Sault Ste. Marie is completed and water turned into the new canal. The company now has about 9,000 horsepower.

The proposition to improve the city electric-light and waterworks plant at St. Clair rather than contract for power from the Edison Company of Detroit was the issue which re-elected Frank Schrempferman as mayor.

The Muskegon-Grand Rapids Power Company is preparing figures covering a proposition for furnishing to Holland light and power from its big dams on the Muskegon River. It is expected that the city will insist on the power company purchasing the municipal plants as one of the conditions under which a contract will be granted, but if this exaction is demanded it is doubtful if the city and the power company will get together.

The Detroit and Bay City Traction Company, which was to build an electric road from Bay City to Detroit, via Birmingham, is having trouble with its Birmingham and Southfield stockholders. Messrs. Rockwell and Christian of Detroit and Whitcomb of Chicago raised $2,500 there by the sale of stock. The purchasers claim they bought with the understanding that if the road did not come their way they were to have their money back. It is stated the promoters furnished bonds to this effect. The franchise offered by the village was refused and now the stockholders have placed the case in the hands of Attorney F. W. Brown.

The Kalamazoo, Lake Shore and Chicago Railway Company has acquired the Lawton-South Haven branch of the Pere Marquette and will run hourly trains between South Haven and Kalamazoo. Later on the electric service will be installed. The company will also build a line from Toquin to Paw Paw Lake, connecting from that resort with Coloma. L. W. B.

Illinois.

Peoria, April 6.—The Springfield and Southeastern Railway Company has filed notice with the City Council of Springfield of its acceptance of the ordinance recently passed by the council. The Springfield and Southeastern is the line that is to be built from Springfield to Pana.

The House passed the bill making 10 hours a working day for conductors and motormen of street-railway companies. It also passed a bill making general regulations for safety of the public in street cars. The bill prohibits running boards, requires center aisles in all cars, heated vestibules and steel fenders and requires conveniences in cars running more than 18 miles in continuous trips.

William H. Brown, the new secretary-treasurer of the Peoria Gas and Electric Company, came from Springfield this week, where for the last four years he has been in a similar position with the Utilities Company.

The Illinois Traction Company is advertising special Sunday rates from Springfield to East St. Louis, $1.50 round trip; to Decatur, $1, and 75 cents to Lincoln for the round trips.

The Lincoln City Council has passed an ordinance granting the Illinois Traction Company a 50-year franchise to pass through the city on Chicago Street.

The Rock Island Southeastern Railroad Company has announced a meeting of stockholders for May

29th, to be held in Rock Island, for the purpose of increasing the capital stock of the company from $50,000 to $3,000,000. The line is to be built from Rock Island to either Monmouth or Galesburg.

The Illinois Traction Company has received an electric locomotive here and will use it in switching, instead of the present steam locomotive. The line to Bloomington will be opened as soon as the bridge is completed. Most of the wire is up, and the track is laid. The company will install a block system for the line to East Peoria, as, in addition to the through line, the company will run one of the city lines over the bridge to East Peoria. The company is desirous of securing a franchise on South Washington Street for the Canton line and the company now offers the property owners a bond to insure the exchange of freight with the steam roads. V. N.

Northwestern States.

Minneapolis, April 6.—The Chippewa Valley Electric Railway Company has commenced work on the reconstruction of its light and power plant at Eau Claire, Wis. It is reported that it will also erect a three-story brick office and station building.

The Chisholm (Minn.) Light and Power Company has sold its plant to A. McMillan of Grand Rapids, Mich. Improvements costing $25,000 are contemplated.

The La Crosse Water Power Company has begun work on the construction of a dam at Hatfield, Wis.

Svitlik Bros. have made a survey near Cadott, Wis., for a site for a dam which will be erected to furnish power for the electric-light plant.

The Southern Wisconsin Light and Traction Company has filed articles of incorporation and will build a line from Madison to Janesville. The company is capitalized at $2,000,000.

The municipal lighting system at Granite Falls, Minn., is to be remodeled and an alternating system installed.

The seventh annual convention of the Iowa Electrical Association will be held at Clinton, April 18th and 19th.

It has been announced that the La Crosse Gas and Electric Company and the Wisconsin Light and Power Company have been consolidated at La Crosse, Wis.

The power dam which was destroyed at Decorah, Iowa, recently, is to be rebuilt at once.

The government commission appointed to investigate the matter has reported that there is at present about 40,000 horsepower going to waste at government dam No. 2, below Minneapolis, and that there is fully 10,000 horsepower available the entire year. It is proposed to build a power plant for furnishing electricity to the federal buildings in St. Paul and Minneapolis and at Fort Snelling, and it is possible that there may be some power available for commercial purposes.

The Great Northern Railway Company will utilize electric power in the place of steam on its division from Minot to Williston, N. D. The minerals in the water there are very injurious to the locomotive boilers. R.

Pacific Slope.

San Francisco, April 6.—The long-anticipated open war between the striking union known as Local No. 6 of the inside wiremen and the new Union No. 1, which recently received a charter from the Building Trades Council, of which P. H. McCarthy is president, broke out yesterday at the new Hotel Fairmont, which is being rushed to completion. Law Brothers, who own the $2,000,000 hotel, had been notified by the Building Trades officers to discharge the 24 electric wiremen of No. 6 because their union had been suspended for striking on January 1st for a raise of $1 a day without giving the required 90 days' notice. They were still working and getting the $6 a day, which they demanded wherever they could get work. Yesterday the representatives of the Building Trades Council and the different unions whose members were employed on the building ordered all hands to quit work until the differences between the council and the wiremen were adjusted. About 400 men walked out, leaving only the 75 plumbers and the electricians and engineers at work in defiance of the order. It is more than possible that the entire building situation in San Francisco will be tied up, if this trouble is not settled satisfactorily. The owners of the Fairmont have been making great exertions to have the hotel opened with a banquet of the Merchants' Association on April 18th, the anniversary of the disaster which prevented the expected opening last year.

A 10-year contract has been made between the Trinity Copper Company and the Northern California Power Company of Redding, Cal., for electrical power to develop the Shasta King mine, near Redding. The Trinity Copper Company has provided a 200-horsepower motor at the mine for immediate use. The Northern California Power Company is also installing a 2,000-horsepower plant for use at the Mammoth mine, a 1,200-horsepower plant at Herault, and is preparing to put in a plant at the Crown Deep mine.

The Los Angeles Board of Public Works is advertising for sealed bids for one tangential water-wheel for equipping one hydro-electric generating plant of 125-kilowatt capacity, for five miles of 15,000-volt transmission line and for step-up and step-down transformers in accordance with specifications on file with the Board of Public Works. The same board has also invited bids for furnishing and erecting near Tehachapi, Kern County, Cal., the necessary boilers, engines, electric generators and motors for delivering 1,250 horsepower electric current to the Los Angeles aqueduct cement works, in accordance with plans on file. These bids are to be submitted on or before May 6th.

The White Pine Telephone Company, which owns the only telephone system in the vicinity of Ely, Nev., has decided on the improvement and extension of its lines at a cost of $50,000. The company's lines will be extended to the new mining camps in the neighborhood.

A. H. Kleinecke has been awarded a franchise for an electric railway in Tuolumne County, Cal., from the Stanislaus County line across the Sierra Nevada Mountains, into Mono County, with numerous branches throughout Tuolumne County.

The Western Sierras Power Company has been incorporated at Sacramento, Cal., with a capital stock of $10,000 by C. C. Bonte, H. Stillman, E. S. Brown and others.

Governor Gillett has signed the enabling act permitting Los Angeles, Cal., to issue bonds for the construction of the Owens River municipal water plant. The construction of this system involves the putting in of several electric power plants.

Nineteen farmers living along Old Cow Creek have brought action at Redding, Cal., to prevent the Northern Light and Power Company from using the waters of that stream for power purposes, on the ground that their riparian rights would be violated. It is alleged that the farmers desire to use more water than the stream carries in the dry season and that the company plans to divert the stream, with the result that the lands along it would become unproductive.

At a meeting of the stockholders of the San Francisco Coke and Gas Company last week action was taken to change the name of the company to the Metropolitan Coke and Gas Company and to increase the capital stock of the company considerably, so as to provide for adding an electric plant.

It is announced that the California Gas and Electric Company will begin work as soon as the weather clears on the completion of its power plant on Deer Creek, near Nevada City, on which work was suspended last fall. Practically all of the machinery is on hand for the plant.

The Allis-Chalmers Company has taken a contract to supply additional induction motors aggregating 400 horsepower for the projected cement mill of the Henry Cowell, Lime and Cement Company at Concord, Cal., making a total of about 2,300 horsepower in motor capacity.

The Westinghouse Electric and Manufacturing Company has closed a contract with the Santa Cruz Portland Cement Company for additional induction motors for its new 6,000-barrel cement mill at Davenport, Cal., making the entire electric equipment in motors 5,475 horsepower. A.

PERSONAL.

J. W. Shaw of Cayuga, Ind., has been appointed manager of the electric-light plant at Paxton, Ill. He was formerly connected with the Cayuga Electric Company.

Sir William Preece is in this country as one of the guests of Andrew Carnegie at the dedication of the Carnegie Institute in Pittsburg and the Engineering Societies Building in New York city.

In a list proposed by W. T. Stead from which to select the American delegates to the Hague peace conference are the names of Grover Cleveland, William Jennings Bryan, Andrew Carnegie, George Westinghouse, Thomas A. Edison and others.

Louis D. Hess of Altoona, Pa., has been appointed superintendent of the Citizens' Electric Light, Heat and Power Company at that place. Mr. Hess was for many years connected with the telegraph department of the Pennsylvania Railroad at Altoona.

David Munson, the pioneer lightning-rod man of Indianapolis, is dead. Mr. Munson was born in 1820 and spent his entire mature life in inventing, manufacturing, improving and perfecting lightning rods. Mr. Munson patented more than 100 different kinds of lightning rods, taking out his last patent three years ago. He built up an extensive lightning-rod business, and his appliances were sold over the entire country.

Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, Electrical Engineering Department, has been chosen as the third member of the special commission to arbitrate on the price the city of Boston should pay the Edison Electric Illuminating Company for lighting the streets and public buildings. Excise Commissioner Samuel H. Hudson represents the city and Herbert A. Wagner of New York represents the company on the commission, and they chose Professor Jackson as the third member. The commission will have the power to reduce the price now paid, if it finds it excessive.

Charles H. Armatage of Albany, N. Y., has been appointed traffic manager of the United Traction Company in that city and its subsidiary lines.

Mason B. Starring, formerly vice-president of the Chicago City Railway Company, is now president of the Northwestern Elevated Railroad Company of Chicago, succeeding Clarence Buckingham, who becomes vice-president. Mr. Starring had been with the City Railway Company for 20 years. Walter B. Smith and C. Ledyard Blair retire as directors of the elevated railway company and Samuel McRoberts is elected to the directorate.

ELECTRIC LIGHTING.

E. H. Corle will establish a $15,000 electric-light plant at Joliet, Mont.

The Lebanon (Ind.) Electric Company will expend $35,000 in improving its plant.

Lodi, Wis., will soon vote on the proposition to install a $10,000 electric-light plant.

R. A. Talbott has made application for an electric-light franchise in Rock Valley, Iowa.

The Altus Gin and Manufacturing Company has been granted an electric-light franchise in Ozark, Ark.

The report that the Chicago Edison properties may be transferred to Chicago Subway interests is again in circulation.

Hensley Bros. have begun the rebuilding of their electric-light plant in Jacksboro, Texas, which was recently destroyed by fire.

The Elma (Wash.) Light and Power Company has been incorporated for $30,000 by George A. Avery, Zula B. Avery and others.

The Grays Harbor Railway and Light Company of Aberdeen, Wash., has plans for the eretcion of a new power plant to cost $250,000.

Announcement has been made that the Wisconsin Light and Power Company, organized at La Crosse two years ago, has sold its properties to the older concern.

The plant of the Palisades (Colo.) Light, Heat and Power Company was destroyed by fire on March 31st. Preparations have already been begun to rebuild the plant.

An application for a concession for the supply of electricity in Adrianople, Turkey, has been favorably reported. The minister of public works has, however, decided to invite tenders for the work.

The secretary of state of Indiana has ordered proceedings to be instituted against the Western Gas and Investment Company, which has been operating lighting plants in Seymour, Madison and other Indiana towns. The secretary says that the company has violated the foreign-corporation laws of the state, and has no authority to do business in Indiana. The penalty is $1,000 fine.

The gas and electrical exposition, to be given in Lincoln, Neb., April 22d to 27th, by the Lincoln Gas and Electric Light Company, promises to be an attractive affair. It is to be educational as well as entertaining. The newest gas and electrical devices will be shown and the lighting will be brilliant. Local merchants are assisting the company in preparing to entertain visitors from Nebraska, Iowa, Missouri and Kansas.

In its effort to increase the electrical interest of its friends and patrons, the Edison Electric Illuminating Company of Boston, through Mr. William H. Atkins, general superintendent, is sending out a polite letter requesting patrons to send in a suggestion or hint which will show the company how to improve its service in any way. A stamped envelope is provided for the purpose. A miniature booklet is also enclosed, which treats in non-technical terms of the metallized-filament lamp.

The Bay City (Mich.) Traction and Electric Company is to invest a large sum of money in enlarging its power plant and increasing its equipment. A 500-kilowatt turbine is to be placed to generate power for the electric-lighting plant. A new 750-kilowatt generator will also be put in for the purpose of generating power for the railway. Two 500-horsepower boilers will be added to the battery, making five boilers in all. These improvements will involve an expenditure of between $50,000 and $100,000.

ELECTRIC RAILWAYS.

A company has been organized with a capital of $15,000 to build a street railway in Arcadia, Fla.

The spending of $320,000 for the improvement of the street-railway facilities of Woonsocket, R. I., during this year, and the expenditure of some $450,000 additional to the plans previously announced in perfecting the trackage and equipment of the Rhode Island Company in the city of Provi-

dence, is projected by the New York, New Haven and Hartford Railroad management.

Webster Merrifield of Grand Forks, N. D., president of the North Dakota University, is promoting the building of an electric road from Grand Forks to Crookston.

Officials of the Toledo and Columbus electric railway have arranged for a preliminary survey between Bucyrus and Fremont, Ohio, and work will begin at once.

The Camden Interstate Railway Company will build large street-car barns in Huntington, W. Va. The building will be of concrete block and steel frame, with slate roof.

The Helena (Mont.) and Butte Electric Company has been incorporated to construct an electric railway to cost about $3,000,000. Power will be developed from the dam across the Missouri River near Helena.

The Scientific American says: "The day is coming, if it is not already here, when that miserable blacksmith's contrivance, the common railroad spike, must give place to some form of screwed fastening with larger bearing surface and very much greater holding power."

The town of Cicero, a suburb of Chicago, has passed an ordinance granting permission to the Metropolitan Elevated Railroad Company to extend its Garfield Park branch through the limits of Cicero. The elevated company thus acquires the right to construct a branch road in Ogden Avenue through the town of Clyde.

Stockholders of the Findlay (Ohio) and Marion Railway and Light Company have voted to increase the capital stock of the company from $250,000 to $1,250,000, and a bond of an equal amount was ordered. It is expected that a good part of the construction work will have been done within the next year. R. P. Hankey is president, Detroit, Mich.

The annual report of the Chicago and Milwaukee Electric Railroad Company shows that for the year ended December 31, 1906, the gross income was $549,601, a gain of $184,716 over that of the previous year. The surplus declared of $201,605 was an increase of $100,699 over the surplus of 1905. Through service to Milwaukee will not be ready for some time. The officers elected for 1907 are: President, A. C. Frost; vice-president, Gordon A. Ramsay; secretary, P. G. Beach; treasurer, W. O. Kilman.

Citizens of Ossining, N. Y., last week began tearing up the tracks of the Westchester Traction Company and their work was followed by the laying of new tracks by the Hudson River and Eastern Traction Company, which had been granted a franchise. Two thousand feet of track had been destroyed when deputy sheriffs interfered. The village authorities held that the franchise had been forfeited because, it is said, the company had not run cars in three months. The new company has offered to install a new plant and give good service.

Before the Engineering Society of Pennsylvania on February 19th Mr. E. K. Morse, civil engineer, Pittsburg, Pa., read a comprehensive paper on the subject, "Pittsburg Subways." The city of Pittsburg is confronted with the problem of relieving congested transportation conditions in the business section. In an area of 210 acres all the street-railway and steam-railroad travel is discharged, and in this area the bulk of business is transacted. Only one street, Liberty Avenue, is 80 feet wide, the others being only 40 and 50 feet between building lines. Mr. Morse suggests a system of subways for the city, the plans and suggestions for which he outlines in detail in his excellent paper.

The annual meeting of the stockholders of the Metropolitan Elevated West Side Railway Company of Chicago was held on April 4th. In the financial statement the gross earnings for the year ended February 28th were given as $2,697,238, compared with $2,452,327 for the preceding year. The total operating expenses were $1,172,430 and the net earnings from operation were $1,385,083, as compared with $1,279,897 the previous year. In the calendar year 1906 the Metropolitan lines carried 49,771,812 passengers, or an average of 136,361 a day, as compared with a daily average of 124,271 in 1905. Fifty new motor cars were put in service during the year and 20 more have been ordered.

The Interborough (New York city) Rapid Transit Company's statement of gross earnings, operating expenses, net income, and passengers carried during the year ended December 31st last shows an increase of $2,697,881 over the gross earnings of 1905. The actual figure for last year was $20,916,147. Operating expenses increased $548,482 to $8,973,486, and net earnings were $12,122,660, against $9,973,261 in 1905, a gain of $2,149,398. Other income decreased $28,061, leaving the gross income for 1906, $12,706,259. Net income, after the payment of interest and taxes, was $7,443,192, a gain over 1905 of $1,125,050. The surplus left after paying seven per cent. on Manhattan Railway stock was $3,545,192, $1,041,050 greater than in the previous year. In the same time the number of passengers carried has grown from 366,174,479 to 420,302,389, and the operating per cent. has decreased from 45.25 to 42.04.

RADIO-TELEGRAPHY.

Experiments in radio-telegraphy at the Poulsen station, Denmark, were begun recently, with the result that messages were exchanged with the United States, it is alleged. The results are said to have been satisfactory.

The United States consul-general at Constantinople reports that the Turkish government has decided to establish several radio-telegraph stations in the empire. At present there are only two, at Kelemish, on the Anatolian coast, and Derna, on the coast of Tripoli, in Africa. The government will engage two specialists in Europe for training the staffs of the projected stations.

POWER TRANSMISSION.

The Lanyon Zinc Company of Iola, Kan., will put in a complete electric power plant, which will cost $50,000.

Surveyors are working below Lake Spaulding in California with a view of constructing a dam 300 feet high to hold enough water to run 25,000 inches of water seven months in the year. The supply will be used to run a hydro-electric plant in conjunction with the Pacific Gas and Electric Company at San Francisco, Cal.

R. A. Mitchell of Birmingham, Ala., and his associates have filed incorporation papers for the Alabama Power and Developing Company, which records the completion of the purchase of the Talladega Electric and Power Company, with all its rights, franchises, real estate and power plant. The capital stock is $300,000.

The Pacific Power Company, a new corporation of Anderson, Cal., will soon begin the erection of a 12,500-horsepower electric plant on Battle Creek. It proposes to enter into competition with the Northern California Power Company, which is also constructing a dam on Battle Creek to generate 12,500 electric horsepower. At the present time the Northern company is the only company supplying electricity for commercial use in Shasta and Tehama counties.

The Green River Hydro-electric Company, composed of prominent Louisville (Ky.) and Bowling Green capitalists, will erect on Green River, at Glenmore, an electric power plant having a capacity of 1,000 horsepower. It is expected the plant will be completed by the middle of September. The work will be under the supervision of H. Van Schon, engineer, of Detroit, Mich. It is rumored that the company expects to build an electric railway to Elizabethtown.

O. L. Huie of Marinette, Wis., formerly with the Watertown Gas and Electric Company, has closed a deal whereby he and his business associates in Southern Wisconsin are said to have secured possession of an excellent waterpower in Upper Michigan, on the Escanaba River, consisting of the power known as the Flat Rock mill site and all the power above the Flat Rock to and including Chandler's Falls. It is the intention to survey the waterpower and locate four or five dam sites and follow up the work as fast as possible and make all necessary improvements to develop the power. They expect to put in a large pulp mill.

The new power house of the Edison Electric Company of Los Angeles, Cal., on the Kern River, is nearing completion. The initial electric generating equipment provides for an output of some 20,000 kilowatts. The power will be transmitted by pole lines to Los Angeles and to Santa Barbara. Four General Electric 5,000-kilowatt, three-phase, 50-cycle generators have been installed. These large machines are waterwheel-driven at 250 revolutions per minute, delivering current at a potential of 2,300 volts to the secondaries of the transformers. Each of the 13 transformers has a capacity of 1,667 kilowatts, the primaries being arranged with taps to provide for Y connections at several different potentials, the highest being 75,000 volts and the lowest 33,000 volts. The secondary windings are arranged for delta connection at 2,300 volts.

PUBLICATIONS.

A striking weekly calendar has been published by the New York Edison Company. It is very convenient for desk use, each sheet bearing the six business days of the successive weeks. There are also many catchy hints relative to the company's electric lighting and power service.

Catalogue No. 2 of the Connecticut Electric Manufacturing Company of Bantam, Conn., is out. It is an interesting book, in which are described and illustrated the large line of electrical supplies manufactured by this company, including all kinds of switches, boxes, receptacles, sockets, rosettes, cutouts, fuse blocks, connectors, etc. The company recently completed a new factory thoroughly equipped with the most modern machinery and tools.

Vol. X. of the Transactions of the American Electrochemical Society has been published at the headquarters of the society, 39 South Tenth Street, Philadelphia. The book has 132 pages, neatly bound in cloth. It contains the proceedings, papers and discussions at the tenth general meeting of the society, held at Columbia University, New York, October 8 and 9, 1906.

A corrected index, showing catalogues, bulletins, instruction books, etc., in force April 1st, has been published by the Allis-Chalmers Company, Milwaukee. This gives a list of 135 publications, each treating of a separate product or group of products of the Allis-Chalmers Company. Among these are comprised a new line of bulletins, 88 in number. In addition to the numerical arrangement, the publications are classified according to subject. This makes the index convenient for reference.

Harvey Hubbell, Inc., Bridgeport, Conn., has issued its 1906 catalogue containing many new electrical specialties, original in design and practical in application. To meet the demand for special finished electrical goods, the company carries a stock of the most popular finishes, such as old brass, oxidized copper, polished gilt, etc. In the Hubbell pull socket the extension eyelet permits the use of the pull socket with husks or other fixtures on which the limited space will not admit of the use of the company's regular socket. The Hubbell pull angle wall socket is intended for use in place of the wall socket where it is desirable to have the lamp stand at an angle. Among other things listed in the catalogue are the pull rosette socket, pull switch, incandescent-light attachment for oil lamps, known as the "Dazzlite," Edison adapter, attachment plug, chandelier plug, flush attachment plug, floor receptacle, current tap, weatherproof plug, separate caps for plugs, shade holder, half reflector, tin and aluminum shades, parabola reflector, enameled steel shade, lamp guard, standard pull clusters, cluster and socket fittings, etc., all of "Hubbell" design and manufacture.

SOCIETIES AND SCHOOLS.

The annual meeting of the Technical Publicity Association will be held on April 18th, at the rooms of the Aldine Association, 111 Fifth Avenue, New York city. Officers for the ensuing year will be elected.

MISCELLANEOUS.

The new power house for the Harriman railroad shops at Ogden, Utah, is entirely completed and electric current is delivered to every part of the shops and yards. The plant consists of two Westinghouse generators of 150 kilowatts each. The power for the machine, blacksmith and boiler and car shops is furnished from this plant, and in addition it will furnish the lights for all of the yards, the depot and the offices.

Located in the center of the lumber interests, the Jamestown Exposition will be visited by hundreds of active and prospective mill owners. The Allis-Chalmers Company of Milwaukee is not only making a display of mill machinery at Jamestown, but is also showing the adaptability of electricity to sawmill driving. The Allis-Chalmers Company has just furnished the equipment of the new mill of the Dempsey Company, Tacoma, Wash. This mill will be operated entirely by electric motors.

Both the Harriman railroad system and the Hill lines may be electrically equipped throughout their mountain divisions. Both managements have had electrical engineers working in the mountains for some time ascertaining what water supply there would be available for electrification, making estimates of the cost of such work. There are several reasons why the companies would like to use electricity as a motive power in the mountains. One is the cheapness of such power, which would be furnished by the many waterfalls in the regions traversed, and another is the difficulty of supplying the steam locomotives with water.

The Russian cabinet has rejected the proposal made on behalf of an American syndicate for the construction of a railroad tunnel under Bering Strait, by which it was hoped ultimately to connect the Trans-Siberian Line with the Canadian Pacific Railway. The scheme for a tunnel under Bering Strait and an all-rail route from the United States to Europe has been under consideration for some time and the matter has been pressed in Russia by Baron Loicq de Lobel, who represented the American-Trans-Alaskan-Siberian company. A year ago dispatches from St. Petersburg said the Russian government was disposed to consider this plan favorably.

The scenic commission appointed by Secretary Taft to make an inspection of the American bank of Niagara gorge with a view of restoring it to a state of primeval beauty was at Niagara Falls last week. In the party were Captain Charles W. Kutz of West Point, John Stephen Sewell of Washington, F. D. Millet and C. F. McKim of

New York, and F. L. Olmsted, Jr., of Boston. They covered the state reservation, crossed the upper steel arch bridge to the Canadian side from which they had a splendid view of the American bank, and traveled down the Canadian side of the river. Those who wished to get their views before the commission were given a hearing.

The D. T. Williams Valve Company of Cincinnati has purchased a large seven-story building, only recently built, in order to increase its manufacturing facilities. A large brass foundry is provided for casting the company's line of specialties, together with machine tools and appliances for finishing the products. The large machine tools will be driven by means of Allis-Chalmers induction motors, direct-connected, and the smaller machines will be driven in groups by motors of the same type. These motors will range from five to 50 horsepower. The group-driven machines will use cone pulleys and speed boxes, in order to obtain variable speed on a number of the tools which could not be obtained with direct-connected induction motors.

TRADE NEWS.

The Dixie Electric and Machine Company of Columbia, S. C., asks for catalogues of everything electrical.

The Machinists' Electric Company of Topeka, Kan., has been incorporated with a capital stock of $6,000.

The Stacey & Burns Electric Company of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by R. L. Stacey, L. L. Burns, G. R. Palmer and others.

The Ford-Johnson Electric Company of Amsterdam, N. Y., has been organized to do a general electrical business. H. W. Bordwell of Gloversville, N. Y., is one of the incorporators and directors.

Sealed proposals will be received at the Department of Agriculture, Washington, D. C., until May 3, 1907, for furnishing to the Forest Service 3,000 miles of No. 12 BB galvanized iron wire, 35,000 standard oak brackets and 35,000 standard pony insulators. One-third of this material is to be delivered at Denver, Colo., and the other two-thirds at Salt Lake City, Utah. The right will be reserved to inspect the material either at the point of shipment or delivery. Blank forms of proposals, specifications and all necessary information can be obtained from the Forester, Forest Service, Washington, D. C.

John W. Eakin of the Eakin-Rittenhouse Company of Cairo, Ill., dealer in electrical supplies, has sold a portion of his stock in the concern to Daniel H. Sullivan. Mr. Eakin's health has been failing and he has taken an extended trip to the Pacific Coast.

On April 1st the office of the Goldschmidt Thermit Company was removed to the fourteenth floor of the West Street Building, No. 90 West Street, New York city. The Pacific Coast branch has been opened with office at 432-436 Folsom Street, San Francisco, under the management of Mr. L. Heynemann, for business in the states of California, Oregon, Washington and Nevada.

Upon application of the Laporte (Ind.) Electric Company, the Laporte Circuit Court has appointed E. J. Widdell receiver of the Edwards Electric Headlight Company of Laporte. The company is capitalized at $150,000, and manufactures electric headlights for railroad engines and gas and gasoline engines. The receiver has taken possession. The liabilities and assets have not yet been made known.

The Columbia Incandescent Lamp Company of St. Louis has opened a branch office in Pittsburg, Room 705 Penn Building, with Mr. J. D. O'Bryan in charge. This step has been taken on account of the importance of the lamp trade in Western Pennsylvania and Eastern Ohio, and also owing to the constantly increasing business in that territory. It is the intention to carry a complete and well-assorted stock of lamps in Pittsburg.

The Chicago Inter Ocean publishes this dispatch from Boston, dated April 3d: "It is now considered probable that the General Electric Company will postpone for the time being the erection of a plant at Erie, Pa. The need of the additional facilities is no less urgent now than it was at the time the land was purchased, but the directors have not felt it wise to undertake at this time the expenditure of the comparatively large sum of money necessary."

BUSINESS.

The Twin City Electric and Construction Company of Winston-Salem, N. C., has been capitalized at $25,000 to conduct an electrical construction business and to deal in electrical supplies. E. G. Couch and others are incorporators.

The Electrical Goods Purchasing Company, 105 Reade Street, New York city, is starting the business of purchasing for one electrical concern in each town or for the central station in each town. Mr. Thorpe Wright, manager of the company, requests that manufacturers of electrical goods of all classes send him catalogues, best prices, etc.

The Stackpole Battery Company of St. Marys, Pa., has started a large addition to its already important plant. This extension is necessary so early in the career of the company on account of the prompt recognition by the trade of the merits of the high-grade Elk brand dry cells. The company is now working two shifts, night and day, and with the increased facilities of the new building will be able to handle an output second to none in this country.

The demand for the telephone and telegraph wire made by the Indiana Steel and Wire Company of Muncie, Ind., has necessitated the running of the large plant night and day, and the capacity of the plant has been increased. This company has just published a booklet on telephone wire in which are reproduced a number of tests made on its wire at some of the leading institutions of technology. These are given as a guarantee that the wire is of the highest quality. The company guarantees its wire to be standard, to withstand every test and the equal of any telephone wire on the market.

On April 1st the J. G. Brill Company of Philadelphia, Pa., assumed control of the Wason Manufacturing Company of Springfield, Mass. The Wason company will retain its name and will continue to operate the Springfield plant. The Wason company has just taken a contract to build 65 cars for the elevated railway in New York city. The Brill company has been reorganized with a capital of $10,000,000. It includes the J. G. Brill Company, the Wason Manufacturing Company, the American Car Company of St. Louis, the John Stevenson Company of Elizabeth, N. J., and the G. C. Kuhlman Company of Cleveland, Ohio.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 2, 1907.

848,636. Fire and Police Signaling System. William Condon, Kansas City, Mo., assignor of one-half to Albert Barrett, Kansas City, Mo. Application filed July 7, 1902.

In a signal system are combined a signal box provided with a door, a movable make-and-break device actuated by the opening of the door, and means controlled by the movement of the key in the lock for determining the speed of movement of the make-and-break device.

848,653. Typewriter Operator. Benjamin F. Hutches, Jr., New York, N. Y. Application filed May 15, 1905.

The device comprises a frame independent of the typewriter frame, a key on the operator frame, a contact, an electromagnet in circuit, means for actuating a typewriter character and adapted to be operated by the electromagnet and a punch adapted to be simultaneously operated by the key.

848,654. Automatic Paper Feeder for Typewriters. Benjamin F. Hutches, Jr., New York, N. Y. Application filed February 26, 1906.

A typewriter operator is provided with a rack adapted to engage the carriage. A double lever is adapted to be engaged by the rack. There are a contact controlled by the lever, an electromagnet in circuit, and means controlled by the electromagnet for operating the rack.

848,657. Automatic Sign Exhibitor. Frank A. Johnson, Frederick Weddemann and Edward Blankenberg, Danville, Ill. Application filed March 1, 1906.

The sign exhibitor patented comprises a casing having a view opening, supporting plates secured to the ends of the casing, an electric motor arranged in the casing and a rod connecting the motor with two crank-arms placed upon a crank-shaft journaled in the casing.

848,658. Playing Mechanism for Stringed Instruments. Louis A. Kampelman, St. Louis, Mo. Application filed March 9, 1906.

A musical instrument comprises horizontal strings, a series of magnet coils positioned above the strings, the cores of which are extended, and a spring-held armature pivotally mounted between the extended ends of each pair of cores. An arm is carried by the lower end of each armature and a second arm is pivotally connected to the first arm. A hammer is carried by the second arm. A spring engaging on the rear end of the second arm normally holds it elevated.

848,665. Rotary Explosion Engine. Levi W. Lombard, Medford, Mass. Application filed May 12, 1904. Renewed August 29, 1906.

In the engine are a number of cylinders mounted in a number of disks, a sparking plug in each cylinder, and means for transmitting a current to the plug at a point in the revolution of the cylinders

848,675. Wave Meter. Joseph Murgas, Wilkesbarre, Pa. Application filed January 29, 1906.

In a wave meter are combined a closed circuit adapted to have its period varied and comprising an electrostatic telephone receiver for indicating a resonant condition of the circuit, means for indicating the constants of the circuits for each adjustment, and electrostatic means for coupling the circuit with the system, the wave length of which is to be measured, the electrostatic means comprising opposed electrodes, each having a plurality of projecting prongs.

848,676. Electric Transformer. Joseph Murgas, Wilkesbarre, Pa. Application filed March 17, 1906.

In an electric transformer there are a baseboard having a grooved way, a carriage sliding in the way, a primary mounted on the carriage, uprights connected to the base, a secondary secured to the uprights and a fixed binding post for one terminal of the secondary. An adjustable contact makes sliding connection upon the various turns of the secondary.

848,701. Game Apparatus. Thomas M. St. John, New York, N. Y. Application filed December 3, 1904.

The apparatus described comprises a board carrying an electrophorous consisting of a suitable non-conductor adapted to be statically charged by friction. The device is adapted to be used for experiments, light pieces of paper, pith, etc., being employed.

848,719. Alternating-current Motor. Edward Bretch, St. Louis, Mo. Application filed November 17, 1905.

In a dynamo-electric machine are a slotted laminated field-core in combination with an armature having a core of magnetic material, a commutated winding of low resistance carried by the core, an inner winding of low resistance carried by the core and located within the zone of the commutated winding and separated therefrom to form a pathway for the magnetic flux to pass through the commutated winding without penetrating the inner winding.

848,720. Automatic Current Interrupter. Victor H. Broc, New York, N. Y., assignor to the Broc-Barbier Auto Ignition Company, New York, N. Y. Application filed September 5, 1906.

In an electrical-current interrupter is a vibrating arm or lever composed of two parts, one magnetically attractable hung at one end and one magnetically inert, the strip magnetically attractable being adapted to be attracted away from the other by a magnet.

848,730. System for Transmitting Electric Currents to Cars. John J. Eagan, San Francisco, Cal. Application filed December 26, 1905.

In a system for transmitting electric currents to cars are a longitudinal rod having laterally movable extensions pivotally connected thereto, mounted on a car, the car being supported on trucks arranged for turning, a number of turnable vertical rods at each end of the car arranged for connection and disconnection, and means in proximity to the base of the car for the turning of the vertical rods by the trucks.

848,749. Trunk Circuit for Telephone Systems. Joseph B. Kelley and Edwin B. Heaford, Omaha, Neb. Application filed December 31, 1906.

In a telephone system are combined an exchange station, a toll station, a two-conductor trunk line, a signal circuit associated with the trunk line, a bridged relay for closing the signal circuit when the exchange station is connected with the trunk line, a relay for opening the signal circuit when the toll station is connected with the trunk line, and a means for locking out the signal as long as the bridged relay is energized.

848,750. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed June 28, 1906.

In a telegraph system combined with the line are a return circuit, two branches from the line to the return circuit at each station, one branch conductively connected to the line circuit and including the winding of a receiving device, a transmitter and an inductance, the second branch including a winding of the receiving device disposed oppositely to the first-mentioned winding and a condenser.

848,751. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed August 9, 1906.

A line of transmission comprises means to neutralize the inducing effect of other lines, the means embracing for the devices inserted in the line, a converter, one coil connected to part of the circuit with the interposition of condensers and the second coil connected in multiple arc to the receiving device to be protected.

848,752. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed August 27, 1906.

In telegraphic apparatus are combined a relay or receiving device inserted in a line of transmission, a shunt circuit embracing the armature of an electromagnet and means to close the shunt during the upward movement of the armature.

848,753. Electric Receiving Device. Isidor Kitsee, Philadelphia, Pa. Application filed September 8, 1906.

Combined are a receiving device and a localized translating device, both operatively related to each other, the receiving device inserted in the line of transmission and comprising two telephonic receivers, the vibrating diaphragms of both receivers provided with polarized means and adapted through their movements to actuate the translating device.

848,757. Orientation Device. Henry C. Lomb and Ernest G. Sailer, Rochester, N. Y. Application filed October 29, 1906.

In a device for establishing a luminous point of reference in an optical field are combined an optical instrument, a cross-hair arranged to appear in the field thereof embodying an electrical conducting filament reduced in the area of its cross section at a point intermediate its ends and an electrical circuit including the filament.

848,793. Relay Structure. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed February 4, 1907.

The electrical relay structure includes a relay having two windings, an armature therefor, means including an external resistance and a source of current for causing a preliminary energization of one winding of the relay, a switch contact of the relay adapted to limit the preliminary energization, and means automatically set in train of action by the preliminary energization to subsequently establish a path for current to energize the relay to hold its armature fully attracted.

848,814. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 26, 1902.

Combined with a trunk line adapted to connect telephone lines together for conversation are a relay at the incoming end actuated by current over the trunk from the outgoing end, a second relay at the incoming end, a signal also at the latter end, the actuation of which depends upon the relays, the second relay being initially actuated over a local circuit and a locking circuit therefor to maintain the relay actuated.

848,819. Bushing Coupling. Charles A. Freeman, East Orange, N. J. Application filed November 27, 1906.

In combination with an electrical conduit having a lining wound in helical convolutions are a tubular metallic member having a thread to enter the juncture of the windings, and arranged to part the windings longitudinally by its entrance and be locked therein, the member having a flange adapted to receive a tool.

848,849. Telegraphy. Walter P. Phillips, New York, N. Y. Application filed July 27, 1904.

A telegraphic recording instrument comprises in combination two oppositely directed magnet poles, armatures facing the poles and adapted to be reciprocated by the alternate attractive action thereof, a recording device carried by the armatures, flat springs supporting the armatures and adjustable supports for the opposite ends of the same, whereby the springs tend to maintain the armatures in a position of symmetry with respect to the poles.

848,893. Switching Device. Edward F. Gehrkens, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 22, 1904.

Combined with a source of current having a number of taps are a main contact blade in circuit with one of the taps, means for moving the blade from tap to tap, an auxiliary contact blade connected through an impedance to the main contact blade, and means for imparting to the auxiliary blade an intermittent motion with respect to the main contact blade.

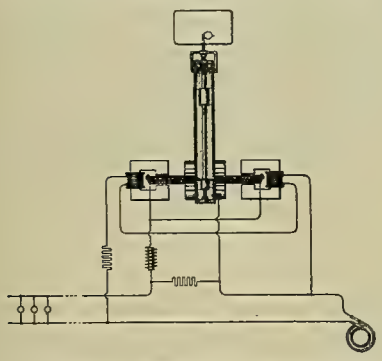
848,902. Attaching Plug and Wall Receptacle. James J. Hartley and Frank C. De Reamer, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed April 22, 1905.

In a coupling for electric conductors are comprised an insulating base having in the front side two pockets and two recesses, metallic sockets located in the pockets and terminal connections located in the recesses, bridging strips on the back side of the base, and screws extending through the base and connecting the ends of each strip respectively with a socket and a terminal connection.

848,915. Trip-coil for Circuit-breakers. Ezra B. Merriam, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 15, 1905.

Combined with an automatic circuit-breaker are mechanism for tripping the same comprising a trip lever, an electromagnet having differential windings for actuating the same, and means whereby the fluxes due to a current through the windings may be joined or opposed at will.

848,923. Alternating-current Meter. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1906.



NO. 848,923.—ALTERNATING-CURRENT METER.

In connection with the meter described are an inductive potential circuit, a series circuit, an inductive resistance in the series circuit in series with the meter, and a resistance of smaller self-induction in shunt to the first-mentioned resistance and meter. (See cut.)

848,925. Electric Governor. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 6, 1904.

In combination with an alternating-current circuit are a motive device connected thereto, automatic means for varing the speed of the motive device when the frequency of the circuit changes, a second motive device and regulating means for utilizing a relative change of speed of the motive devices.

848,926. System of Motor Control. Carl Schiebeler, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 5, 1905.

Combined in a system of control are a motor, a motor controller having "off," braking and power positions, and means associated with the controller for effecting different braking conditions in the same position of the controller according as the controller is moved to the braking position from the "off" position or from the power position.

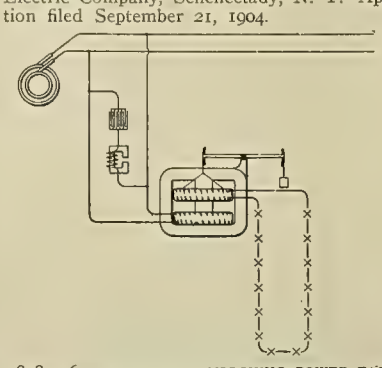
848,928. Electric Feeding Mechanism. Arthur W. Sherwood, McDonough, Ga. Application filed December 26, 1906.

In a feeding device are a series of dumping feed boxes, a sounding signal at the end of the series, an electric circuit having a controlling switch distant from the boxes, a transmitter and receiver in the circuit, the former being adjacent the signal and the latter adjacent the switch, and means in the circuit to dump the boxes and sound the signal.

848,935. System of Electrical Distribution. Matthew O. Troy, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 19, 1902.

Combined with a series circuit containing translating devices possessing inductance are a device possessing capacity in series in the circuit, and a source of current for supplying the circuit, the source possessing sufficient inductance to damp out harmonics in the wave of current in the circuit.

848,936. Means for Improving the Power Factor of Alternating-current Circuits. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 21, 1904.



NO. 848,936.—MEANS FOR IMPROVING POWER FACTOR OF ALTERNATING-CURRENT CIRCUITS.

In combination with an alternating-current supply circuit are a consumption circuit including a device or devices taking lagging current from the supply circuit, and means for improving the power factor of the supply circuit consisting of a condenser and an inductance in series with each other in a circuit independent of the consumption circuit. (See cut.)

848,939. Electric Heating Unit. Tycho Van Aller, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 29, 1905.

An electric heating unit comprises an insulating base, a series of resistance coils having their ends supported in the base, similarly supported insulating spacing strips between the coils and a shield for the coils adapted to be supported by the strips.

848,940. Electric Switch Operating Apparatus. Ira L. Van Buskirk, Louisville, Ky. Application filed September 13, 1906.

Combined with an electric switch are a vibratory dog adapted to engage the switch when the latter is closed, an electromagnet and an armature, a link connecting the armature with the dog, and a series of push-buttons circuited with the electromagnet and adapted upon depression to vibrate the dog to release the same from engagement with the switch through the link connection between the dog and armature. A spring is connected with the switch and adapted to throw the same into open position when the dog has been actuated.

848,941. Electrical Connecting Plug. Frederick M. Vogel, Lynn, and Charles E. White, Malden, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed February 25, 1906.

Combined with a coupling provided with terminals and an electrical conducting cord therefor are means for preventing sharp flexure of the cord comprising a supporting clip, a bushing extending therefrom for supporting the cord, a flexible tube engaging the clip and mounted upon the bushing and means for securing the clip to the coupling.

848,944. Reverse-current Device. Edmund B. Wedmore, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 11, 1905.

An electric protective device includes current and potential coils, an open magnetic circuit threading the coils, including a movable member, and means for promoting magnetic leakage of the flux of the current coil away from the movable member.

848,954. Process of Making Resistance Devices. Lawrence E. Barringer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 5, 1906.

The process consists in placing a resistance coil in a suitable base, filling the interstices of the coil with a compound of silica and a hydrate and subjecting the whole to steam treatment.

848,958. Selective Signal System. Elmer F. Bliss, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 12, 1906.

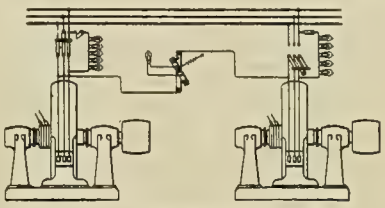
In a signal system there are a number of selective devices, means controllable from a distance for moving the devices independently step by step, a movable member normally locked in one position and arranged to be unlocked by the joint action of the devices and a signal controlled by the member.

848,959. Block-signal System. Elmer F. Bliss, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 19, 1906.

In an electric railway employing the rails as return conductor for the power current there is a pair of relays having a common winding connected across the track rails and each having a second winding supplied with current independently of the rail circuit and of each other.

848,970. Synchronism Indicator. Paul L. Clark, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 19, 1903.

In a synchronism indicator are two alternating-current machines, two relatively movable coils which repel each other when the phase displacement of the machines is great, and a signal lamp which fluctuates in brilliancy when the phase displacement is small and the coils are not moving. (See cut.)



NO. 848,970.—SYNCHRONISM INDICATOR.

848,982. Protection of Parallel Transmission Lines. Anders Fjare, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1904.

In combination with three or more parallel transmission lines are two series transformers for each line, a transformer energized in common from series transformers in all the lines, a differential tripping device for each line having one winding connected to the secondary of one of the series transformers in that line and the other connected to a secondary of the common transformer and a switch in the circuit of each line controlled by the tripping device for that line.

848,984. Electropneumatic Track Channeler. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Rand Company, New York, N. Y. Application filed September 27, 1906.

Combined are a percussive tool, an air-presser for operating it by reciprocating columns of air, a motor for driving the presser, an air pump independent of the presser having a pipe leading to the presser for raising the pressure therein and a check-valve located in the pipe at the desired distance from the presser.

848,994. Electric Junction and Outlet Box. Otto C. Hoffmann, New York, N. Y., and Albert I. Appleton, Chicago, Ill., assignors to the Chicago Fuse Wire and Manufacturing Company, Chicago, Ill. Application filed November 8, 1906.

In an outlet box are a perforated casing, supporting ears for such casing, the casing consisting of a "unit," comprising a variable number of duplicate "spacers" removably united, an end plate on the "unit" and an end plate removably attached to the last "spacer" constituting continuous enclosure.

848,996. Receptacle for Storage-battery Plates. Charles S. Kaufmann, Chicago, Ill., assignor to the American Battery Company, Chicago, Ill. Application filed September 26, 1904.

The receptacle is a tank provided with an outwardly flaring protective strip secured to the top of the tank below its edge and upwardly extending above the edge. The strip has a straight upper edge and an inwardly diverging lower edge which forms a groove or channel in conjunction with the tank.

849,009. Method of Electric Lighting. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed April 18, 1903. Renewed September 27, 1906.

The method described of converting electric energy and producing light thereby consists in passing the energy through an elongated column or columns of gas or vapor in which the energy is converted into light and distributing or conducting the luminous columns around or through the space to be illuminated.

849,024. Prepayment Time-switch Apparatus. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 23, 1905.

In a prepayment time-switch apparatus are two switches electrically connected in series and operable entirely independently, a clockwork for opening one of the switches, a winding shaft having a limited movement for closing this switch and winding the clockwork, and means for automatically stopping the clockwork when either of the switches is opened.

849,027. Integrating Photometer. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 13, 1902.

Combined with a source of radiation are an object and a series of reflecting devices for reflecting radiations from the source upon the object, the reflecting devices being so placed that each reflects radiation from the source of the average intensity which would exist on one of a series of equal areas on the surface of an imaginary sphere surrounding the source.

849,028. Connector for Electric Conductors. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1904.

The connector described comprises a stem having a flange thereon, a perforated plate fitting on the stem and provided with an extension adapted to grip the conductor, and a second flange on the stem holding the conductor firmly between it and the perforated plate.

849,032. Telephone System. Charles A. Wardner, Brushton, N. Y. Application filed December 7, 1905.

In a party-line telephone system are combined with a main circuit comprising two metallic conductors, a supplemental conductor, a common ground return for one or more of the conductors and means whereby the normal talking circuit can be changed from metallic to grounded.

849,045. Advertising Machine. Edgar W. Brown, Dayton, Ohio. Application filed April 12, 1906.

Combined in the machine described are means for producing an interrupted light and figures moving in the path of the interrupted light, different portions of the figures being spaced so as to cause the different portions to appear to move at different speeds.

849,051. Power-transmission Device. Alexander Churchward, Pelham, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 6, 1902.

Combined are a friction disk, a friction roller placed to engage the same, with electromagnetic means for automatically forcing one of the parts toward the other with a pressure proportional to the power transmitted by the parts.

849,061. Ventilating Apparatus. James G. Garner, Chicago, Ill. Application filed December 9, 1904.

In the ventilating apparatus described are combined with the casing provided with an air outlet, a purifying and attemperating means, a centrifugal fan for circulating the air, a fan motor and a motor controlling device.

849,085. Dynamo-electric Machine. Emanuel Rosenberg, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1904.

The machine comprises a multiple conductor system connected with the machine, a winding on the machine connected to one of the outside conductors of the system, and an auxiliary winding on the machine connected to an intermediate conductor of the system.

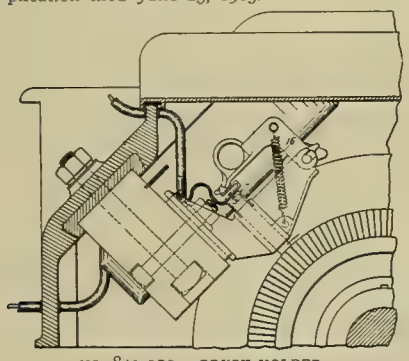
849,089. Socket Key for Electric Lamp Sockets. Philip L. Sylvester, Scranton, Pa., assignor to the Scranton Button Company, Scranton, Pa. Application filed July 5, 1906.

The key comprises a finger-piece of molded insulating material having a flattened head and a shank or thickened portion at one end of the head and a metal stem or spindle embedded in the shank.

849,116. Gas-lighting Apparatus. Ernest A. Frary and Edward N. Frary, Deerfield, Mass. Application filed March 9, 1906.

In the apparatus described are an electric-lighting gas burner having a cock controlling the gas delivery and comprising a gas-ignition device. Electromagnetic devices which open and close the gas-cock and operate the ignition device comprise two contacts and a circuit-closing movable member between them.

849,120. Brush-holder. Frank W. Garrett, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed June 23, 1905.



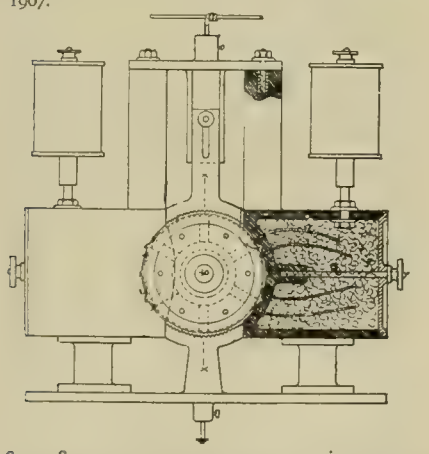
NO. 849,120.—BRUSH-HOLDER.

A U-shaped brush-clip has fastened thereto a U-shaped spring-piece upon which the pressure finger of the brush-holder is adapted to rest when the brush and clip are in position in the brush-holder. (See cut.)

849,145. Automobile. Joseph Ledwinka, Philadelphia, Pa., assignor to the Imperial Electric Motor Company, Philadelphia, Pa. Application filed July 10, 1906.

Combined with a wheel of an automobile are a motor casing carrying a stationary axle for the wheel, a motor carried by the casing, comprising an armature shaft, bearings in unitary relation with the casing, respectively upon opposite sides thereof, a brake shaft mounted in one of the bearings, a counter shaft mounted in the other of the bearings and a power-transmitting connection between the armature shaft and wheel.

849,148. Protective Device for Electric Circuits. Frederick W. Lord and Frederick W. Erickson, New York, N. Y. Application filed January 28, 1907.



NO. 849,148.—PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

Combined in a protective device are an air-gap electrode connected to a line wire, a second air-gap electrode connected to ground and a rotatable member composed of a number of electrodes adapted to form a continuous series of bridges between the line wire and ground electrodes insulated from each other, with insulating surfaces partly enclosing the rotating electrodes through which oil is conveyed to form a film between the electrodes. (See cut.)

849,157. Engineer's Alarm. Edward McClintock, Merriam Park, Minn. Application filed November 6, 1905.

In combination with a track circuit having a pole-changer are good-order and alarm circuits having signals, the good-order circuit being normally closed and the alarm-circuit normally open, sources of electrical energy for the circuits and means connected with the alarm circuit and arranged to operate throttle and air-brake valves to stop the train when the alarm circuit is closed.

849,159. Fuse-clip. Frederick R. Parker, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed March 14, 1906.

A fuse has a terminal connected with clamping means whereby it is securely clamped in place. A tongue portion of a spring member aids in gripping a circuit conductor to connect it in circuit with the fuse.

849,170. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 3, 1902.

Combined with a track circuit for signaling purposes are a source of alternating-current supply, a translating device responsive to an alternating current in the circuit and unresponsive to a modification of the alternating current and means for modifying the alternating current.

849,171. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 3, 1902. Renewed January 17, 1906.

In a signaling system there are a home signal, a distant signal for the home signal, a track circuit including a relay and source of alternating current for controlling each signal, and means for changing the phase of alternating current in one track circuit by the other track circuit.

849,172. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 3, 1902. Renewed January 17, 1906.

There are in combination a controlling mechanism for a number of signals responsive to an alternating current of one frequency to control one signal and responsive to an alternating current of a different frequency to control a second signal and means for supplying the alternating currents of different frequencies of the mechanism.

849,173. Signaling System for Electric Railways. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 3, 1907.

In combination with a signaling system for railways are relays for controlling the signals, each relay comprising two coils, means movable in response to the action of both coils for closing a circuit under the influence of current of one frequency, and means responsive to changes in frequency for causing one of the coils to preponderate to open the circuit under the influence of current of a lower frequency.

849,216. Policeman's Club. Charles J. Diehl and Henry W. C. Eickhoff, Tippecanoe City, Ohio. Application filed August 23, 1906.

In the club described are combined in a hollow handle portion a battery, an electric light carried thereby, a switch controlling the flow of current to the light comprising contact plates on the opposite sides of the club, and a split ring having its closed sides in permanent contact with one of the plates and its open side above the other of the contact plates and normally out of engagement therewith.

849,226. Electric Sign. William B. Garrett, Ashton, Ill., assignor of one-half to Francis E. Dresser and Andrew B. Elmer, Rochelle, Ill. Application filed May 28, 1906.

The sign comprises a number of incandescent lamps closely arranged in parallel rows, a number of contact members, individual circuit connections between the lamps and members, a movable support provided with a number of seats having the same relative arrangement as the lamps, and contact points removably mounted in the seats and adapted to be brought into engagement with the contact members.

849,241. Organ. Robert Hope-Jones, New York, N. Y. Application filed April 22, 1904.

The organ described has a number of departments, a series of stop controllers for one department of the organ, a series of stop controllers for a second department of the organ, and a seris of electrical circuits and devices controlled thereby connecting the two series of actions whereby the operation of the stops of the one department is made dependent upon the position of the actions of the second department. Electropneumatic motors control a series of bellows which move the controller.

849,250. Combined Telephone Desk Stand and Call Bell. Charles A. L'Hommedieu, Buffalo, N. Y., assignor of one-third to William A. L'Hommedieu, New York, N. Y., and one-third to Harry L'Hommedieu, Buffalo, N. Y. Application filed January 5, 1905.

The telephone comprises a base having an opening therein, a standard having screw-threaded engagement with the base, a bell embracing the standard and having similar engagement therewith, and a bell-ringing mechanism located in the base.

849,262. Trolley Wheel. George B. Nussbaum, New Philadelphia, Ohio, assignor of one-half to John Thurman Milar, New Philadelphia, Ohio. Application filed December 6, 1906.

A trolley pole is provided with a segmental recess and a harp support pivotally mounted for rocking movement on the pole and provided with a laterally extending lug.

849,275. Terminal for Electrical Moldings. Reuben Simon, New York, N. Y. Application filed May 9, 1906.

Combined with a molding provided with channels are a body portion of insulating material having channels adapted to register with the channels of the molding, the body portion being further provided with a constricted edge, the latter being rounded for preventing abrasion of wires, and means for connecting the body portion with the molding.

849,276. Automatic Street Indicator for Electric Railways. Eric M. Smith, Albert M. Kemp and Joseph E. Fitzwater, Denver, Colo. Application filed November 23, 1905.

A solenoid is adapted to drive an oscillating lever and a movable sign-carrying member having actuating means in the opposite direction. There are means for passing a current through the solenoid winding at predetermined intervals.

849,283. Compound Brake. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed June 19, 1905.

The brake is provided with electromagnetic means for releasing it and means for restoring it, and an additional brake for a movable member to normal position upon the operation of the electromagnetic means.

849,287. Electric Signal System. William M. Thomas, Chicago, Ill., assignor of one-half to Otto Eisenschiml, Chicago, Ill. Application filed August 3, 1906.

In the system described are a dynamo-electric machine of the alternating type having a field and an inductor adapted and arranged to be relatively vibrated, a number of devices, one for each circuit, arranged for relatively vibrating the indicator and field, a number of circuits in the system, a means for causing energization of a given circuit upon the movement of the motion-imparting device associated with the circuit.

849,292. Antimagnetic Device for Watches. Ashbel T. Wall, East Greenwich, R. I., and Orlando M. Thowless, Newark, N. J. Application filed January 4, 1905.

The watchcase is composed in necessary parts of magnetic metal. Attached to the movement is an enameled dial plate formed of magnetic metal with copper welded to one or both sides thereof, the face of the copper being enameled.

849,296. Detector Device. Simon W. Wardwell, Providence, R. I. Application filed January 24, 1906.

In combination in a normally open electrical circuit with an electromagnetic stop device are a traveling insulated wire forming one terminal of the circuit, a grooved guidewheel forming the other terminal of the circuit and a ring of coiled spring wire within the groove of the wheel.

849,335. Electric Dental Furnace. Louis Markwitz, San Francisco, Cal. Application filed January 22, 1906.

The electric furnace comprises a muffle provided with corrugations or grooves on its exterior surface arranged to receive a winding of wire and a jacket of earthy non-heat conducting material encompassing the muffle and consisting of two horizontally separable parts.

849,336. Signaling System for Telephone Exchanges. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Original application filed July 11, 1902. Divided and this application filed January 20, 1905.

Combined with a telephone line having a spring-jack, the latter being provided with a plug and plug circuit, are a line-signal-controlling magnet in a ground branch from the line, including a battery, a magnet adapted to efface the indicator of the signal when displayed, the last-mentioned magnet being serially included in the line between the branch and the spring-jack, and a ground branch from the conductor of the plug circuit which is connected with the serial magnet.

849,343. Casing for Electric Signaling Instruments. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company, a corporation of Illinois. Application filed February 24, 1902.

The base of the casing described has a passageway through it for the conductors connected to the instrument.

849,353. Electric Ear-phone. Lewis F. Clarke, Boston, Mass., assignor to the Globe Ear Phone Company, Boston, Mass. Application filed February 13, 1907.

The ear-phone comprises a pocket battery having separated contact plugs projecting from its upper end, combined with a transmitter having a socket piece provided with separated sockets adapted to aline with and receive the plugs, and circuit terminals held by the socket piece and engaged with the sockets.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 8, 1907:

424,947. Recoil Check for Ordnance. W. Anderson, Westminster, England.
424,995. Switch Board. E. A. Owen, East Saginaw, Mich.
424,997. Electric Stop Motion for Warping Machines. J. E. Prest, Northbridge, Mass.
425,004. Electric Alarm Device for Clocks. R. Schmitz, Cleveland, Ohio.
425,056. Machine for Weaving Insulated Coverings on Electrical Conductors. C. T. Stetson, Hanson, Mass.
425,061. Lightning Arrester. J. D. Bishop, Chicago, Ill.
425,071. Pole for Electric Wires. L. R. Greene, Boston, Mass.
425,076. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
425,077. Electric-railway Car. R. M. Hunter, Philadelphia, Pa.
425,078. Electrical Annunciator Drop. M. Hynes, Boston, Mass.
425,086. Central Office System for Autographic Telegraphs. J. H. Robertson, Rutherford, N. J.
425,089. Thermostat. W. F. Singer, Carthage, N. Y.
425,101. Support for Electric-railway Conductors. C. J. Kilian, Milwaukee, Wis.
425,106. Electric Rotary Pump. E. I. Nichols, San Francisco, Cal.
425,125. Electric-lighting and Advertising System. A. Douglass, Danes Inn, Strand, England.
425,135. Electrode for Galvanic Batteries. W. P. Kookogey, Brooklyn, N. Y.
425,143. Burglar Alarm. J. Moran, Adair, Mo.
425,164. Method of Electric Welding. C. L. Coffin, Detroit, Mich.
425,269 and 425,270. Electric Meter. M. E. Thompson, Boston, Mass.
425,335. Process of Manufacturing Metallic Electrodes for Batteries. F. Marx, Berlin, Germany.
425,388. Electric-railway Apparatus. J. B. Odell, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Hydro-electric Power Development on the Chicago Drainage Canal.

A large and in some respects unique hydro-electric power development is nearing completion on the Chicago Drainage Canal at a point about 1½ miles south of Lockport, Ill., and something over thirty miles southwest of Chicago. The history of this power plant dates, indirectly, to the time when the Sanitary District of Chicago was organized in 1890. It was then that the plans were laid for the construction of the Drainage Canal for sanitary purposes, now completed to Lockport and still being extended to a point beyond Joliet, some forty miles from Chicago. Primarily, the Drainage Canal was planned to afford an outlet for Chicago's sewerage system, so that Lake Michigan, the source of water supply, would not be contaminated, as would be the case in the natural order of events. Permission was obtained from the United States government to divert 10,000 cubic inches of water per second from Lake Michigan into the Chicago River, reversing the flow of the river. The construction of the canal involved many difficulties and numerous knotty engineering problems. All have been successfully solved, and, besides serving its sanitary mission, the big ditch is also, potentially, a model ship canal, which no one doubts will some day form part of a deep waterway between Chicago and the Gulf.

Since the Sanitary District was organized in 1890 $52,697,495 has been expended for construction and maintenance of the canal. Receipts have amounted to $53,171,199; this includes $35,688,266 from taxes, $17,030,000 from the sale of bonds, $382,424 from interest and $36,784 from the sale of land.

A few years ago the trustees and engineers of the Sanitary District began to see a source of income for the project if the large flow of water in the canal could be "harnessed" for the generation of electricity. The engineers worked out a plan for a large hydro-electric power plant, and three years ago work was commenced on the plant now nearing completion below Lockport.

While the electrical installation for this large plant is not yet sufficiently advanced to warrant a detailed description, a preliminary survey of the project will not be amiss. There are many features of interest about the plant, among them the power house itself, the dam, the ship lock and the great channel wall necessary to get a fall of 34 feet at the waterwheels. All these are of concrete or concrete and steel construction.

When the waterpower project was begun the canal ended at the controlling works at the north line of Lockport. From this point there is a gradual fall to the south, and surveys proved that by slight excavation for a distance below the controlling works and the construction of powerful concrete containing walls between which to conduct the water of the canal a sufficient fall could be obtained at a distance of 1½ miles, and at that point the generating plant was located.

It will be understood, then, that the concrete retaining walls, built to a height level with the controlling works dam, gradually rise in height from a few feet at the controlling works to 40 feet at the power site. Similarly, the excavation grows less as the power site is approached.

The power house, controlling works and the ship lock, placed side by side, form the dam across the channel. The power house is 385 feet long, 70 feet wide and 47 feet high. The retaining walls of the channel are 40 feet high and therefore will bring the water level near the top of the building on the receiving side, giving a fall of 34 feet to the turbines, which furnish the power. These turbines are located in chambers at the floor level and discharge through chambers to the tail race.

The movable-crest dam or controlling works joins the power house to the east. This part of the dam is for the purpose of regulating the flow of water in the canal. When the plant is completed the present controlling works at Lockport will be abandoned.

Joining the controlling dam to the east and completing the dam across the channel is the large lock for lowering boats to the lower level of the canal below the power site, to be used when the deep waterway project is completed. The concrete walls of the lock are 52 feet high at the lower end, and the lock is of sufficient size to admit the largest river steamers.

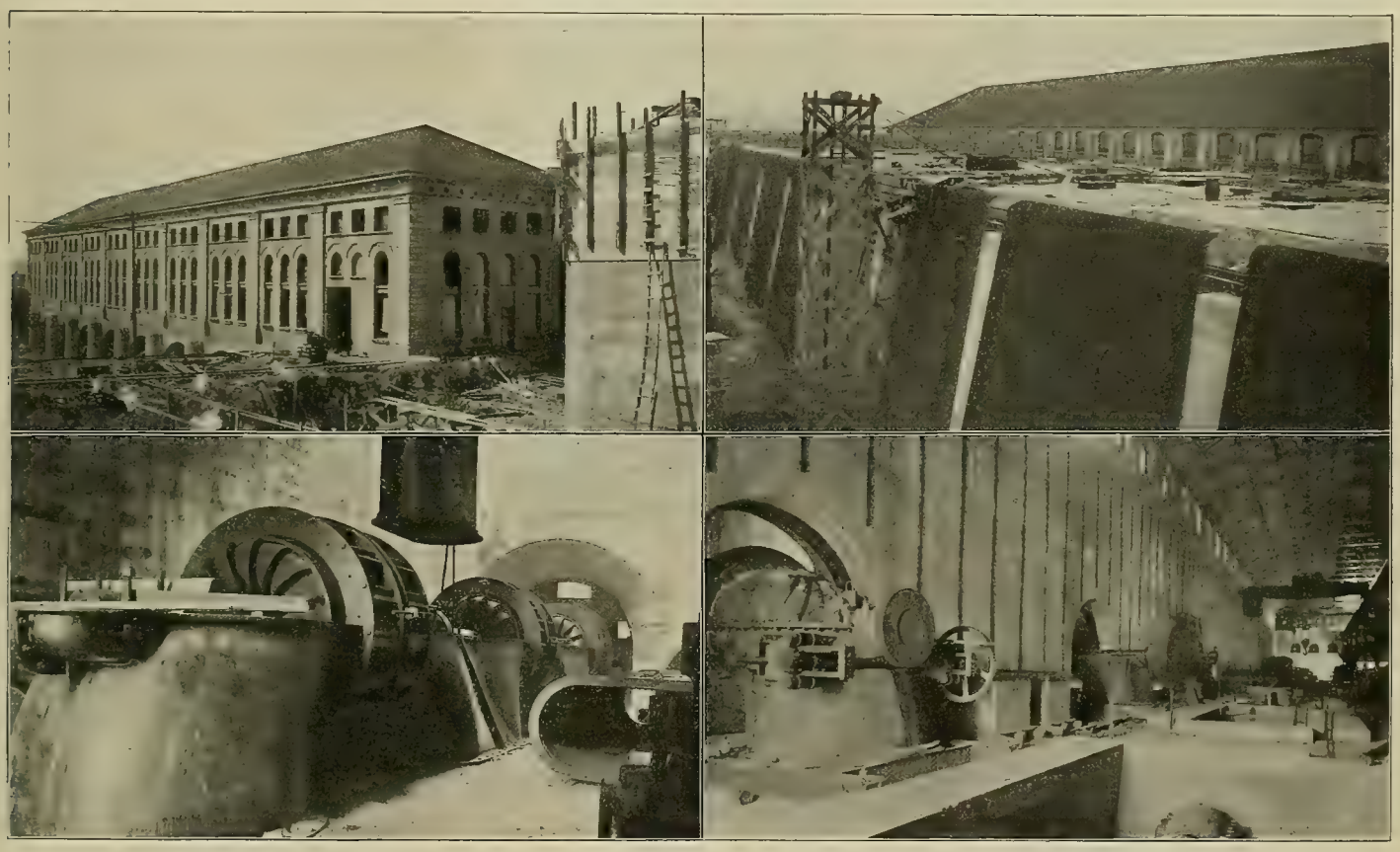
Built at an angle across the channel is a concrete guard protecting the forebay from floating ice This wall diverts the ice to the controlling dam Within the forebay and protecting the wheel chambers from drift wood or other material which might get past the ice guard are a series of iron racks extending the length of the power house.

Everything about the plant is built on solid rock, and the various structures are made of concrete. All the stone required in the concrete mixing is obtained on the spot.

The power house is absolutely fireproof, no combustible material being used in construction. The building is designed to receive eight 4,000-kilowatt alternating-current generators and three exciter units of 250 kilowatts capacity each, the generators and exciters being each direct-connected to waterwheel units of the Wellman-Seaver-Morgan make. The generator turbines are each of 6,000-horsepower capacity and the exciter wheels 600 horsepower.

At present four of the generator units and two exciter sets are being installed. This will give an initial output of 20,000 horsepower, which will be available soon. Preparations are being made for setting up the fifth unit, and the other three will be installed as required, bringing the capacity of the plant up to 40,000 horsepower when completed.

The generators now being installed are of the Crocker-Wheeler make and are designed for three-



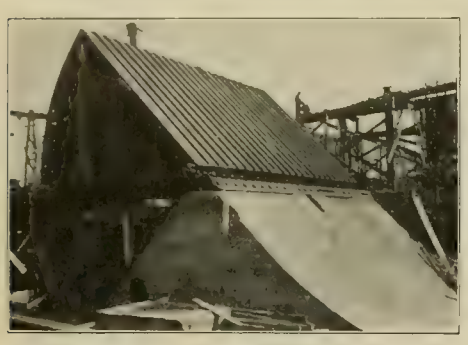
Power House from Down-stream Side, Showing Discharge Chambers.
One of the Turbines in Course of Erection.

Power House from Up-stream Side, Showing Straining Racks.
Interior of Power House, Showing Turbine Chambers.

HYDRO-ELECTRIC POWER DEVELOPMENT ON CHICAGO DRAINAGE CANAL, NEAR LOCKPORT, ILL.

phase 60-cycle alternating current at 6,600 volts. From this the current will be stepped up to 44,000 volts for transmission to the Chicago sub-station, where it will be transformed down to 12,000 volts for distribution to local points of use. At the local points another transformation may be made to the desired voltage for any commercial lighting or power use. The large transformers of the present installation at the power house were furnished by the General Electric Company.

The entire north half of the power house, 385



HYDRO-ELECTRIC DEVELOPMENT ON DRAINAGE CANAL NEAR LOCKPORT.—MOVABLE-CREST DAM.

by 35 feet, is devoted to the generators and exciters, the waterwheel for each machine being located in a chamber adjoining. Traveling over the generator space is a 40-ton electric crane. The south half of the main building contains the switchboards, transformers, bus-bars, oil switches, circuit-breakers, lightning arrester-apparatus, etc. It has three floors or galleries.

The Chicago sub-station, quite similar to the power house in construction and design, is located at Western Avenue and the Drainage Canal. It is 124 feet long, 70 feet wide and 42 feet high. Here will be located the step-down transformers, special switching devices, switchboards, etc., with ample space for a complete duplication when required. From this building power will be distributed to the different local points.

Material is now being distributed along the canal for the transmission line to Chicago. The line will consist of two circuits of aluminum wire, either circuit having ample capacity to transmit the full load. Galvanized steel poles, 60 feet high, will be used, set in concrete foundations. The transmission lines will follow the canal from Lockport to Chicago, passing over the District's own lands through Romeo, Lemont, Sag, Willow Springs and Summit.

A safe margin in generator and transformer capacity, duplicate transmission lines, interchanging switching arrangements, together with all the most modern devices, have been provided for, and no expense has been spared to make the installation modern throughout, insuring absolutely reliable service.

The site of the plant is quite isolated; nevertheless, the scene is one of great activity. The work has required the greatest care and skill on the part of the engineers and contractors, and its completion in the near future will enable the trustees to deliver power in Chicago and vicinity at a cost undoubtedly much below that now entailed in either renting or manufacturing power under ordinary existing conditions.

The District is planning to extend the canal to a point below Joliet, where it is proposed to erect another plant similar to the one now nearing completion.

It is the defined purpose of the Sanitary District to supply the municipalities within its limits with such power as may now or later be required for their own use. The surplus power, now approximately 10,000 horsepower, will be sold to power users in general at a price lower than the cost of steam power. This power will be available at an early date at any point along the canal between Robey Street and Lockport, and at other points when applications are made therefor. The District is prepared to lease sites adjacent to the canal at points convenient for supplying this power, and with water for all uses of the manufacturer.

The trustees have expended about $3,000,000 on the waterpower development at Lockport since they began to carry out the plan three years ago. The planning and installing of the electrical plant and equipment have been under the direction of Mr. Edward B. Ellicott, electrical engineer of the District, who has also directed the entire development at Lockport. Mr. Isham Randolph is chief engineer of the Sanitary District and Mr. Robert R. McCormick is president of the trustees. The Western Electrician is indebted to Mr. Ellicott for the pictures accompanying this article.

The Moore Tube Lighting.

An interesting patent issued by the United States Patent Office on April 2d last was one on "Method of Electric Lighting," granted to Daniel McFarlan

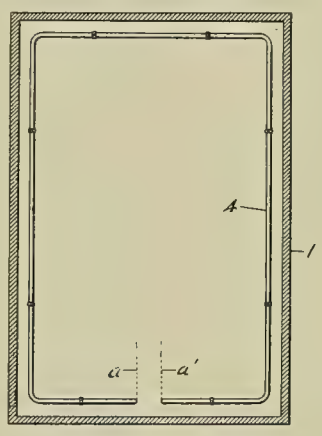


FIG. 1. MOORE TUBE LIGHTING.

Moore of Newark, N. J. This patent relates to the "electric daylight" or tube lighting with which Mr. Moore's name has been so long connected and which has lately come into increased prominence. The present patent was applied for on April 18, 1903, but the application was renewed on September 27, 1906. It will be of interest to quote largely from Mr. Moore's specification:

"My invention relates to methods of distributing electric energy and converting the same into light and involves a radical departure from previous practice, in which the electric energy is distributed or conducted over metal conductors and converted into light at isolated or distinct spots, whereas in my improved system the energy may be considered as converted into light and the luminous agent distributed or conducted over a space or area which is to be lighted.

"My improved method of distributing electric energy and illuminating areas or spaces thereby consists, substantially, in converting the electric energy into a luminous column of gas or vapor and distributing or conducting said luminous column over, around, or through the spaces to be illuminated, in contradistinction to distributing the current and at local points converting it into areas of light more or less localized.

"In carrying out my invention I may employ any conducting gas or vapor and one of any desired degree of attenuation, depending upon the nature or character of the gas or vapor and the nature or character of the electric energy used in rendering the same luminous. To confine and permit the distribution or conduction of the luminous column in the desired directions or over the desired localities or spaces, the said gas is confined in a suitable tube of glass or other proper translucent non-conductor, which, in the case of glass and in

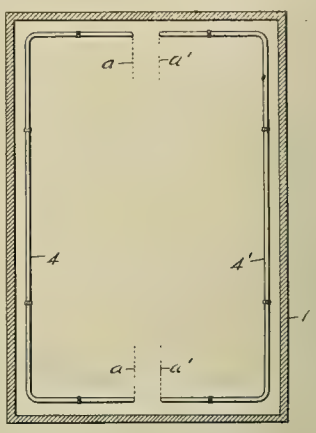


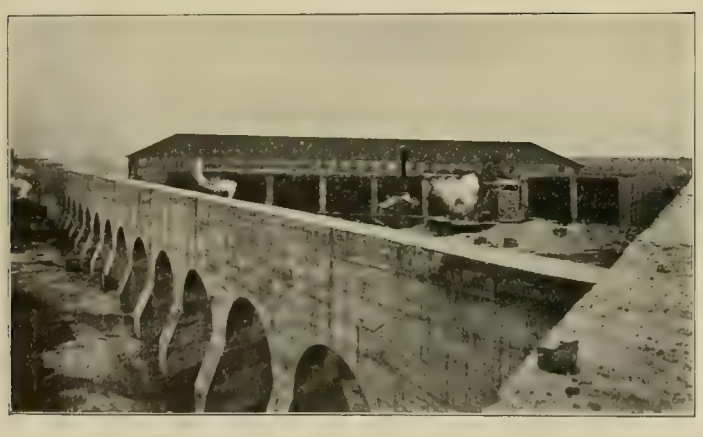
FIG. 2. MOORE TUBE LIGHTING.

the ordinary practice of my invention, would be built up in lengths of suitable size convenient for handling and joined end to end by proper joints adapted to prevent the escape of the attenuated gas or vapor or the entrance of the atmosphere and provided with terminals at proper points on its length or with means for applying the electric energy to the gaseous contents, so as to render the same luminous. As well understood in the art, said means may consist of either an external conducting body wrapping or surrounding the portion of tube where the energy is applied or may consist of internal conductors connected with the source of energy through a wire or conductor sealed into the tube.

"Fig. 1 illustrates my invention diagrammatically and as applied to the lighting of an arbitrarily selected area indicated by the parallelogram (1). Fig. 2 illustrates diagrammatically a modification in the manner of practicing my invention.

"As before stated, the usual practice in electric lighting has been heretofore to run metallic conductors in any desired manner over, around, or through the area or space indicated by the parallelogram (1) and to take off electric energy from the same at a number of spots or points and convert it into light by means of individual lamps or lighting devices affording spots or points of comparatively intense illumination, the number of such lamps or lights depending upon their power and the degree of illumination desired. In my improved method, as illustrated in Fig. 1, the electric energy is employed to produce a luminous column of light-giving gas and said column of gas is conducted around or through the space to be lighted, the electric wires or conductors supplying the energy instead of being distributed through the same, as heretofore being excluded.

"In the drawings, (4) indicates a tube of glass or other translucent material properly sealed and distributed or disposed over, around, or through



Concrete Wall to Deflect Ice from Forebay.

Concrete Wall of Lock for Ship Canal.

HYDRAULIC DEVELOPMENT ON CHICAGO DRAINAGE CANAL NEAR LOCKPORT, ILL.

the area to be illuminated and having its gaseous contents rendered luminous by the application of electric energy derived from any suitable source typified by wires or conductors (a) (a'), from which the energy is applied, preferably at the ends of the continuous tube, and conducted around through the gaseous contents of the same and over, through and around the areas to be lighted as luminous electric energy. Inasmuch as the manner of applying the energy to the gaseous contents forms no particular part of my invention, I have merely shown in this diagram the connection of the conductors (a) (a') in a skeleton way to the end of the tube. The manner of mounting or supporting the tube is also omitted from the drawings, as this forms no particular part of my invention and may be varied according to requirements or choice. So, also, the direction in which the tube (4) is conducted or disposed over or in relation to the space or area to be illuminated may be varied as choice may dictate. It is shown in the figures as disposed near the confines of the arbitrarily selected area shown on the drawings, although it might obviously run in part or whole across or longitudinally of said area.

"It is obvious that it is not necessary that the whole length of tubing containing the luminous column of gas should be fed or supplied from one point or one source of energy, but that said tube might be operated and have its column of gas rendered luminous in sections in the manner indicated in Fig. 2, where the two sections of tube (4) (4') are shown as supplied from two sources (a) (a'), properly joined thereto so as to form practically a continuous electric circuit embracing the gaseous columns of the two sections of tubes (4) (4') in series with one another.

"It is obvious that the method is not limited to the employment of a single tube supplied from the same source of energy (a) (a'), but that a number of tubes might be run out in multiple from said source and disposed or conducted over the arbitrarily selected area to be illuminated in any desired direction or manner.

My improved method of electric lighting presents the following advantages: First, it is possible to dispense with or diminish the use of distributing wiring through the building or rooms thereof, as well as with the use of armored piping or conduit, junction boxes and moldings, flexible cords, sockets and other appliances now used for incandescent house lighting; second, when high potentials are used for rendering the distributed gas column luminous it becomes possible to more completely localize and protect such high potential; third, my method presents a radical and improved advantage in that the light is much more thoroughly distributed and diffused than is possible with those systems where the given area to be illuminated is provided with a number of distinct lighting devices, each furnishing a point or spot of light and each independently operated or furnished with energy from a conducting wire or wires.

It is to be understood that in the foregoing specification the term "gas" is employed in its broadest sense, and is therefore to be understood as including any vapor.

Electric Power for Jamestown Exposition.

Electric power for the approaching exposition at Jamestown, like that at the Buffalo Pan-American Fair, will come from a distance. Having no Niagara to rely upon, however, power for the Jamestown Exposition will be furnished by steam turbines located in the power house of the Norfolk Railway and Light Company, about seven miles from the exposition grounds. This fair will be the first at which the electric power will be generated by steam turbines. The machines will be of the Curtis type, these, as well as the complete electrical equipment, being supplied by the General Electric Company.

The exposition authorities have entered into a contract with the Norfolk Railway and Light Company to furnish all the electricity required for illumination and power purposes. The electricity generated at their Jamestown power house will be transmitted on especially constructed lines to a model sub-station in Machinery Hall. Here will be located the transforming and distributing apparatus. This equipment consists of large air-cooled transformers, many smaller transformers for general illumination, as well as constant-current transformers for the series-arc lighting system which will be used for police illumination. At the sub-station also are motor-generator sets to provide direct current for the operation of searchlights and small motors where they may be installed by exhibitors.

The switchboard for controlling the various circuits throughout the exposition grounds is located in a gallery and is typical of modern switchboard engineering. All the electrical machinery follows standard lines similar to that installed at the St. Louis, the Pan-American and other American expositions.

Some Details of the Valtellina Alternating-current Locomotives.

By Emile Guarini.

The three electric locomotives built comparatively recently for the Valtellina Railway in Italy by Ganz & Co. of Budapest are of much interest. Two of them are of identical construction. The third differs from the others inasmuch as, instead of water rheostats, metallic resistances have been used to gain experience with this type. Necessarily, the master controllers and the apparatus for operating the resistances are also of different design. In other respects the equipment of all three locomotives is the same.

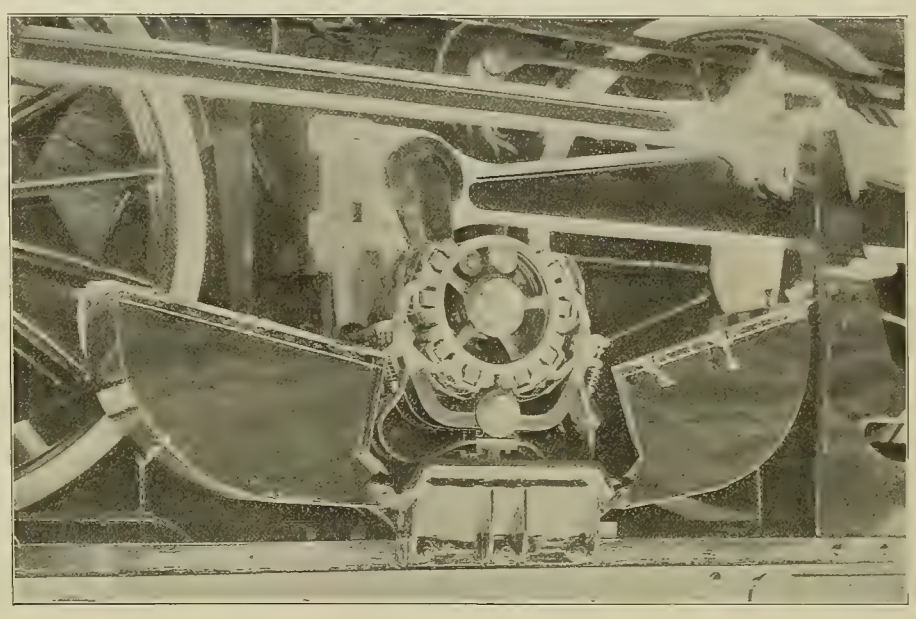
The total length between buffers of these locomotives is 11,540 millimeters (37 feet 10 inches). In the middle of the machine is the motorman's cab, the front of the cab being so shaped as to reduce the air resistance when running at high speed. The rheostats are placed in the ends of the locomotive. The cab is provided with doors on both sides and also at both ends, enabling a communication with the next carriage along the outside of the locomotive. The machine has only one fixed axle, the middle one; the other two driving axles have a range of movement sideward of about 25 millimeters. At each end of the machine there is a pony axle—a leading and trailing axle, respectively, both having a radial movement; one of them also has a lateral movement. The fixed wheel base of the locomotive is the distance from the middle driving axle to the middle of the fixed truck. The design of this truck allows of a very smooth running in curves, and has, it is said, over other designs, the advantage of the weight being transmitted by the bolster and by the side frame of the truck to the axle boxes, and that the distribution of the weight is perfectly secured.

The diameter of the driving wheels is 1,500 millimeters; that of the other wheels 850 millimeters. The locomotive can be run equally well in both directions and is provided with two motors and two main speeds, which latter correspond to the cascade and single connection of the motors. In cascade connection each pair of motors is combined in such manner that the primary of the one is connected to the line, whereas its secondary is connected to the primary of the other motor, both motors being double motors, uniting a high-tension (primary) and a low-tension (secondary) motor on the same axle and in the same casing. The secondary of the second motor is either connected to the rheostat or short-circuited. In single connection each motor is independently connected to the line.

Both halves of the motors have eight poles, and accordingly the number of revolutions is 225 per minute, or, when working in cascade, 112.5 per minute. During the tests they have repeatedly developed double their normal tractive force, even when the voltage dropped about 25 to 30 per cent. The two halves of the twin motor have common slip rings. When the group works in single, only the high-tension motor is switched in, and then its rotor is short-circuited through the slip rings. When the two motor halves work in cascade, the slip rings are not used at all, since the two rotors are connected together and the stator of the second motor is short-circuited.

The motors run with the same number of revolutions as the driving axles, but are mounted between the two axles and drive the axles with cranks and coupling rods—a rather novel feature in electric locomotives. The main advantages claimed for this design are as follows:

The motors, being built in between two axles, may easily be taken out for repairs and can be replaced by other motors. The slip rings and brushes of the motors are put outside of the locomotive frame, the use of such a design enabling ready access to those parts of the motors which require attendance and revision. As all driving axles are driven by all motors with the same mechanism, there is no danger that different loads be thrown upon the individual motors, or that one of the driving axles will slip. The mechanism has no dead point, the cranks on the two sides being keyed at a different angle of 90 degrees. This mechanism has only rotating parts, which can be completely balanced by counterweights, so that no disturbing oscillations can arise by unbalanced masses, as in the case of steam locomotives. The energy losses in the mechanism are small, whereas the piston rods and connecting rods cause the most friction in the mechanism of a steam locomotive. The weight of the motors has no hammering effects on the rails, as all parts are spring-supported.



SLIP-RINGS AND BRUSHES OF VALTELLINA ELECTRIC LOCOMOTIVE.

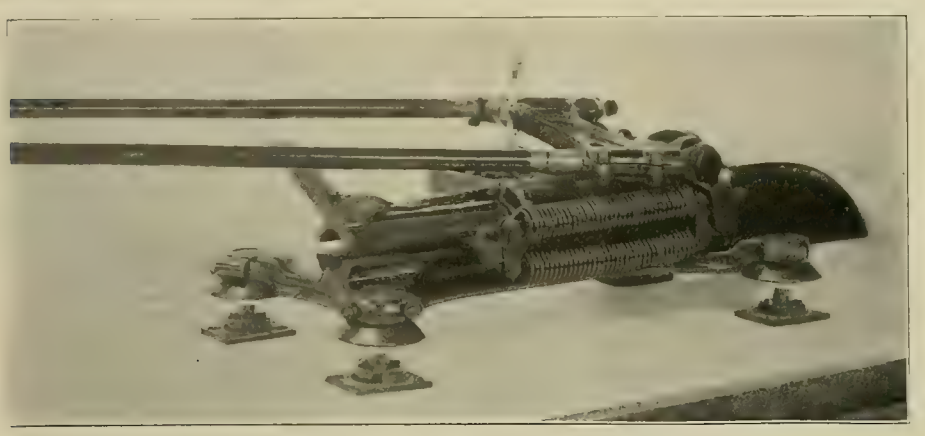
All apparatus for taking off the current and for actuating and regulating the motors are controlled from one place by means of compressed air, the current-collecting device by means of the so-called trolley valve and the driving apparatus by the pneumatic master controller. The latter is provided in duplicate, one at each side of the locomotive. Through these two controllers is operated the entire connecting and regulating apparatus of the motors; that is, the two primary switches, the speed controllers and the resistances, including the short-circuiter.

This controller is a combination of valves, and has three levers interlocked. The main lever serves for operating the starting and regulating valve. At standstill this lever stands vertically; at starting the driver pulls the lever toward himself, when it describes a certain angle and is brought into its first position, at which it acts upon a starting lever, and thus admits compressed air to the primary switches and rheostat switchheads, these latter being brought by this means into a position at which they are ready to be acted upon by the regulating valve. When the lever is farther turned, the regulating valve begins to act and effects the insertion of the resistances. The second lever acts upon the reversing valve; the outward position makes the locomotive run forward, and vice versa. The regulating valve has two openings, which are connected with the corresponding parts of the air pistons of the primary switch. According to the position of the valve, these openings are connected either with the air tank or with the open air. The third lever connects the motors either in cascade or single.

The various levers are interlocked in such a

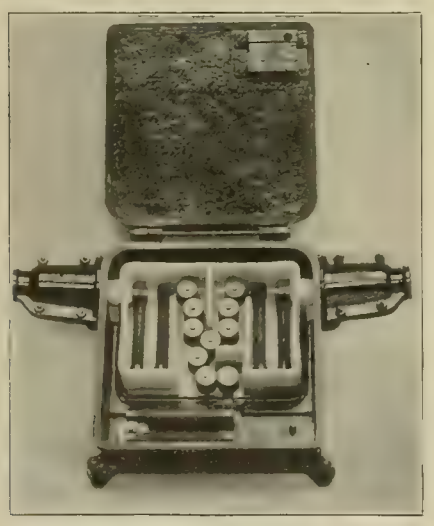
manner as to allow of the reversing lever and speed-regulating lever being moved only when the starting lever is in its initial position, so that both the primary switch and the resistances are disconnected. On the other hand, the starting lever can be moved only when the two other levers are in their end positions. The two controllers can never be used simultaneously.

The water rheostats, one for each twin motor, are built similar in principle to that used for the previously built cars of the Valtellina Railway. On the third locomotive metallic resistances are used, as mentioned at the beginning. The resistance switches used on this machine consist of six rings of contacts, insulated from one another, being on the one hand connected to the terminals of the secondary motor, and on the other with the various steps of the resistances. On a vertical shaft operated from below by a chain pulley from the stand, contact knives are arranged, which, by turning the shaft farther, disconnect, step by step, the resistances until in the last position the secondary terminals of the motor are short-circuited.



TROLLEY BASE OF VALTELLINA ELECTRIC LOCOMOTIVE.

Each group of motors has a separate primary switch, the two primary switches being placed on a common base in the middle of the cab. These switches are constructed on the same principle as the primary switches of the other Valtellina train equipment, being of the piston type. The switches are actuated throughout by compressed air for throwing in as well as for reversing. The switches are thrown in in such a manner that a plate holding the contact plungers is lifted by the admission of compressed air through the starting valve of the master controllers, whereby the contact plungers are pressed into the contact tubes. The contact is broken per phase at two points. The reversing can be done only with a primary cut-out switch. It is effected by the plate with the contact plunger being turned at an angle of 60 degrees. For this purpose two pistons are provided, connected with the reversing valve of the pneumatic controller. According as the one piston or the other is connected with the reservoir or open air, the plate assumes the corresponding position.



LIGHTNING ARRESTER OF VALTELLINA ELECTRIC LOCOMOTIVE.

The speed regulator, as stated before, serves for connecting the motors in cascade or single. It is designed as follows: On one axle are the contact brushes which bring about the two different connections, and this axle can be shifted in a vertical direction. It terminates in the piston of an air cylinder whose smaller and upper surface is connected with the air reservoir, so that the air pressure ordinarily holds the apparatus in the lower position, which corresponds to the cascade connection. The larger surface on the bottom of the piston is in connection with the atmosphere through the speed-regulating valve of the controller. Now, when the lever of the controller is in the high-speed position, compressed air flows through the speed-regulating valve into the lower part of the cylinder, and the piston is pressed up, and thus it effects the connection in single. Since the corresponding lever of the pneumatic master controller can be moved only when the starting lever is at zero, it is impossible to operate the speed regulator except when it is without current.

The high-tension cut-outs, lightning arresters, choking coils and fuse box are fitted on the lower side of the roof of the motorman's cab, and all high-tension conductors are placed in metal tubes, which are carefully grounded.

The locomotive is provided with the same system of current collectors as has been used on the other vehicles of the Valtellina Railway; i. e., two pairs of current-collecting rolls are used, working alternately, corresponding to the two directions of the run. The current-collecting rollers are pressed against the overhead wires by compressed air, which is conducted into the cylinders of the under frame. Two degrees of pressure are provided, corresponding, respectively, to the two main speeds of 64 and 32 kilometers (40 and 20 miles) an hour. A switch is inserted in the current leads and is automatically opened when the current collectors are lowered.

The total weight of the locomotive in working order is 62 tons, 42 tons being divided as adhesional weight on the three middle axles, and 20 tons as dead weight on the first and fifth axle.

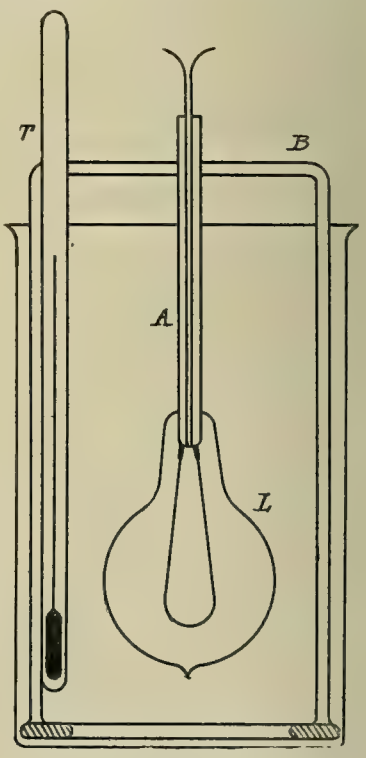
A New Method of Testing the Light Efficiency of Incandescent Lamps.

By A. de Courcy.

An improved method of finding the relative amount of light furnished by an incandescent lamp has been brought out recently in Germany by F. Russner. It uses the calorimeter principle for estimating the amount of light, and therefore the luminous efficiency of the lamp. It is an improvement upon the method which was brought out some time ago by Tumbirg and Grimsahl. Their idea was to absorb the heat rays given off by the lamp by placing it in pure water of one inch or less, and afterward placing the lamp in blackened water so as to absorb both the heat and the light rays. By taking the difference in the heat value in the two experiments, in calories, we have the fraction of the total yield, which is represented by the light rays alone. However, it is found that one inch of water does not absorb all the heat rays, and if it is desired to use a thicker layer it becomes difficult to measure the rise in temperature, as this is now of a smaller value.

The present experimenter was led to observe that a ferrous salt has an absorbing power for the infra-red rays which is very much superior to water, and the layer is, therefore, thin and colorless, and gives a good passage to the light rays from the lamp. In practice he uses the double sulphate of iron and ammonia, which is found in commerce. When first dissolved, the solution is somewhat cloudy, as the oxygen contained in the water transforms the ferrous oxide into the insoluble ferric-oxide. However, the solution can be cleared by adding a few drops of sulphuric acid, and then filtering. By using, for comparison, a light screen consisting of a solution of iodine in bisulphide of carbon, with a thermo-pile and mirror galvanometer, Mr. Russner found that a 30 per cent. solution of the iron salt in 0.8-inch thickness was sufficient to absorb all the infra-red rays from an incandescent lamp. The iodine solution allows all the invisible rays to pass while absorbing all the light rays. Thus, to stop off all the calorific action of the light rays we place the iodine screen before the thermo-electric pile.

The form of calorimeter which is devised according to the above experiments is shown in the accompanying diagram. It consists of a glass vessel about four inches in diameter and eight inches deep, in which is placed 30 per cent. of the iron salt mentioned above. Resting on the bottom of the vessel is a glass ring (R) and fixed to it by cement is a glass tube (B), which is bent into the form ∩. The ring and tube serve to agitate the liquid and keep a uniform heat. Against one limb of the tube is fixed a sensitive Bechmann thermometer (T) which reads to 1-100 degree C. The incandescent lamp (L) to be measured is prepared beforehand by scraping the two copper wires coming from the filament and soldering them to larger copper wires, which are brought out by two concentric glass tubes (A) fastened to the base of the lamp by cement. A storage battery is preferred for the current supply to the lamp, in order to have the measurements quite regular, as this is necessary in order to have exact results.



A NEW METHOD OF TESTING THE LIGHT EFFICIENCY OF INCANDESCENT LAMPS.

At each operation of the calorimeter we first cool the bath below the temperature of the surrounding air, and then pass current into the lamp for a certain time until the temperature is raised by an equal amount above air. During this time the light rays pass freely through the iron solution and the glass.

Russner's Tests of Light Efficiency of Incandescent Lamps.

Lamp.	Volts.	Amperes.	Watts.	Luminous Efficiency in Per Ct.	Power for Luminous Rays in Watts.	Time in Minutes.	Mean Rise in Temperature.		Difference.	Light in Hefner Candles.	Luminous Energy Given by One Candle in Watts.
							Lamp Covered.	Lamp Bare.			
Carbon No. 1	115	.50	57.5	.58	.338	5	2.995	2.978	.018	19	.018
Carbon No. 2	115	.90	103.5	.61	.614	4	4.412	4.385	.027	32	.020
Tantalum	115	.40	46.	2.20	1.012	10	4.846	4.738	.108	35	.029
Osmium	65	.56	36.4	2.30	.837	12	4.601	4.503	.106	24	.035
Osram	115	.40	46.	2.46	1.132	10	4.870	4.750	.120	34	.033

In the second case where we wish to collect the heat corresponding to the luminous rays along with the heat rays proper, the lamp bulb is covered with blackened tinfoil. Alcohol varnish can also be used for the blackening to advantage. After taking the calorimeter reading in the same way as above, we find a slight excess of temperature which corresponds to the value of the energy of the light rays. Several check measurements should be made with the same lamp, and the results are averaged.

Care must be taken in making the tests in order to have the readings near the same value, and the surrounding air, as well as the value of the current, is to be kept constant. The author has not succeeded as yet in obtaining perfect results with his method, and it can no doubt be improved. All the tests should show the same value for the luminous power of a standard Hefner candle in various kinds of lamps, but according to the figures in the last column of the accompanying table it will be seen that only the three lamps with metallic filaments show concordant results. The mean value is 0.323 watts, or $0.323 \times 10^7 = 323{,}000$ ergs. This does not agree with the value found previously by Angström.

OBITUARY.

General Eugene Griffin.

A man of exceptional prominence in the electrical field and of many charming personal characteristics, as well as an army officer of distinction, has passed

BRIGADIER-GENERAL EUGENE GRIFFIN.

away by the death of General Eugene Griffin, director and first vice-president of the General Electric Company, at Schenectady, N. Y., on the night of April 10th.

The death of General Griffin, which was due to apoplexy, was quite unexpected and particularly sad. The home of the decedent was in New York, but, in company with his wife and daughter, he had gone to Schenectady to witness an amateur play given by a local club, of which his son, Hancock Griffin, was a leading member. Following the performance, while at an informal supper with a few friends, the general collapsed, expiring about an hour later. The news caused great surprise, as well as sorrow, to the friends of the deceased gentleman in varied occupations and many localities.

This sudden death of General Griffin does, in fact, remove from the electrical fraternity, as well as from military and social circles, a man of broad and keen intellectual interests. Trained as a military engineer at West Point, and serving as such with honor, he entered the business world as second vice-president of the Thomson-Houston Electric Company. Upon the consolidation of this company with the Edison General Electric Company, forming the General Electric Company, General Griffin became the first vice-president of the General Electric Company, holding that office until his death. For many years he was general sales manager of the company.

General Griffin was born at Ellsworth, Me., on October 13, 1855. After finishing a preparatory school education, he entered West Point Military Academy, and graduated in 1875, with high honors. On leaving the academy he entered the engineering corps, the highest branch in the army service, serving as a second lieutenant, first lieutenant and later as captain. From 1883 to 1885 he was a professor of civil and military engineering and the art of war at the academy. From then until late in 1886 Captain Griffin was aide-de-camp on the staff of Major-general Winfield Scott Hancock, and until the close of the year 1888 he was chief of the engineering division of the Atlantic and of the Department of the East. In 1889 he resigned from the army to take up electrical engineering work.

Upon leaving the army Captain Griffin entered the service of the Thomson-Houston Electric Company as second vice-president. This position he held until 1891, when the Thomson-Houston company was consolidated with the Edison General Electric Company. He was then elected to the office of first vice-president of the General Electric Company. In 1893 he was elected to the position of president of the Thomson-Houston International Electric Company. He was also a director of the British Thomson-Houston Company and of the Campagnie Francais pour l'Exploitation de Procedes Thomson-Houston, Paris.

At the outbreak of the Spanish-American War, Captain Griffin promptly offered his services to the United States government. On word from Washington he organized the First Regiment, United States Volunteer Engineers, of which he became colonel. This regiment was mustered into service in the spring of 1898. Later its commander was promoted to the rank of brigadier-general.

On December 8, 1898, the officers of the regiment, returned after service in Porto Rico, gave a dinner in New York in honor of Colonel Griffin, at which he was presented a loving-cup. The recipient gave an interesting address, in which he reviewed the history of his regiment. This was the concluding paragraph:

"And now, comrades, as to the future. Unless we form some association to perpetuate the memory of this regiment, it is doubtful if we ever come together again as we are tonight. The thought is a sad one. I doubt if there is any comradeship so lasting, so close, so binding as the comradeship of the tented field. It is sad to see this broken up. The regiment has practically disbanded now, and a few days more will see all officers scattered to their homes. You have all stood loyally and obediently by me as your superior officer; your services have been exceptionally able, conscientious and efficient. I have tried to do my duty by you and by the regiment. And now I wish you all good-by and Godspeed in whatever walks of civil life fate may lead your steps."

Not only by his regiment, but in all the activities of life, General Griffin tried to do his duty.

General Griffin was prominent in club life, being a member of the Union, Racquet and Tennis, University, Engineers, Ardsley Riding, and City Midday clubs, of New York city. He was also a member of the Metropolitan at Washington, the Somerset at Boston, and the Mohawk and Mohawk Golf clubs, of Schenectady, and the City Liberal Club, of London.

In engineering and army clubs General Griffin held membership in the following: Military Order of Foreign Wars, United States Military Academy Alumni, New England Society, Society of Naval Architects and Marine Engineers, Order of Spanish-American War Veterans, the Pilgrims of the United States, the Institution of Civil Engineering of Great Britain, American Institute of Electrical Engineers, and American Society of Mechanical Engineers.

The funeral services were read at the Church of Transfiguration in New York city, on April 13th, a brief service having been held at the Mohawk Club in Schenectady on April 12th. The final portion of the burial service was conducted by Dr. Goodwin, who officiated at the marriage of the dead man 28 years ago.

After the services at the church the body was taken to West Point, where interment was made with full military honors. Colonel Scott, the present superintendent of the post, was a classmate of General Griffin, and a full corps of cadets acted as an escort at the burial. All flags at West Point were halfmasted. As the processon left the chapel 11 minute guns were fired and after the salute at the grave, a second salute of 11 guns was given.

The pallbearers were: C. A. Coffin, President General Electric Company; Col. H. L. Scott, Superintendent West Point Military Academy; Hinsdill Parsons, Schenectady; B. E. Sunny, Chicago; Col. H. F. Hodges, Major of Engineers, Washington; H. R. Bishop, New York; S. M. Hamill, Schenectady, and Dr. Louis Seaman, of New York.

General Griffin was married in 1879 to Miss Allie Hancock, niece of General Winfield Scott Hancock. He is survived by his widow and two children, Priscilla Griffin and Hancock Griffin.

Edouard Hospitalier.

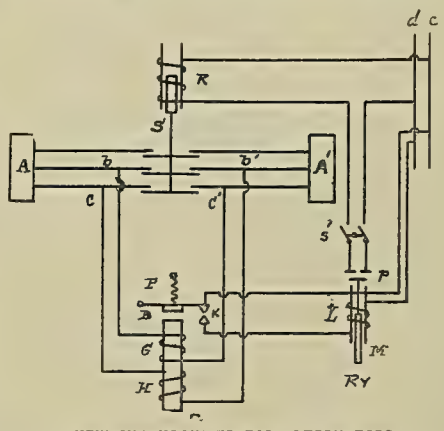
The death is announced of Edouard Hospitalier in France last month, at the age of 54. Mr. Hospitalier was a distinguished French electrical engineer, well known in the United States and other countries. In 1893 he was an official delegate to the World's Electrical Congress at Chicago, and he was frequently a member of other large exhibition juries and committees. Mr. Hospitalier took a keen interest in technical societies, and among others, filled all the positions on the council of the Société Internationale des Electriciens, from secretary to president. In business he was journalistically inclined, having held important positions on leading technical journals; at the time of his death he was editor-in-chief of L'Industrie Electrique, which he founded in 1891.

E. HOSPITALIER.

When the question of the adoption of the first international electrical units was under discussion Mr. Hospitalier took great interest in the subject and wrote many valuable articles on electrical nomenclature and units and insisting on exact measurements. In 1882 the city of Paris founded the School of Industrial Physics and Chemistry and Mr. Hospitalier was chosen professor of electricity. His course of lectures extended over a period of 20 years. He was the author of several works, among which may be mentioned "Les Principales Applications de l'Electricité," "L'Electricité dans la Maison," "Formulaire Pratique de l'Electricien," "Compteurs," "Traite Élémentaire de l'Energie Électrique," and "Recettes de l'Electricien."

A New Synchronizer for Alternators.

An automatic device for coupling three-phase alternators in parallel has been recently invented in France. It consists of three different pieces of apparatus—first, a synchronizer; second, a time relay, and, third, an electromagnetic coupler. As shown in the accompanying diagram, the synchronizer is formed of an electromagnet having two contrary windings (G) and (H). The terminals of the windings are brought to the terminals of



A NEW SYNCHRONIZER FOR ALTERNATORS.

the three-phase alternators (A) (A'), using the same general method of connection as is employed for coupling phase lamps upon the circuits so as to obtain synchronism by observing the light. The resultant field which is due to the windings has its maximum value at the moment of sychronism. At this moment the armature (B) of the electromagnet is attracted [against the spring (F)] and is made to close a circuit at the contact points (K). But in order to be sure that the synchronism is stable, the machine switch should not close the circuit unless the synchronism has lasted for a sufficient time. In order to carry this out, there is an adjustable relay inserted in the circuit.

When the synchronizer armature is attracted and closes the circuit at (K), the core (M) of the relay (R Y) is lifted up in the solenoid (L) with a certain speed, which depends on the regulation of a dash-pot, with which the relay is provided. The relay operates to close the circuit (s'R), in which is placed the magnet-controlled machine switch (S). Should the duration of synchronism not be sufficient for the proper action, the armature (B) of the synchronizer is released, breaking the second circuit at (K) and allowing the solenoid core (M) of the relay to fall by its own weight.

The dash-pot device which is used to regulate the movement of the relay (R Y) is simple in action. The core (M) is made to strike against a bellows, which carries an adjustable opening for allowing the air to escape. By adjusting the orifice the time required for the stroke of the solenoid core can be regulated from two to 20 seconds. When the core falls again, the atmospheric pressure causes a valve to open so as to admit air and fill up the bellows. The theoretical conditions for the proper working of the synchronizer can be explained by a series of calculations and formulæ which lie outside the limits of the present description.

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DATES AHEAD.

Oklahoma Electric Light, Railway and Gas Association (first annual meeting), Oklahoma City, April 22d and 23d.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Institute of Electrical Engineers (special high-tension meeting), Chicago, May 23th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

STEEL TELEPHONE call-boxes are to be set up in the City of London. There are to be some fifty of them, and the police will use them to summon the electric police ambulance, or others like it, recently illustrated in the Western Electrician. Our correspondent in London, writing under date of April 6, 1907, notes that "Every policeman will have a key. When a street accident occurs necessitating the presence of an ambulance the box is unlocked and the telephone inside made use of to summon the ambulance. The call-boxes take the form of iron pillars placed in the most convenient spot in the street, sometimes on the edge of the pavement and at other times close against buildings." This is of course substantially the police patrol-box system so extensively used in the United States, and it is curious that it should be introduced in the City of London on a very modest scale twenty years or more after its employment in American cities of the second and third class.

CONVENTIONAL SYMBOLS indicating various classes of electrical apparatus on drawings have been standardized to some extent, but much remains to be done in this direction by co-operation between technical bodies, the United States Patent Office and the various private interests affected. There is still a confusing divergence in practice, and we observe an instance of this in the report of the committee on "Records, Reports and Accounts," presented at the recent Chicago meeting of the American Railway Engineering and Maintenance of Way Association. Among other things, this committee studied the subject of conventional signs, and it recommended a large number of such symbols. Many of the symbols presented are familiar and no doubt all are well adapted for railroad work. The committee is entitled to commendation for its work. But it is a pity that the few electrical signs given, as for arc lamp and incandescent lamp, are not such as are in common use among electrical men. It would seem that there should be some co-operation between technical societies to the desirable end of securing uniformity in drawing symbols. If the great engineering societies were to take up the subject jointly and adopt a set of simple, fundamental symbols, not too complicated or diffuse, after conferring with the Patent Office, there is little doubt that the conventional signs so recommended would in time come into general use.

SWITCHBOARDS have not generally increased in size to a degree corresponding to the increase in size of power stations and generators. Different methods of handling the current, with remote control and all the improved apparatus now in use, render the actual switchboard of a large modern power house a relatively simple affair, although, to be sure, the switching auxiliaries still remain to be taken into account. In some of the largest power plants, as at Fisk Street in Chicago, these auxiliaries are placed in a separate switch-house of large dimensions. But the switchboard itself in the power house is comparatively small. In the earlier days of power-plant design these refinements were unknown. At the World's Columbian Exposition of 1893, for example, the switchboard of the service plant was a tremendous affair, as all visitors to Machinery Hall will remember. Since then generators have increased ten times in capacity; if the switchboard had grown in like proportion it would be of truly Brobdingnagian proportions. It is therefore not improbable that the report that the largest switchboard in the world is being built in the United States for Rio de Janeiro, Brazil, is true. In that city all the electric-light, railway and power circuits are to be controlled from one board, it is said, and therefore the conditions are different from the typical power house of the United States or Europe. The switchboard in question, according to a published account, will have 100 panels and will be built of marble at a cost, when equipped, of about $200,000. These statements are not verified by the builder or owner, and we give them for what they are worth. Apparently, however, the day of the very large switchboard has not altogether passed, and it would be of some interest to know whether, as asserted, the Brazilian city is to have the largest board in the world. No doubt if an exact comparison were instituted there would be a number of claimants for the distinction, such as it is.

IN COMMENTING on Mr. Harriman's prediction that within ten years the standard gauge of American railroads will have to be changed from 4 feet 8½ inches to 6 feet, the Railway Age makes the pertinent remark that the electric railways must be taken into account if such a change is to be seriously considered. Our contemporary says:

"As time goes on the interchange of traffic between electric street and interurban railways and the steam railways is almost certain to cause a closer interlinking of the two systems. If the gauge of street railways is to be changed also, the streets in many cities will have to be rebuilt, and, in fact, there seems to be scarcely any limit to the expense of such a radical change. It would be most unfortunate to introduce at this stage of transportation progress different gauges for steam and electric lines. * * * There is no doubt that the capacity of many existing roads can be vastly increased by electrification, and the cost of the entire change to electricity would certainly be far less than the expense of altering the track gauge. The railroads of the future are sure to depend more and more upon electricity for their proper operation; electrified suburban service is the entering wedge which it may be expected will sooner or later drive the limited steam trains from all rails carrying dense traffic. It has not yet been shown what can be done with the electric locomotive in hauling heavy trunk line freight trains, but all signs point to electricity as the accepted railway motive power of the future."

This is not only a good argument against the suggested change of gauge, with which we think nearly all electrical and railroad men will agree, but the last sentence quoted is particularly significant. It comes from a technical journal of repute devoted to steam-railroad interests and is so decided in predicting the coming of electric power in railroad train operation that some faint-hearted electrical men will remark it with pleasure in which a considerable element of surprise is mingled.

AS PREVIOUSLY pointed out in the Western Electrician, the derailing accident on an electrically equipped third-rail line of the New York Central Railroad in the northern suburbs of New York city last February has been the cause of the publication of much valuable data on electric railroading. So, while the loss of life was distressing, the accident was not without its lesson and its benefit. The lesson appears to be that, with powerful electric locomotives, owing to the grateful absence of reciprocating motion, the speed is apt to be greater than is suspected, and especial care must be taken to avoid dangerous speeds, particularly on curves. It is reported that since the disaster the New York Central has issued an order prohibiting motormen from exceeding a speed of 35 miles an hour on curves.

But while the agitation following the accident has brought to light much useful information, it has also prompted some suggestions that appear to be rather far-fetched. Such a one is attributed by the newspapers to Vice-president W. C. Brown of the New York Central Railroad itself. It is said that at the state railroad commissioners' investigation on April 15th "J. B. Hedges, representing Governor Hughes, asked Vice-president Brown if he had a settled opinion of the cause of the accident. Mr. Brown said he had not, but it might have been due to an obstruction—a piece of steel or iron perhaps—attracted to the track by the electromagnetic force in the dynamo." Unless the newspapers have misquoted Mr. Brown (which is, of course, quite possible), his hypothesis will hardly be considered tenable by practical electric-railway men. A compass needle might be deflected by the magnetic field of the third-rail of a direct-current railroad, but it is highly improbable that the magnetic attraction would be strong enough to cause to adhere to the rail an iron or steel object large enough to cause any trouble—as, for instance, a bolt or a horseshoe. There has been collected a considerable body of experience with third-rail roads in this and other countries, and so far as we are aware the slight magnetic field of the third rail has never caused an accident.

A Method of Photometry of High Candlepower Units.[1]

By T. B. Lambert.

At the risk of being called iconoclastic I would like to destroy the candlepower unit as a standard without having anything definite to substitute in its stead, for I believe that it would be well to leave the old pathway with the one idea in view, that of finding a better one, something more practical if possible.

We might say, for instance, that one sound was twice as loud as another if the amplitude of its waves were twice as great, or assume that it would be twice as loud if it could be heard at double the distance. Neither would be correct, because the loudness of the sound depends upon the physiological effect on the human ear of him who acts as the judge. We seem to be bound up in the creed that certain effects vary inversely as the square of the distance, which, even if true, to some extent does not apply to effects on the human ear or eye. Certain sounds have a peculiar strident effect, more or less dependent upon the resonant pitch of the parts of the physical ear, and also upon the nervous condition of the individual himself, both of which should be eliminated in an instrument designed to measure the amount or quantity of sound.

I have used the measurement of sound as an illustrative topic because of its parallelism with the problem of light measurement, and the fact that we have not fallen into any errors in sound measurement is primarily because we have not been called upon to make measurements of it. And here let me state that there is just now a demand for an instrument not yet made which might be called a sonometer, for use in the telephone field. We are measuring the transmission of telephone speech over lines and instruments in a very crude manner that can lay no claim to scientific accuracy; and if someone will but devise a satisfactory method of taking these results accurately, perhaps it will, at the same time, point out a more scientific method of measuring light values than by our primitive candlepower unit.

A particular point which I wish to bring out is the comparisons of high candlepower units without reference to the fanciful systems of measurement devised by the various manufacturers to bring out the particular virtue of their several products. At the risk of being tedious, I wish to take you through the same paths that lead me to the simple method whereby the large units of light may be compared directly with small ones or with one another.

If you study the heavens some evening you will come to the conclusion that there is no mistaking the slight differences in the magnitude of the stars, mere points of light in the strictest sense, since even the brightest of them show no appreciable disk under the most powerful telescopes. Yet we note with unfailing certainty that one star is brighter than another, however small the difference. There is not as much actual illumination from all the stars together as from a common firefly at a distance of a few feet. All this simply means that our eyes are able to discern carefully and accurately between lights that are very low in intensity.

The practical commercial units such as the 8, 16 and 32-candlepower incandescent lights are so bright that the eye cannot compare their light values at all accurately, except by indirect methods such as we use in various photometric schemes. We can look at the stars of the tenth magnitude and note with certainty that one is a shade brighter than another, but to detect the difference between two incandescent lights, one of 16 candlepower and the other of 18 candlepower by direct vision, we will utterly fail; though indirectly, by letting the light from these two sources fall on a properly designed and arranged photometric screen, we can make fairly close comparisons.

If we have two units to compare and can reduce their illuminating value by a certain known ratio we can compare them with an exactness such as we compare star magnitudes. This does not take the color factor into account, which factor is solely a physiological question, and in this discussion for simplicity's sake reference is made to comparisons between lights of the same quality.

In order to reduce by a definite known ratio the quantity of light thrown on a photometric screen by a certain unit, it is only necessary to permit it to shine on the screen the desired proportion of time. If the light is shut off for one-half the time the illumination is reduced to one-half of the value; if the light is shut off for ninety-nine-one-hundredths of the time the illumination is consequently reduced to one-one-hundredth of the total value.

To demonstrate this plan I have equipped a simple electric fan motor with an opaque disk in place of the fan and have cut away from the disk a radial slot representing one-one-hundredth of the entire surface of the disk, and by causing this disk to revolve at a high rate of speed between the source of light and the photometric screen the amount of light reaching the screen is thereby reduced to one-one-hundredth of the total emission. It is only necessary that the disk be revolved at a high rate of speed to prevent the effect of flickering, which, if it occurs at the rate of 25 or more per second, is not noticeable to the eye on account of its rapidity and the phenomenon known as "persistence of vision." By this means we are able to reduce the actual light given off from an 800-candlepower arc lamp so that only one-one-hundredth of its value will fall upon the screen, thus reducing its effect to that of an eight-candlepower lamp, with which it can be compared directly on a standard photometer bar in the laboratory.

The actual value of this process depends upon its accuracy, which can be proved nicely and conclusively by constructing several disks with openings of different ratios, and one can easily prove for himself that a disk from which one-half has been cut away and run at a high rate of speed between a 16-candlepower lamp at one end of the photometer bar and the movable screen, the lamp will then compare accurately with an eight-candlepower lamp at the other end. The proportion of light passing through the revolving disk is dependent entirely upon its angular opening.

The original apparatus made for this experiment a few years ago consisted of an adjustable disk made up of two pieces so arranged that the desired angular slot could be readily provided at any value. This was done merely to prove the proposition, as later it was found more advantageous to have several solid disks attachable to the motor, which disks had been cut away according to the ratios of ½, ¼, 1-10, 1-50, 1-100 and 1-500.

When more than a very small angle was to be cut away it was found of advantage to cut one-half of the desired opening on one side and one-half diametrically opposite. This was done in order to balance the apparatus when running at high speed, and then the more the openings distributed around the revolving disk the less the tendency to flickering which might tend to spoil the results.

This was the first and basic principle under which a high-candlepower unit could be directly compared with a low unit on the same standard photometer bar, and it led at once to another feature applicable to diminish the error of the personal equation, enabling the experimenter to not only repeat his own observation but verify those of others. This was accomplished by the simple expedient of reducing by the same proportional amount the light from both units under comparison; to do this one has only to run a slotted disk between the eye and the photometric screen, selecting a disk with an angular opening suited to the intensity of the light under examination. In this plan it is not necessary to know the value of the angular opening, nor is it strictly necessary to run the disk at a rate to avoid flickering, because flickering does not appear to influence results.

It might here be remarked that the revolving slotted disk method cannot be applied to a measurement of units supplied with alternating current, unless both lamps under examination are supplied by currents in exact phase in such a way that the lights would have the same relative intensity at each moment. The disk method for the examination of alternating-current lights would be dangerous in the hands of most observers. These lights could, however, be easily compared with one another or with other standards by indirect methods. By way of passing interest it can be said that the candlepower of the sun could easily be measured, and with quite reasonable exactness, by the same method. Of course it would be of no especial value to know this, except as a bit of curiosity. It is, however, practically applicable to measurement of powerful searchlights.

I want to call your attention to the important work that the illuminating engineer has done for civilization. No other factor of progress and development has been so potent as that of artificial illumination, except the art of printing, and not only is the art of printing largely and directly dependent upon artificial illumination, but also indirectly dependent to a far greater extent in the lengthening of the day into the night. When we shall have learned how to absorb the sunlight and again use it at pleasure, then, and not till then, will the work of the illuminating engineer be ended.

Following the reading of Mr. Lambert's paper a number of different forms of photometers were exhibited and their details explained.

J. R. Cravath explained the working parts of a common form of Weber photometer, in which the calibration was performed by taking a lamp of known candlepower and placing it at known distance from the screen.

Prof. C. E. Freeman of Armour Institute exhibited a portable form of flicker photometer actuated by clock mechanism. It was explained that in order to obtain accurate results with this instrument a small motor should be used to operate it. Professor Freeman also showed another form of portable photometer of German design, a convenient piece of apparatus giving good results.

Other instruments exhibited included one owned by the Chicago Edison Company and explained in detail by Mr. R. F. Schuchardt, and a new model of daylight photometer.

At the next meeting of the Chicago section on May 9th it was announced that Mr. Keech would read a paper on "Lighting of Industrial Plants."

1. A condensation of a paper read before the Chicago Section of the Illuminating Engineering Society, April 11, 1907. The author is foreman of the light and power department of the Chicago Telephone Company.

Problems of Illumination Discussed in New York.

A meeting of the New York Section of the Illuminating Engineering Society was held in the Edison auditorium on April 12th. In opening the meeting, President C. H. Sharp referred to the fact that the council of the general society at its meeting in the afternoon had passed a resolution calling the attention of the local sections to the necessity for a large amount of individual effort toward increasing the membership of the society.

The secretary reported that at two meetings of the officers of the section held since the last formal meeting of March 8th, the application for membership of 12 persons had been passed on by the local board of examiners.

The first subject taken up at the meeting was "The Extent in Practice to which the Distribution of Light About a Lamp Can Be Modified by Reflectors." The subject was presented in the form of a paper prepared by Major E. L. Zalinski and read by L. J. Lewinson. The discussion was led by V. R. Lansingh, who exhibited about 50 lantern slides, giving the distribution of the open gas flame, the mantle burner, the gas arc and the incandescent electric lamp, as well as typical examples of redistribution of light by means of different globes and reflectors. The slides showed the distribution of light as given by globes and reflectors made of glass, metal, porcelain, mirrors and other articles.

A bulletin, entitled "A Comparison of the Units of Luminous Intensity of the United States with Those of Germany, England and France," by Edward P. Hyde of the Bureau of Standards at Washington, D. C., was read by J. E. Woodwell of Washington, D. C. Mr. Woodwell stated that Dr. Hyde took abroad with him some time ago a number of incandescent lamps, carefully standardized at the Bureau of Standards, and left these at the foreign laboratories in England, Germany and France, there to be carefully checked up with the foreign standards, and then, as he traveled from laboratory to laboratory, they were rechecked, in the different laboratories, with a remarkably close agreement on the part of different observers, working with different apparatus. The establishment of primary and secondary standards of light, Mr. Woodwell stated, was fundamental to illuminating engineering. The speaker asserted that the Bureau of Standards had in mind the taking up of the work seriously with a view of investigating all of the present standards which have been tried, also with a view of experimenting with others which may occur to them as variations of the present standards.

Mr. Woodwell, in calling attention to the distinction between a standard and a unit of candlepower, said that a unit of light could be tentatively established which would serve as a comparison of any standard or other unit which may be accepted by the different countries.

The next subject discussed was the "Comparative Rating of Inverted and Upright Gas Lamps." Chairman E. L. Elliott stated that the practice of rating lamps by their horizontal intensity was undoubtedly the result of illuminating-gas practice, and was good as long as the lamps naturally gave out their maximum distribution horizontally, but in the evolution which, the speaker said, had taken place in lamps which came along first with the electric lamp and later with the gas lamp, they naturally give their maximum distribution vertically, and, as a consequence, comparatively little horizontally.

Mr. Elliott said that the whole question of the rating of light sources, in view of the radical changes and improvements made in the last few years, both in what might be termed the more ordinary forms of incandescent electric lighting, or incandescent gas lighting, and the decidedly new departures in electric lighting, tube lighting, both mercury vapor and other vapors, had brought about a condition in which the old method of rating lamps, was, in his opinion, absolutely meaningless, and he regretted to see a tendency on the part of manufacturers to befog the matter by trying to escape in a mist of watts and other things, instead of squarely meeting the issue and getting out some more rational method of rating lamps.

The last topic discussed was "Is It Ever Desirable to Mix Colors of Light and Kinds of Illuminants in Store Lighting?" Chairman Elliott in introducing the subject, cited the case of the New York Postoffice, which, although not a store, was an example of polychromatic lighting, in that various types of lights, such as the flaming arc, mercury arc, incandescent, Moore tube, Nernst and ordinary arc lamps were in use in the building.

In referring to department-store lighting, E. Y. Porter had noticed that a connection with the Moore tube light in a department store in Newark, N. J., where, on account of color effects, it was desirable to use the white or daylight color in one part of a certain floor, in other parts incan-

descent lights were used, the contrast being quite marked between the yellow light and the pure white light. The effect was to accentuate the colors of both, making the yellow light appear red, and the white light blue, as when daylight and incandescent light mix.

W. H. Gardiner could not conceive of conditions which would make it desirable to mix different colors of light or different kinds of illuminants in a store. Speaking from experience, he had been almost tempted to say that in the majority of stores he had seen, different kinds of illuminants were preferred. He thought that condition came about through two reasons—first, that the illuminating installation had been put in distinctly by laymen, with the idea of getting different sizes of units in different places, without direct attention to the quality of the light produced or the mixing qualities of the different lights, and, second, that a great many commercial installations were matters of growth. A man would put in a lot of arc lights, and then, to light some corners, he would put in some incandescent lamps about the edge of the room, or vice versa, and in that way mixtures were obtained.

Mr. Gardiner's idea regarding the problem, was the determination upon that quality of light desirable for each location, the quality of light practical or financially most desirable, and putting it throughout the store and having the illumination standard and uniform in each location.

Committees on Revision of National Electrical Code.

At the meeting of the Electrical Committee of the Underwriters' National Electric Association in New York on March 27th and 28th provision was made for the appointment of various committees to consider revision of the rules in the National Electrical Code. These committees are now announced and are as follows:

Transformers.—C. H. Hill, chairman, 316 Walnut Street, Philadelphia; H. R. Sargent, General Electric Company, Schenectady, N. Y.; Dana Pierce, 382 Ohio Street, Chicago, Ill.

Rule 24 s (Concealed "Knob and Tube" Work).—Ralph Sweetland, chairman, 55 Kilby Street, Boston; J. E. Cole, 11 Wareham Street, Boston; G. E. Bruen, 32 Nassau Street, New York.

Rules 24 A, 25 and 49 A (Armored Cables, Interior Conduits and Switch and Outlet Boxes).—Dana Pierce, chairman, 382 Ohio Street, Chicago; G. E. Bruen, 32 Nassau Street, New York; G. S. Lawler, 31 Milk Street, Boston.

Mercury Vapor Lamps.—J. C. Forsyth, chairman, 32 Nassau Street, New York; E. A. Fitzgerald, Box 298 Syracuse, N. Y.; William McDevitt, 131 South Fourth Street, Philadelphia.

Laboratory Report on Conduits.—E. V. French, chairman, 31 Milk Street, Boston; F. E. Cabot, 55 Kilby Street, Boston; C. M. Goddard, 55 Kilby Street, Boston.

Slow-burning Wire.—F. E. Cabot, chairman, 55 Kilby Street, Boston; H. O. Lacount, 31 Milk Street, Boston; A. M. Schoen, 339 Equitable Building, Atlanta, Ga.

Rule 64 (Signaling Systems).—F. E. Cabot, chairman, 55 Kilby Street, Boston; Ralph Sweetland, 55 Kilby Street, Boston; E. A. Fitzgerald, Box 298 Syracuse, N. Y.; C. H. Hill, 316 Walnut Street, Philadelphia; C. J. H. Woodbury, 125 Milk Street, Boston; F. W. Jones, 253 Broadway, New York; C. C. Johnson, 195 Broadway, New York.

Recodification of Code.—C. M. Goddard, chairman, 55 Kilby Street, Boston; H. O. Lacount, 31 Milk Street, Boston; J. E. Cole, 11 Wareham Street, Boston; W. H. Blood, Jr., 84 State Street, Boston; E. McCleary, 213 Jefferson Street, Detroit, Mich.

Specifications for Electric Cranes.—G. S. Lawler, chairman, 31 Milk Street, Boston; J. G. Emery, Jr., Shaw Electric Crane Company, Muskegon, Mich.; A. G. Wilbor, 5 Haynes Street, Hartford, Conn.

Grounding Systems for Protection Purposes Under Rule 13 A.—C. M. Goddard, chairman, 55 Kilby Street, Boston; F. E. Cabot, 55 Kilby Street, Boston; E. V. French, 31 Milk Street, Boston.

Rule 2 a (Accessibility of Conductors).—G. E. Bruen, chairman, 32 Nassau Street, New York; Arthur Williams, New York Edison Company, 55 Duane Street, New York; F. A. C. Perrine, 60 Wall Street, New York.

Rules and Specifications for Fan Motors.—G. E. Bruen, chairman, 32 Nassau Street, New York; J. C. Forsyth, 32 Nassau Street, New York; W. H. Merrill, Jr., 382 Ohio Street, Chicago.

Fixtures for Lighting Telephone Switchboards.—R. P. Strong, chairman, 809 Hibernia Building, New Orleans; W. H. McDonald, 703 Wilder Building, Rochester, N. Y.; W. S. Boyd, 382 Ohio Street, Chicago.

Switches and Cut-outs.—H. O. Lacount, chairman, 31 Milk Street, Boston; Dana Pierce, 382 Ohio Street, Chicago; J. E. Cole, 11 Wareham Street, Boston; Ralph Sweetland, 55 Kilby Street, Boston; F. E. Cabot, 55 Kilby Street, Boston.

Street-railway Property, Including Rolling Stock.—Ralph Sweetland, chairman, 55 Kilby Street, Boston; William McDevitt, 131 South Fourth Street, Philadelphia; R. E. Loomis, 19 Liberty Street, New York; F. T. Sloane, 85 Clinton Street, Brooklyn; O. B. Johnson, 55 Kilby Street, Boston.

Variable-speed Motors.—H. O. Lacount, chairman, 31 Milk Street, Boston; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg; H. R. Sargent, General Electric Company, Schenectady, N. Y.

Theater Wiring.—J. E. Cole, chairman, 11 Wareham Street, Boston; H. C. Harris, Columbus, Ohio; William Carroll, city electrician, Chicago.

Rheostat Rules and Specifications.—G. E. Bruen, chairman, 32 Nassau Street, New York; J. C. Forsyth, 32 Nassau Street, New York; A. R. Small, 382 Ohio Street, Chicago.

Rules and Specifications for Metal Mouldings.—A. M. Paddon, chairman, 434 State Street, Schenectady, N. Y.; J. E. Cole, 11 Wareham Street, Boston; William McDevitt, 131 South Fourth Street, Philadelphia.

Specifications for Electric Signs.—J. C. Forsyth, chairman, 32 Nassau Street, New York; W. H. Merrill, Jr., 382 Ohio Street, Chicago; J. R. Strong, 35 South Williams Street, New York; H. S. Wyncoop, Municipal Building, Brooklyn.

Rules for Circuit-breakers with Motors.—A. M. Schoen, chairman, 339 Equitable Building, Atlanta, Ga.; Arthur Lewis, Wilkesbarre, Pa.; J. S. Meade, 316 Walnut Street, Philadelphia.

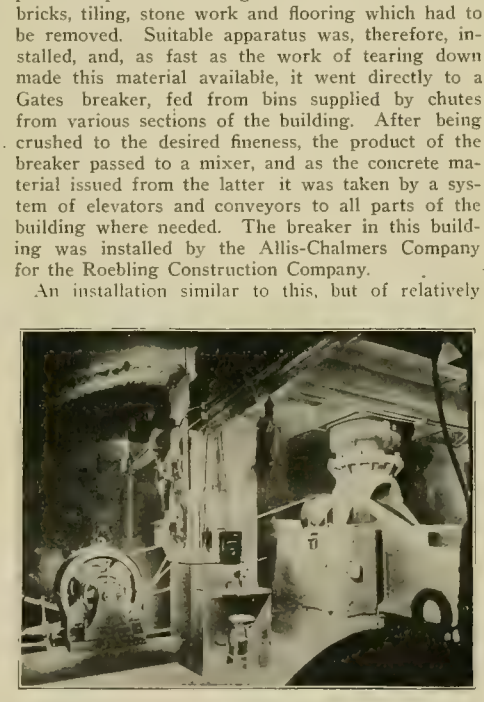
Service Wires (Rule 12 a).—Ralph Sweetland, chairman, 55 Kilby Street, Boston; W. H. Blood, Jr., 84 State Street, Boston; C. H. Hill, 316 Walnut Street, Philadelphia.

Economical Leveling and Construction Work in San Francisco and Chicago.

In the rebuilding of San Francisco, methods of economical leveling and construction have been sought out and practiced to a greater degree, probably, than at any other time and place. As an instance may be cited the work done on the Crocker Building, Post and Market streets, where every avenue to waste, both of material and labor, has been most successfully closed through the exercise of a little ingenuity, aided by modern crushing machinery.

This structure, which is 10 stories in height, with a frontage of about 200 feet, escaped any serious damage from the earthquake, but was gutted by fire. The frame of the building being intact, nothing more was necessary than a reconstruction of its interior, and the contractors at once hit upon the profitable plan of utilizing for concrete mixture all bricks, tiling, stone work and flooring which had to be removed. Suitable apparatus was, therefore, installed, and, as fast as the work of tearing down made this material available, it went directly to a Gates breaker, fed from bins supplied by chutes from various sections of the building. After being crushed to the desired fineness, the product of the breaker passed to a mixer, and as the concrete material issued from the latter it was taken by a system of elevators and conveyors to all parts of the building where needed. The breaker in this building was installed by the Allis-Chalmers Company for the Roebling Construction Company.

An installation similar to this, but of relatively



ELECTRICALLY DRIVEN STONE CRUSHER IN BASEMENT OF CHICAGO BUILDING UNDERGOING DEMOLITION.

greater importance, because on a larger scale, was made at Chicago last year, when the old Cook County court house was dismantled. This temporary crushing plant consisted of two Gates breakers, a Gates elevator and a Gates revolving screen, all driven by electric motors. Part of the installation is shown in the accompanying picture.

There was a No. 6 style K breaker for doing the first crushing and a No. 4 style D breaker for handling rejections. The two discharged into an elevator which conveyed the material to a screen having 1½-inch perforations. The stone was reduced to 1¼-inch size for concrete, and the dust sold for use with it in place of sand. The oversize material was discharged onto a belt conveyor which carried it back to where it was fed into the No. 4 breaker. Each of the breakers was driven by an independent motor, and a third motor was used for driving the elevator, screen and conveyor. The plant was located in the center of the building, where it was easy of access for handling the stone as fast as the building was torn down. The crushed product was discharged into bins placed directly under the screen, from which it could be readily loaded into wagons. The motors and crusher equipment for the Chicago installation were purchased from the Allis-Chalmers Company by the contractors, J. A. McMahon & Company.

Engineering Building Dedicated.

According to the programme previously published, the Engineering Societies Building in New York was formally dedicated on April 16th. Letters were read from President Roosevelt of the United States and President Diaz of Mexico. President Roosevelt heartily congratulated the engineering societies upon the opening of their building, the largest of its kind in the world, and said its erection serves to emphasize the supremacy the country is achieving through its proficiency in applied science. President Diaz expressed sincere regret at not being able to be present at the dedication and extended his cordial good wishes to the engineers, who "do so much for the welfare of humanity." He expressed his admiration for the "great philanthropist, Carnegie, whose splendid generosity is known to the entire civilized world." Andrew Carnegie, donor of the great building, followed the opening prayer with a brief address, and was in turn followed by President Hadley of Yale in a short talk. Earl Grey, governor-general of Canada, who was to have addressed the gathering, was delayed in arriving, and sent his congratulations to Mr. Carnegie and the engineers by telegram.

Carnegie Institute at Pittsburg Dedicated.

The new Carnegie Institute at Pittsburg, Pa., was dedicated on April 11th by Andrew Carnegie, who donated $6,000,000 for the construction of the building, and who has endowed it with millions more. A large number of distinguished guests, including many from abroad, were present at the occasion.

The institute, which is dedicated to literature, art, music and science, rises a glistening edifice of marble from the greensward of Schenley Park, one of the most beautiful in the park system of Pittsburg. Situated on Forbes Street, near Grant Boulevard, the building faces the south, and with its wings and extensions covers an area of four acres, while with the three floors there is a space for the various departments of 16 acres, exclusive of two basements and the power house.

The building, which occupied 30 months in construction, does not contain any woodwork. Six thousand tons of marble, costing $750,000, were used in its construction.

The library has a capacity of 1,500,000 volumes. The art galleries cover 44,700 square feet, and the museum 104,000 square feet.

Twenty-five thousand electric lights and 200 miles of wiring are controlled by what is said to be one of the largest switchboards in the world. The heating and ventilating plant is one of the most elaborate and scientific and cost $650,000.

New-business Programme for Electric-light Convention.

Arthur Williams, president of the National Electric Light Association, has asked Mr. J. Robert Crouse of the Co-operative Electrical Development Association to assist in formulating the commercial or "new-business" programme of the Washington convention, and Mr. Crouse has taken hold of the task with his accustomed energy. He has caused to be prepared an elaborate tentative programme, and he asks for co-operation, suggestions and criticisms. Mr. Crouse is entitled to the generous assistance of readers of the Western Electrician and others in his important work. He is addressed at 1814 East Forty-fifth Street, Cleveland, Ohio.

Three-cent Fares in Cleveland.

In a recent report to the City Council the Cleveland (Ohio) Electric Railway Company states that the operation of cars on Central and Quincy avenues at the three-cent fare, in accord with the policy of the city administration, is a losing venture. These lines have been operated at the low rate following the expiration of the company's franchise, according to the ruling of the District and Supreme courts of the United States. The report stated in brief that the cost of carrying passengers on the lines indicated was in excess of three cents, and that the expense would not warrant a continuance of the test.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XII.—Characteristics and Uses of Alternating-current Generators.

There are three kinds of alternating currents in commercial use at present, known as the single-phase, two-phase and three-phase currents. The distinction between these currents has already been explained in a previous chapter and the three styles of alternators in most general use generate either single-phase, two-phase or three-phase currents correspondingly.

In all of these types of alternating-current generators there is usually a large number of poles, depending on the number of alternations of the current to be generated. The alternations per minute which are most extensively used in the United States today are 7,200 for lighting purposes and 3,000 for power purposes where motors are employed. These alternations correspond respectively with 60 cycles and 25 cycles per second, which is the more common method of designating the character of the current.

But there are many exceptions to these figures, especially for power work, where 50 cycles, 40 cycles, 16 cycles and even less are employed in special cases, but 25-cycle current may be considered standard for most commercial work, as it is applicable to both power purposes and lighting as well, whereas at any lower frequency than this the fluctuations become visible in incandescent lamps.

In all alternating-current generators the field is excited by current from an outside source, such as a direct-current dynamo or a storage battery. A small direct-connected engine and direct-current dynamo, known as an exciter set, is usually employed for field excitation, and 125-volt current is generally used for this purpose, although 250-volt current is sometimes employed.

Both the fields and the armature cores of alternators are built up of thin punchings of sheet steel, each lamination being insulated from the others by paper, varnish, etc., similar to the cores of direct-current armatures. The object of the laminations, as explained before, is to prevent wasteful eddy currents, which would otherwise heat up the cores excessively.

In most alternations, especially the large ones, the armature is stationary and is located on the outside of the machine, while the fields revolve inside of the armature. These are known as revolving-field generators and are of advantage in several ways. In the first place, only two collector rings are necessary on the revolving fields for collecting the direct current for exciting the fields. The armature, being outside of the field, is necessarily considerably larger than a revolving armature, and therefore offers considerably more space for the windings and insulation, and owing to the fact that the armature is stationary it is not subjected to any mechanical strain or displacement, which on a revolving armature tends to injure the insulation.

The armature windings consist of either one, two or three series of coils, corresponding to single, two and three-phase currents, as the case may be, and in the case of the two-phase or three-phase machines, these sets of coils overlap each other to a certain extent, producing the two or three-phase currents.

Of the three types of alternators mentioned, the polyphase machines are much more generally used. A single-phase machine of the same capacity as the two or three-phase generator must be built 40 to 50 per cent. larger than either of the latter, and is therefore relatively more expensive. Further than this, single-phase machines are not well adapted to power purposes, as, with the exception of special-type railway motors, alternating-current motors suitable for use on single-phase current are not self-starting, and require to be brought up to speed by some outside source of power before any load can be thrown upon them.

A reason for the greater use of three-phase than two-phase generators is that the three-phase current is transmitted by means of three feeders, while the two-phase current requires four feeders, so that, with the three-phase current, an extra transmission line is thus dispensed with.

There are no such well-defined standards of voltage with alternating-current generators as there are in the case of direct-current generators. In direct-current work 110 and 220 volts are almost exclusively used in incandescent-lighting work, and 500 to 600 volts for street-railway work. In alternating-current generators the voltages in general use include 110, 220, 440, 550, 1,100, 2,200, 6,600, 11,000 and 13,200. The reason for this wide variation of voltage is that alternators are almost always used in connection with transformers, by means of which practically any voltage desired can be obtained with but very slight losses in transformation; whereas, in direct-current work no such efficient means for changing the voltage of the current exists.

The voltage of transmission lines has never been standardized to any extent, and for this reason a large range of voltages is found in use at present. In cases where the distance to which the current is to be transmitted is not excessive the use of generators wound for comparatively high voltages, as 11,000 or 13,200 volts, is becoming common practice. Where a higher voltage than this is essential, it is usual to wind the generators for a comparatively low voltage and step up the current to any pressure desired, by means of transformers. This high-tension current, after being transmitted to the desired distance, is passed through step-down transformers, which reduce the current down to any desired working pressure.

Alternating-current generators are operated in parallel, the same as direct-current generators, but before being thrown into parallel it is necessary that each generator has the same speed and phase relations, otherwise a destructive current will surge back and forth between the two machines. The operation of bringing an alternator into the same speed and phase relation as others to which it is to be connected in parallel is known as synchronizing, and when the machines are in proper relation for being thrown together in parallel they are said to be operating in synchronism. The operation of synchronizing will be described later, together with the apparatus by means of which it is accomplished.

It will be seen from the fact that alternating-current generators operate at several thousand alternations per minute, and that these alternations must be in unison in all the machines operating in parallel, that extremely accurate speed regulation is necessary for operating alternators under these conditions. For this reason, where alternators are driven by reciprocating steam engines, extremely heavy flywheels are generally employed to counteract any fluctuation in the engine speed.

The driving impulse on a reciprocating engine varies from a maximum when the crank is on 90 degrees to zero when the engine is on dead center, and even these periodic variations in the course of a single revolution are sufficient to cause trouble in the parallel operation of alternators, unless these fluctuations are smoothed out, so to speak, by means of a very heavy flywheel.

It is this objection which has been largely instrumental in introducing the steam turbine for this class of work within the last two or three years, as the steam turbine has the advantage of possessing an absolutely uniform turning movement during every part of its revolution. This absolute uniformity of speed makes the operation of synchronizing considerably easier than it is in the case where reciprocating engines are used.

Where there is any fluctuation in the supply of power for driving the alternator, what is known as hunting, or pumping, occurs. This is a periodic flow of current between the generators in parallel on the same system, and is shown by the periodic fluctuation of the instruments connected to the line. It results in undue heating of the machines. As the capacity of the machines is limited solely by the temperature to which they may be raised without injuring the insulation, it is important to avoid any preventable causes of heating, and also to design the frames and windings of alternators so that a circulation of air can be maintained through them which carries off the heat. It is obvious that the rise of temperature in a machine will be less with good ventilation than with poor, and the result of proper ventilation is that a larger output of current is thereby secured from the machine.

The output of alternators is frequently expressed in kilovolt-amperes, instead of kilowatts, as the product of the amperes and volts does not represent the true watt output of the machine. This depends upon what is known as the power factor of the load. When the load is non-inductive, as, for example, for incandescent lights, the power factor is practically unity, or 100 per cent. When the machine is operating an inductive load, such as motors, the power factor varies, and may be 65 or 70 per cent., or less, under some conditions. Where the power factor is unity, or 100 per cent., the variations in the current and its electromotive force are identical; that is to say, when the current is at its maximum potential the electromotive force is also at its maximum potential, and their intermediate and minimum values also coincide. When an inductive load is placed upon a motor, the phases of the current and its electromotive do not coincide; that is to say, the current reaches its maximum either a little before or a little after its electromotive force is a maximum, in which case the current is said to be either lagging or leading, with relation to its electromotive force. When this occurs, the power in the circuit is not represented by the product of the volts and amperes, but this product must be multiplied by a certain factor, in order to represent the kilowatts. This factor is called the power factor, and depends entirely upon the nature of the load, and not upon the generator.

[To be continued.]

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Seeking a Magnetic Insulator.

E. C. C., Bremen, Ind.: Can you tell us with what material or how we can insulate a magnet? We have tried rubber (hard and soft), glass, mica, slate, hardwood-fiber and all other non-conductors we know. But a magnet attracts through all of them. Any advice on this subject would be greatly appreciated.

ANSWER.

You will probably be compelled to give up your search as a bad job. Metcalfe says in "Elements of Electrical Engineering" (Chapter I.), now running in the Western Electrician: "There is no such thing as a magnetic insulator. The attraction of a magnet for a magnetic substance cannot be cut off by interposing any other substance between them. The only way of decreasing the attraction between two magnets, or a magnet and a magnetic substance, is by separating them, and it has been found that the attraction varies inversely as the square of the distance between them." This is the commonly accepted view, based on experience.

Meter Racing.

A. C., Vallejo, Cal.: We have had a peculiar incident happen with a meter in a certain residence in this city. The meter began to run away, probably going twice its full-load speed and no load being on. Please let me know what will make a meter run away without any lights burning or any load whatever.

ANSWER.

Perhaps with a knowledge of all the facts it would be impossible to give a reason for the peculiar action of this meter. Certainly it is impossible to do so from the data in the question. If the meter is of the commutator type, the phenomenon might possibly be explained on the ground that lightning or a heavy short-circuit demagnetized the permanent magnets, thereby eliminating nearly all retarding effect. At the same time a large part of the resistance in the shunt circuit may have been cut out, giving a strong light-load compensating effect, which would cause a considerable rotation with the reduced retardation. But this is merely a possibility; if the meter is of the induction type, the explanation may be entirely different. To hazard a more pretentious conjecture it would be necessary to know exactly what type of meter "ran away" and all the circumstances surrounding the occurrence.

Great Northern Railroad May Use Electricity.

A newspaper dispatch from St. Paul, Minn., says that electricity may be utilized by the Great Northern Railway Company instead of steam as motive power on at least one division of its transcontinental line in North Dakota as well as in hauling its trains through the famous Cascade Tunnel in the Rocky Mountains. The stretch of road where it has been decided to use electricity is between Minot and Williston, where the road's supply of water is so full of mineral salts that an engine must be taken into the roundhouse after every run to have its boiler cleaned.

Recent Developments in Prime Movers.[1]

By Harold Almert.

Recent developments in the field of prime movers have upset what had become known to the engineering profession as standard practice in the design of power stations and particularly in regard to the selection of prime movers. In nearly all power installations the reciprocating steam engine would be found as the principal prime mover or generator of mechanical power, and the only difference in the design of these various stations was the selection of the size and type best suited to the local conditions and the arrangement of these units to the best advantage.

At first the size of units were small, 500 horsepower seemed to be the maximum; where more power was required the number of units was multiplied. For a time this seemed to solve the problem, but when a dozen or more of these units were installed in a single station and the demand for more power was daily increasing, the operators began calling on the manufacturers for larger units. The builders were equal to the task, and as each order came in the size of the units called for seemed to increase, so that in several cases half a dozen or more units, each of 12,000 horsepower capacity, may be found housed under one roof, and all feeding their power into a common system of distribution, and all this development in the remarkably short space of time of little more than a decade.

Steam Turbines.

In Europe a number of prominent investigators have been steadily engaged in the development of the steam turbine, but up to three years ago builders of engines on this side of the water looked upon the steam turbine only as a scientific toy. The development made in England showed that efficiencies were being obtained and engineering difficulties were being overcome to such an extent that builders of apparatus in this country began to give the development of this type of prime mover serious consideration. A number of turbines of the smaller sizes of the De Laval type had been built and used with more or less success for special installations, but the high rotative speeds made this type of turbine impracticable for the larger size, as it could not be connected to electric generators without a system of gears.

Steam Economy.

The steam consumption of the single-stage turbine is high and therefore unsuited to the replacing of the reciprocating engine. The speed of the rotating element in this type is several thousand revolutions a minute, therefore no benefit is derived from the expansive qualities of the steam used.

Parsons and Curtis conceived the idea of increasing the number of rotating elements, so that the steam in leaving the first rotating member passes into a similarly constructed stationary element and is there deflected and again passes into another moving element, and so on, until the steam is fully expanded as in the reciprocating engine. This method had the further advantage of reducing the rotating speed, so that suitable electric generators could be designed for connecting directly to them.

When this was accomplished the steam turbine established its commercial worth, and threatened to become a serious rival to the reciprocating steam engine, especially in the larger sizes and in installations where real estate is valuable because of the small floor space required by turbines. Large turbines are built in two types, vertical and horizontal, and as large as 10,000 kilowatts capacity.

Observations abroad show that in nearly all of the larger stations the steam turbine is superseding the reciprocating steam engine. In no case is the internal-combustion motor in any form replacing the steam engine in these larger stations.

Gas Engines.

There are a number of successful installations of large internal combustion engines in Europe in industrial plants, but these are special cases, and the engines are used to operate where large quantities of blast-furnace and other gases are available, and which would otherwise be wasted were it not for this type of prime mover. The situation is the same in this country, with a few exceptions.

About the time that the steam turbine began to attract attention in this country, the gas engine also appeared. This type of engine had, of course, been extensively used for years in the smaller sizes, operating on both natural and artificial gas and gasoline, but the development of the gas producer in connection with this type of engine gave results that promised this combination a prominent place in the production of power. Therefore, when the statement was made that a prominent American firm had obtained foreign patents and would appear at the St. Louis Exposition with a 3,500-horsepower engine that would operate with one pound of coal per horsepower-hour, the prospective buyer of engines was very much at a loss to know whether the steam turbine or gas engine was the coming prime mover.

It soon developed that the steam turbine was to occupy the field where the larger size of units were required, for the present at least. In moderate sizes the gas engine would divide the honors equally with the turbine, and in the smaller sizes the gas engine would make the better showing.

Labor.

The gas engine is under a disadvantage in that the basic principles under which a gas engine operates, simple as they are, are not understood by stationary or steam engineers, who are the men in nearly all cases that are called upon to operate them. The technical schools realize this fact, and have therefore set about to train a number of young men who, for want of a better name, we will call gas engineers.

Many central stations of small size using gas engines instead of steam are operating successfully with men who have had no special training and who receive no more salary than they did when the same plants were operated by steam. I think that a little increased cost of labor would prove a good investment for this class of service, as better trained men can be obtained who can return this investment with good interest in the yearly operation of the plant.

Efficiency and First Cost.

The economy of the internal-combustion engine has been recognized from its inception. Both the theoretical and practical efficiency of this type of prime mover is from two to five times greater than that of the average externally fired heat engine. The smallest gas engines have a thermal efficiency from 20 to 24 per cent., while the largest steam engine, with all the modern refinements known to the art, does remarkably well to turn into work 12 per cent. of the heat supplied to the furnace under normal conditions. For well-known reasons the thermal efficiency of steam engines increases with the cylinder volumes, but although this increased efficiency is not so apparent in the internal-combustion engine, a comparison of the thermal efficiency of an ordinary gas engine with the largest and most economical engine propelled by steam, while perfectly fair to both types, still shows 100 per cent. in favor of the gas engine.

By selling the by-products of bituminous-gas producers at market prices it is said that power from gas engines can be generated 14 per cent. cheaper than from waterfalls.

The first cost of large gas-engine plants, including coal-handling apparatus, piping, scrubbers, cleaners, buildings, compressor and engines, is not far from that of a steam plant complete of similar rating. It is stated that gas engines do not wear out any quicker than steam engines, but this is a somewhat mooted question. Gas producers last much longer than boilers and require but little attention and repairs. The Erie Railroad Company has had two 200-horsepower producers in operation at Jersey City for seven years, and the fire in one has never been out. Imagine the condition of a steam boiler after such a run.

The standby losses of the internal-combustion-engine plant are much less than for steam if run intermittently, or if part of the equipment is held in reserve for immediate service. The California Gas and Electric Corporation, which normally gets its power from waterfalls, carries a gasometer always full of gas in reserve for use in engines should the long-distance electric waterpower fail.

When compressed air is available (and all large gas engines use this medium) the engines can be started and can take their full load in two minutes, as no warming up of the cylinders is necessary. The waste heat (about 70 per cent. of the heat supplied) can be used for heating, and a higher temperature maintained than with heat from steam-engine exhaust.

Several questions naturally here arise. If the internal-combustion motor has so many advantages over steam, why, then, has it not had a greater development? Why are we not using gas engines in our larger power plants? Why are we using 40,000 heat units instead of 10,000 in generating a brake horsepower. Why are we burning 400 cubic feet of waste gases under our boilers to evaporate enough water to produce a horsepower when 100 cubic feet burned behind the piston of a gas engine would do the same amount of work? Simply because the American manufacturer has not kept pace with the development of the gas engine, and because the gas producer has not kept pace with the gas engine until recently.

There are to be had, however, at this time both producers and engines of any size required that are just as reliable and much more efficient than any steam equipment, and the near future will see this producer type of apparatus grow steadily in the favor of power users.

The first cost of large producer plants, as already stated, will be little more than that of similarly rated steam equipments, while that of smaller plants will show the gas plant to cost about 25 to 50 per cent. more than steam.

For the smaller plants the gas engines will make the best showing in operating costs; one pound of coal per horsepower-hour is a frequent occurrence for the producer-gas equipment, while seven to 10 pounds of coal is the average for steam plants.

Many plants that are now operating at a loss can, by the careful selection of the size and kind of internal-combustion-motor equipment, be made to pay at least a small dividend; and many gas companies that are troubled with under-production, strange as it may seem, can become their own largest consumer and produce electric light and power for distribution to very good advantage.

The erection of producer-gas plants at the mouth of coal mines, and generating and transmitting electric power for wholesaling to plants already in operation, will no doubt prove a profitable business to those who get into the field early and get the choice locations.

In the case of a number of the small plants where they operate a 24-hour service the selection of a small internal-combustion motor, where the all-day efficiencies are of paramount importance, as an addition to the old central-station steam equipment to carry the peak load in emergencies, will work out all right.

Discussion (in Abstract).

Thomas B. Whitted, St. Louis: The gas engine certainly occupies a prominent place in the field today, and a place that is growing more and more important. I have listened to the interesting discussions here, especially with reference to peak loads, and that is where gas engines fit in nicely. I was recently concerned in two installations of an elevated railway, where, instead of putting in rotary-converter sub-stations and high-tension lines from the main plant, they put in two gas-producer plants. One of the installations contains Loomis-Pettibone producers, and Crossley gas engines, a type now abandoned. The other contains the Del Vargne engine and the R. D. Wood producer. The labor in these stations, I think, is not required to be more intelligent than in the average boiler or engine room.

There is no more intelligence required to put coal in a producer than under a boiler, and I do not think that there is as much, because the coal is measured out, and all the stoker is required to do is to hold open a scuttle and shove it in; and when the plant is completed it will be fed in automatically, of course. The Loomis-Pettibone producer requires a knowledge of gas only to a certain extent. You have to change to make your water gas. It makes both producer and water gas. Consequently a man must have a little knowledge about it; but I do not think the question of labor is more serious in a gas plant than in a steam plant.

The tendency of modern times is certainly toward an internal-combustion engine. Steam engineers must admit that they have practically reached the limits of efficiency that can be obtained, either with reciprocating engines or steam turbines. Of course, we are getting larger units and better economy in steam turbines, but there is a limit that cannot be gotten away from. Therefore, it looks to me as though we must charge a greater amount of depreciation on a unit that is going to become antiquated more quickly than the gas engine, which is going to be the coming unit. It is free from smoke and is just as reliable as the steam engine.

The United States Steel Company went into the subject very thoroughly. It sent its engineers abroad and investigated the subject as fully as possible, and its favorable decision, I think, largely influenced the gas-engine industry as it is today.

The question was brought up: Why don't more people buy them, if they are such good things? Well, there have been some pretty bad failures. You will call to mind the signal lack of success at Johannesburg, South Africa, which, as far as I know, was at the time the largest producer plant that had been undertaken anywhere. That contract was placed in 1901. Moreover, about seven or eight years ago, some prominent American manufacturers acquired, outright, European rights and patents to build large gas engines. They made some installations in the country to operate, not on producer gas, but on gas of another kind, and they have not proven to be entirely successful.

But, on the other hand, look at what has been accomplished in the last 12 months. A plant of 5,000 horsepower has been built in Texas, using low-grade lignite coal that can be obtained at $1 a ton. In the southern part of Texas you have oil the equivalent of about $2.50 coal, and in Dallas and Fort Worth you can get McAllister coal at $2.45. By putting gas engines in the plant you get a constant load, and there is a saving of over $65,000 a year, which is pretty good interest on the increased cost of a gas-engine plant over steam.

The reference to this report is not very specific as to the increased cost of a gas-producer plant over a steam plant; but my experience has been that it is quite a good deal. I have known of a number of steam-turbine plants, including condensers, etc., that have been put in for $75 a kilowatt, and I do not believe that a gas-engine plant, even though it be of 3,000 to 5,000-horsepower capacity, divided into 800-kilowatt units, can be put in for less than $100 a kilowatt. When gas is already supplied in medium-sized units the gas engine and generator can be installed at a less cost than the complete steam plant.

We [Westinghouse] built our first gas engine in

1. Abstract of a report presented to the Northwestern Electrical Association at its convention in Chicago on January 17, 1907. Mr. Almert, who is a consulting engineer of Chicago, was president of the association at the time this report was made.

1895; it was a small affair of 10 horsepower and weighed 3,950 pounds. In 1900 we had about 20,000 horsepower in engines, scattered throughout the country, none of them very large, and our bed was not one of roses. There are gentlemen here who have used our earlier type of gas engines, and they know some of the troubles that we had with them, and know that the experience that we gained in those early days is one of our most valuable assets today.

In 1901 I went to Philadelphia to see three 175-kilowatt units operating in parallel. It was at that time the only direct-connected gas-engine-driven plant with 60-cycle engine generators in the country. The load was fluctuating, and all three governors were belted together. I asked why that was done, and was told that the generator people wanted 1½ per cent. regulation on the engines. I believe you remember that both the generator people and the steam people were trying in those days to get very close regulation. Those three engines and those three generators, with practically no change, are operating today without any belting of the governors together, for the reason that they give the machines more play, and the close regulation they were trying to obtain was entirely unnecessary. I believe most engine builders guarantee a regulation of from two to four per cent instead of 1½.

About that time they realized that they could not build vertical gas engines of the single-acting type larger than 600 horsepower, because of the cost. So they turned their attention to the horizontal engine, one of which was on exhibition at the World's Fair. But 1903 found us with about 30,000 to 35,000 horsepower of gas engines out, about 8,000 horsepower of which were of the horizontal type, the largest engine being 600 horsepower, vertical, and it was a pretty husky piece of machinery, too.

The United States Steel Company in 1903 took this matter up and sent a committee of five engineers abroad to investigate the subpect, determining, if their investigations proved satisfactory, to install a number of gas engines in its various steel mills.

Upon the return of the committee American manufacturers, as well as European, were invited to bid on this work. The American manufacturers, presumably, woke up just about that time, and the result was that the order was placed with us for two engines. Those engines were started three months ago, and have proven satisfactory. They were started up one morning, took a half load that afternoon, and next day went into full service, and have been operating on full service ever since. The total length of the engine is 87 feet; the total width 40 feet; the crank pins 17 inches in length; the crane journals 30 by 54. The weight of the engine without the flywheel is 1,500,000 pounds, and the weight of the flywheel is 140,000 pounds, the gross weight being 1,640,000 pounds. These engines develop their power from blast-furnace gas containing about 80 B. T. U., this gas being a by-product of the coke furnace. They are blowing engines, rated nominally at 3,200 horsepower, and are capable of supplying 40,000 cubic feet of free air per minute. In addition to that preliminary order, we have undertaken to build eight duplicates for the plant at Gary, and we are building 2,000-kilowatt generator units for the Lucy furnaces, and the same for the Pittsburg works.

About the time the United States Steel Company people arrived at this decision, several manufacturers decided they ought to get out a complete line of gas engines, up to about 1,000 horsepower, and within a very short time orders were in for engines from almost every class of service, such as interurban railways, cement mills, lighting plants, ordinary city street-car systems, etc.

If you will follow the gas-engine industry for five years you must agree that it is the coming power; it is the power that eliminates smoke, and is especially adapted for city work. Referring to the rapidity with which the engines can be started, one well-known manufacturer of engines, together with a manufacturer of producers, took a contract agreeing to start that engine from a dead rest and have it under load in 1½ minutes.

The gas engine certainly lends itself to a class of service where you have a plant installed and need a relay, or where you need additional power for short periods of time, and your standby losses are not going on as they are in a boiler plant.

H. H. Scott: I agree that the gas engine will grow much more rapidly in the future than it has in the past. The actual efficiency on those engines is much greater than is possible with any steam apparatus. The common result with a gas engine, using ordinary illuminating gas, is not to exceed 30 feet per kilowatt-hour. Thirty feet of illuminating gas is 18,000 B. T. U., which is a little over the equivalent of one pound of coal. So it is simply a question of mechanical perfection to make the gas engine much more prominent than it is now.

Mr. Almert: I had the pleasure of visiting the fuel-testing plant of the United States Geological Survey at St. Louis a few months ago, in which they are carrying on some very interesting experiments; and I would advise the members of this association to write to the United States Geological Survey and get copies of these reports. They are engaged down there in testing bituminous coals from all the mines in the United States, and they get carload samples, which are carefully selected by their inspectors, so that they are not picked samples by the miners; and one portion of this coal goes for test on coking, another for producer-gas purposes, and another for steaming purposes.

While the manufacturers claim, and while in a great many cases we do find that they get one pound of coal per horsepower-hour, I do not think at this time they can get as good results as that in general station practice. They make a test of a 60-hour run, and in making their deductions for power used for circulating the water in the jacket, etc., and taking in generator losses (they have a belted unit), and assuming that their efficiency of generator and belt is 15 per cent., the amount of power available at the switchboard for outside purposes shows a consumption of about 2.08 pounds of coal per horsepower-hour on their general run of coal, some better and some worse; but they have had uniformly good results down there.

It has been a serious problem in some of the early developments, where they used coal high in sulphur, and I looked to see the result there and found that they had had trouble due to this source, but the general belief is that sulphur carried over into the engine gives no trouble unless it comes in contact with moisture, and it should not do that in ordinary operation. They did have trouble with their cylinders, and had to renew them, because the sulphur disintegrated the cylinder; but it was due to the fact that there was an imperfection in the casting which permitted water to get through the jacket into the cylinder.

Of course, a number of things of this kind must be taken into consideration, but generally we find that those who have engines of this class in operation are getting satisfactory service out of them. This is particularly true where the units are so selected that they operate at or near their normal load capacity. The characteristics of this class of engines show that the efficiency drops off very rapidly when you get below half load, and is not so good on three-fourths load; but if you can operate these units and put in several of them and have them small, you can operate them without trouble in parallel, and get much higher efficiency than is possible by the ordinary units.

Mr. Whitted: I hope you will pardon me for mentioning the question of efficiency. I do not like a wrong impression to be created. I am a pretty enthusiastic gas man, so I think the best way is to state the efficiency exactly. On full load the average gas engine requires 11,000 to 12,000 B. T. U. per horsepower, on three-fourths load it is usually 14,000, and on one-half load it is usually about 16,500; and even if we operate our gas engines on half load all the time, we would still make a big saving over any kind of steam engine that we could put in.

Modern Problems of Illumination.

It is now believed that the correct design of illumination for any given area may be based on fundamental mathematical laws. But the correct application of these laws requires experience, careful calculations, good judgment and a sense of the artistic. While it is generally best to take up any engineering problem directly on the ground, it is nevertheless possible in many cases to correctly design the illumination for any given area by a study of the plans and elevations of the building or room.

It is said of one large public building recently completed that it was originally designed for the equivalent of 20,000 16-candlepower lamps. Although the outlets were not placed so as to get the maximum results, nevertheless by careful study of conditions, correct design of fixtures for illuminating as well as artistic effect, and the selection of the right glassware for each place, the load has been reduced to the equivalent of 15,000 eight-candlepower lamps, resulting in a saving, it is declared, of over $25,000 annually.

By the selection of scientifically constructed glassware it is possible to obtain diffusion of the light and at the same time direct the maximum amount in the desired direction. This is one of the strongest features of the well-known Holophane system of illumination.

In communicating with any of the engineering departments now being maintained by most up-to-date companies in this field it is advisable to send drawings or blue-prints of the buildings to be illuminated, giving, if possible, the location of furniture, the uses to which each room will be put, color scheme, etc.

It is often possible to get good results in a number of different ways, thus affording rather a wide latitude in the matter of preference as to what method of illumination is wanted, such as ceiling, lighting, bracket lighting, etc. It is but fair to say that the Holophane Glass Company of New York has been a pioneer in the movement toward better illumination and has established an engineering department whose force is composed of some of the best known illuminating engineers. The services of this staff are offered to those interested, free of charge, whether or not it is desired to use the Holophane system.

Lamp Reflectors as Modifiers of Light Distribution.

At a meeting of the New York Section of the Illuminating Engineering Society, held on April 12th, a paper, prepared by Major E. L. Zalinski on the "Extent in Practice to which the Distribution of Light About a Lamp Can Be Modified by Reflectors" was read. Following was the discussion in part:

Dr. Louis Bell, Boston: I think there is some misapprehension regarding the matter of the actual performance of reflectors, diffusing and otherwise. If you stop to look at a reflector of ordinary prismatic glass and watch it carefully to see where the light comes from, it at once appears that the distribution is gained by the traveling around of the bright area, and not the reflector, to a very large extent. In any form of reflector, where total reflection is the chief source of added efficiency, and it is a very great source of added efficiency to have any such reflector, the light comes first from the lamp, and second, from the total reflection taking place in various ways. I tried one big reflector for concentrated effects, about 95.5 inches in diameter, which at a distance of perhaps 60 feet gives the effect of a great flaming circle. In that way, by properly shaping the prisms and the reflector itself, you can give an enormous range of variations to the distribution.

Diffused surface gives a general distribution of light in so far as the surface is a diffusing one, but in point of fact this is a thing which is generally misunderstood. You can take a prismatic glass reflector and gradually proceed to confer upon the side or inside a mat surface, by sand blasting or other process. At the first stage the outside is merely covered with the thinnest possible film. The diffusion is almost nil, the glass acting almost as before; a little bit more etching and sand blasting, and you begin to get from the surface of the glass a diffusive effect, which is superimposed upon the effect of the clear regular reflection, and that goes on and on increasing until you get a diffusing surface sufficiently dense so that you can convert it into a pure diffused reflection; in other words, the progress from diffusion to pure prismatic reflection or pure mirror reflection is one which is not a sudden change in character in the least.

The value of diffusion in the way of reducing spots of high intrinsic brilliancy is very great, but the point I want to impress is that the phenomena, diffusing and regular reflection, can and do customarily exist together and that every time you begin to diffuse light from the surface you begin to widen the distribution. If you start with a very strongly concentrated reflector and put on a light diffusing surface, the tendency will be to make it less strongly concentrated and convert it more and more into a rounder distribution. If you start with a widely diffusing shade at the beginning, the change will still be toward uniformity, but will not be as marked as it is when you start with a strong downward beam.

The two phenomena, diffused and regular reflection, as I have stated, ordinarily co-exist. If there is any kind of diffusing surface, the diffused reflection is simply superimposed upon the other. As the diffusion is more and more prominent, and the regular reflection less and less prominent, you will get a softening of sharp peaks due to regular reflection into a comparatively regular curve. The phenomenon passes from one phase to the other with entire uniformity, and in every case where we use reflectors, if you watch the reflector carefully, if there is any diffusing surface on it, you will see the effect of the light concentrated passing down to a widening distribution, and at the same time softening. If you have been in a counting room, you will find that very nearly every clerk simply gets the light reflected downward, which throws a strong beam on the eyes. The two kinds of reflection must be employed in such cases, where people have to work on white surfaces, with the light thrown downward.

P. S. Millar, New York: The determination of the distribution of light which can be obtained by globes and reflectors is made by photometrical measurement. The well-known reflector, No. 2623, of the Holophane company, was tested in connection with a 16-candlepower lamp. The first of two tests was obtained with the photometer at a distance of 10 feet from the source of light. The second determination was then made with the photometer maintained at a distance of four feet from the source of light. The differences were rather marked, being a change from 40 to 55 candlepower, directly beneath the lamp.

The usual practice is to secure a photometrical balance by moving the photometer between two sources of light, a fixed distance apart. The photometer should be maintained at a certain definite point, and the distance should be stated at which it is maintained from the source of light under test.

E. Y. Porter, Newark, N. J.: As illuminating engineers, we are interested in the illuminating efficiency of any system or arrangement of reflectors, or light cources, or anything of that sort. While I do not imagine it is at all new, yet I think there is a term which is not being used as

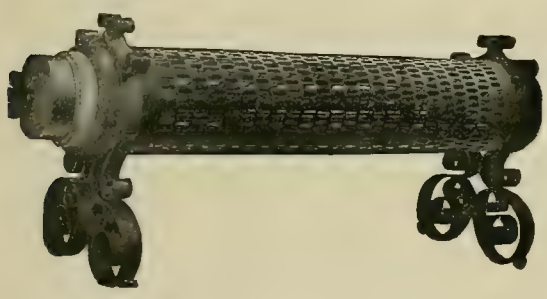
much as its importance warrants, which we might call the "illuminating efficiency" of any lamp or system of lights. We are very familiar with the term "watts per square foot," but that tells us nothing as to its economical effect; watts per square foot does not give any true indication of the light we get. We also use the term "mean candle-feet," or "mean flux," or something of that sort, as representing the illumination. That does not tell us anything from an economical standpoint, but if we can combine these two, and get what might be termed the "illuminating efficiency," which could be applied to any system of illumination in a given space, then we would get something which tells us what its value is from an economic standpoint. I may represent this illuminating efficiency as the mean foot-candles, multiplied by the square feet and divided by the watts. That is something very definite.

If the illuminating engineer can go to a client and measure his illumination under one system of lighting, and then can alter that system of lighting and increase the value of the lighting from one to two, he is earning a good commission. That is just the thing we are after—getting the very highest illuminating efficiency out of any system or combination of units. That brings us to the difference between illuminating efficiency, and what we may call "photometric efficiency." I have recently made measurements between two systems of lighting where the illuminating efficiency was very different from the comparative photometric efficiency.

I believe we are on the verge of being able to determine these things very readily. I have been privileged to use a luminometer which is not on the market yet, I understand, but which my experience leads me to believe will be of immense value to illuminating engineers generally. It is simple, self-contained and very portable. It has been to me a source of great information, in being able easily to get a concrete conception of what we have in the matter of illumination, and I hope and believe that eventually the distributing companies will be selling illumination instead of watts. It is not at all inconceivable that a little selenium-cell attachment might be arranged which could be placed in various parts of the room and register in time the actual illumination delivered.

Portable Electric Heater.

A portable type of electric heater which has been termed the "J-M" and which is approved by the underwriters has recently been brought out by the H. W. Johns-Manville Company of New York city.



PORTABLE ELECTRIC HEATER.

It is neat in appearance, as shown by the illustration, and may be finished in black japan, bronze, silver or gold, or otherwise decorated. This heater is adapted for use in residences, hotels, public buildings, offices, theaters, steamships, yachts, bathrooms, drying rooms, ovens, etc. For 110-volt circuits it is provided with a "three-temperature" regulating switch, so that practically any desired degree of heat can be secured. The current consumed is 2,000 watts, which will comfortably heat a room containing from 1,000 to 1,500 cubic feet of space. Insulation is porcelain and the construction is fire and waterproof throughout.

Power Prices in Ontario.

At a meeting of the executive of the Western Ontario Municipalities Niagara Falls Power Union at Galt the prices formulated by the commission were accepted, which, taking Galt as an illustration, were as follows: Five horsepower, used 10 hours per day, will cost the consumer, delivered at his factory, all charges of whatever nature included, $31.50 per horsepower per annum; 10 horsepower, $30; 50 horsepower, $24; 100 horsepower, $22.50; 200 horsepower, $21. It is also figured that in the case of Galt the rates for arc lamps will be 60 lights all night every night in the year for $42 to $45 per light, as against $75 now paid, and incandescent lighting five cents to seven cents per kilowatt hour, as against the present rate of 12 to 14 cents.

Platinum, which bounded up in price several times last year and kept on the upward movement the first three months of this year, recently began a turn the other way, and has fallen $4 an ounce, going down from $38, the top mark, to $34. Refiners say that there is a likelihood of a further decline.

The Rowland Telegraphic System.

A special meeting of the American Institute of Electrical Engineers was held on the evening of April 15th in the auditorium of the Engineers Building, New York, Sir William Preece, K. C. B., presiding. There was a large attendance and an animated discussion, in which Messrs. Patrick B. Delany, Gano Dunn, Francis W. Jones, A. E. Kennelly, A. A. Knudson, William Maver, Jr., and others participated.

The discussion was opened by Mr. Ralph W. Pope, secretary of the Institute, who gave a most interesting retrospect of practical telegraphy, resulting from the experience of one who was an active participant in telegraphy in the early days. Mr. Pope dealt largely on the development and improvement in printing telegraph systems, leading up to the latest automatic methods of transmission, including the Brooks system, the latest acquisition of the Western Union Telegraph Company.

The paper of the evening, "The Rowland Telegraphic System," was presented by Mr. Louis M. Potts, constructing engineer of the Rowland Telegraphic Company of Baltimore. Following are extracts from the paper:

The Rowland telegraphic system is a system in which the two features of multiplexing and printing are combined. The multiplex feature is accomplished by the synchronous operation of the instruments at the terminal stations. By this means, in an octoplex installation, each of the four operators is given the use of a telegraph wire one-fourteenth of a second, at intervals recurring 3.5 times a second.* In addition, the wire is duplexed by the polar duplex method, so that four transmissions in each direction, or eight in all, are obtained. In a quadruplex installation, each of the two operators is given the use of the wire for one-seventh of a second at intervals recurring 3.5 times a second; and the duplexing of the wire provides for two transmissions in each direction, or four in all.

The printing is accomplished by a perfectly direct method; that is, no punched or otherwise prepared tape is used at either the sending or receiving station, but the printing is controlled directly from a keyboard, practically identical with that of a typewriter. The total duration of the operation, from the depression of the key at the sending station until the character is printed at the receiving station, is less than one-quarter of a second.

All the operations at the receiving station are controlled from the keyboard at the sending station. This keyboard is identical with a typewriter keyboard, except for three additional keys, the so-called "lining," "backing," and "blanking" keys. The lining key is for the purpose of enabling the sending operator to move the paper from line to line on the printer at the distant station, the paper being moved the distance between two consecutive lines each time this key is depressed. The backing key is used for the purpose of returning the carriage at the distant station to the beginning of a new line. The blanking key is used for the purpose of shifting a telegraph blank on the printer at the distant station to the proper position for a new message. By the use of these keys, in conjunction with the other keys, the operator has perfect control over the receiving printer at the distant station. All the operations performed on a typewriter, such as paragraphing, tabulating, etc., can be performed equally well with this keyboard.

At the sending station, in addition to the keyboard, there is a home recorder and a signal light for the guidance of the operator. The home recorder consists of a tape-printing arrangement. A narrow paper band passes directly over the keyboard, and directly in front of the operator. On this tape is recorded the character corresponding to each key depressed. When the lining, backing and blanking keys are depressed, in place of performing these operations on the home-recorder, characters are printed on the tape, indicating that these keys have been operated properly. When the backing key is depressed, an arrow is printed on the tape. This arrow, as the tape moves, travels with the tape along a properly graduated scale and indicates to the operator the position of the character last printed on the page printer at the receiving station.

The speed of each operator is limited by the number of times per minute the keys are unlocked. The normal operating speed being 210 revolutions of the driving mechanism a minute, the keys are unlocked 3½ times each second, or 210 times a minute. One key can be depressed each time the keys are unlocked. The theoretical maximum speed is about 40 words a minute. On account of the time required for returning the carriage to the beginning of the line, and also because of the fact that the operator does not always take advantage of the unlocking of the keys, when operating for long periods, the speed in actual practice is about 35 words a minute. However, except on the longest lines, the speed of the operation of the machine may be very materially augmented. Upon the basis of 30 words a message, which is generally accepted as a fair average, this speed is equivalent to a rate of about 75* messages per hour, per operator, or 300 in each direction per hour, per wire, or 600 per hour, per wire, for the full octoplex.

In the Rowland system of telegraphy, the basis of the telegraphic current is an alternating current.

In an octoplex installation the current, at the normal speed of operation, has a period of 98 cycles per second. The same current is used for signaling and synchronizing. This alternating current is sent over the line continuously. The signals consist in reversing certain combinations of waves, as will be described later.

The alternating current used for the Rowland system is generated directly by the machine itself, this being necessary because the frequency of the current must correspond exactly with the speed of the machine. The current is generated by a dynamo or by a transformer and a commutator, together with a combination of resistances and condensers, which serve no other purpose than to reduce sparking on the commutator.

The transformer consists of two primary and two secondary coils with an iron core. The commutator used in connection with the current generator has eight rings, one being a solid collecting ring and the other seven being crown sections having in the octoplex 56 segments and in the quadruplex 28 segments, every alternate segment being electrically connected.

One terminal of each of the two primary coils of the transformer is connected directly to negative. The other terminals are connected to the alternate segments of the first crown section, the coils being so connected that the current flows through them in such a manner as to magnetize the iron in opposite directions.

In most of the systems of multiplex telegraphy that have ever been tried the principle of synchronism has been used; that is, the apparatus at either end of the line has been operated in unison with that at the other end. In most synchronous systems of telegraphy, synchronism is obtained by adjusting the apparatus at each station so that it rotates very closely to some predetermined speed and in some way, at definite intervals, a correcting impulse is sent over the line; by this means the position of the apparatus is changed by the amount it has deviated from the other machine since the last correction. All methods of synchronism based on this principle have proved that they require extremely delicate adjustment, and even under the best conditions are subject to frequent disturbances.

The synchronism as used in the Rowland system of telegraphy is of a continuous and stable character. The synchronism is maintained by the use of every impulse which comes over the line (of which there are in the octoplex 196 per second), and not a small fraction of the total number, as in the case of the systems referred to above. These impulses come at such a rapid rate that, on account of the large inertia of the moving parts, no effect is observed due to each impulse separately; but the regulation is entirely due to the integral effect of a large number of impulses, so that any variation of even a comparatively large number of the impulses will produce no sudden disturbance of the synchronism.

The most important practical requirements of the telegraphic service are accuracy and promptness. These factors, in a great measure, determine for the telegraph its peculiar field. In the Morse system the presence of the human element in every operation necessarily introduces corresponding inaccuracies. In the Rowland system the human element is reduced to a minimum by keyboard transmission and automatic reception. The printed local record before the Rowland operator, too, shows what has been transmitted, and furnishes the operator an immediate method of checking the message sent. The octoplex wire capacity of the Rowland, and direct transmission from typewriter keyboards with direct reception in printed characters on regular telegraphic blanks, ready for immediate delivery, constitute the best possible combination to insure promptness. With the Morse system, particularly in wet weather, when the wire capacity is reduced, serious delays in transmitting telegrams often occur through a sudden or abnormal accumulation of business. The octoplex wire capacity of the Rowland system in all weather conditions provides a greatly increased margin for reducing and avoiding such delays.

The efficiency of a Rowland operator is practically double that of a Morse operator. To transmit a Morse message, two skilled operators are necessary, while to transmit a Rowland message one typist is necessary. The sole requirement that the operator shall be a typist and able to transmit a message intelligently, greatly broadens the labor field and permits the economies incident to such an increased supply.

*The normal operating speed is fixed at 210 revolutions of the line unit per minute, or three and one-half revolutions per second, or one revolution in one divided by three and one-half, or two-sevenths of a second. This interval of two-sevenths of a second being divided among four operators, gives each one the use of the wire for two-sevenths divided by four, or one-fourteenth of a second.

*A rate of 71 messages per hour has been maintained in commercial practice for all-day operation. A rate of 50 to 60 messages per hour is maintained with ease.

BOOK TABLE.

ELECTRIC-RAILWAY ENGINEERING. By H. F. Parshall and H. M. Hobart. New York: D. Van Nostrand Company. 1907. Pp. (7½ by 10¾ inches), xxiv., 475, with 437 illustrations and 123 tables. Price, $10.

This work is divided into three parts—first, the mechanics of electric traction; second, the generation and transmission of electric energy, and, third, the rolling stock.

In the first part the authors have taken up tractive resistance, acceleration, the tractive force and power at the car axles and the characteristics of railway motors, a chapter being devoted to each of these subjects. Very complete tables and curves are used in each chapter; the acceleration curves, the curves showing the tractive force with various accelerations and for various train weights, and those accompanying the chapter on railway motors (which include a number of characteristic curves under various operating conditions), are exceedingly complete.

The second part is divided into chapters treating of the generating plant, high-tension transmission lines, sub-stations and the distributing system. The first of these chapters goes into the general design of the generating plant, outlining modern methods of laying out the entire plant, taking into consideration the boilers, stacks, piping, mechanical stokers, condensers, pumps, coal storage, engines, generators and switchboards. The chapter dwelling on this treats of it in a general way, and does not involve any abstruse calculations.

Comparisons are made in this chapter of the relative efficiencies of English and foreign power stations. A table is included showing the over-all plant efficiencies of a number of generating stations, and tables giving the thermal efficiencies of engines and generators; and over-all plant efficiencies of stations operating under both steady and fluctuating loads under actual service conditions, are also included. In the case of fluctuating load the efficiencies are shown for various load factors. Under the chapter on high-tension transmission lines, calculations are introduced, accompanied by graphical determinations, which are exceedingly clear and concise. This chapter is also accompanied by drawings and photographs showing some modern methods of underground cable installations.

In the chapter on sub-stations a comparison is made between the merits of the motor-generator and the rotary. Curves illustrating various characteristics, efficiency, power factor, etc., of the rotary are introduced in this chapter. The operation of shunt and compound rotaries is also discussed. A description is embodied of typical sub-stations operated by various companies in this country and abroad, including those recently installed by the New York Central Railroad.

In the chapter on the distributing system various methods of three-rail and overhead construction are shown. Various types of rails are also described.

As a portion of Part Third is a chapter on electric locomotives, which includes very complete descriptions of those put in service on the New York Central and Baltimore and Ohio railroads. Interesting data are introduced on the subject of heavy electric traction work.

The last chapter is devoted to the subject of trucks, and is accompanied by numerous drawings of various types.

This important book, while made up largely of features of interest to the engineer, includes under each heading such general descriptions as would make the book valuable also to the layman interested in the subject of electric traction. As the title of this work would indicate, the subject is a broad one, but the authors are to be complimented on the selection of their material, embodying that which is most useful to the engineer and eliminating such as would rarely, if ever, be met with in practical work. The book is distinctly modern, and where calculations are introduced, the reasoning is clear and concise, and the use of abstruse mathematics is not introduced. The curves included in this work are numerous and complete, and they alone should make the book of great value to the engineer as a work of reference, since they cover the operation of practically all apparatus, from the boilers to the motors.

Chicago City Railway Company Accepts Ordinance.

The directors of the Chicago City Railway Company, which operates on the South Side of the city, on April 13th formally accepted the Chicago traction settlement ordinances as affecting that company. It is expected that the Union Traction Company, which operates lines on the North and West sides of the city, will also accept the ordinance.

Indiana District Telephone Meeting.

The third meeting of the Seventh District of the Indiana Independent Telephone Association was held in Indianapolis, April 10th. Vice-president W. W. Mendenhall presided. Every one of the 23 companies in the district were represented. The secretary read a lengthy review of what has been accomplished by the Independent companies, comprising the Seventh District, during the last year.

The members reported a large number of patrons and the necessity to enlarge their systems in order to take care of applicants. Among those who will buy new equipment for extensions are: Virgil Buntin, of the Lebanon Telephone Company; C. G. White, of the Arcadia Telephone Company; E. Hawkins, of the Home Telephone Company of Noblesvlle; J. J. Brown, of the Consolidated Telephone Company of Danville; F. R. Strickler, of the Franklin Telephone Company; George C. Hitt, of the Indianapolis Telephone Company; J. E. Newman, of the Morgantown Telephone Company; O. P. Macey, of the Mooresville Telephone Company, and Marvin Jessup, of the Deming Telephone Company. It is predicted that more money will be expended on telephone development in Indiana this year than during any previous year.

The reported offer of the Central Union Telephone Company to turn over its local exchanges in certain towns and cities to the Independent companies on a small percentage of the proceeds in exchange for the toll-line business of the Independents, brought out a warm discussion and much diversity of opinion. A resolution was finally passed, declaring it to be a question of too great importance to be handled by a district meeting; that no action should be taken until the annual meeting of the association in May, and that no such proposition should at any time be entertained unless made to include the entire state.

Delegates were elected to the International convention to be held in Chicago in June and to the annual meeting of the Indiana association in May. W. W. Mendenhall and A. J. Newsom were unanimously re-elected president and secretary, respectively.

Telephone Situation in Mexico City.

The New Telephone Company, in which L. M. Ericsson and associates of Stockholm, Sweden, are the principal stockholders, has placed part of its system in the city of Mexico in operation. When its plans are finished the company will have expended more than $2,000,000, it is said, in establishing a modern and complete telephone system. K. W. Pettersson, of Stockholm, chief engineer of the company, and under whose direction the installaton of the system is being done, expects to finish the work about May 1st and depart for his home about that date. It is an underground system throughout the city. The lines are also being extended to adjacent towns and villages in the Federal District. The company is expending about $160,000 in the purchase and fitting up of a building to be occupied as headquarters. The same interests have acquired concessions for the establishment of long-distance conphone lines in the states of Vera Cruz and San Luis Potosi. It is stated that it contemplates building long-distance lines to many parts of the republic, connecting them all with the central system in Mexico City.

The formidable competitor of this Swedish company is the Mexican Telephone and Telegraph Company, which has also been at work for the last two or three years rebuilding its lines in first-class style and making extensions of its system in Mexico City and elsewhere. This company is composed of Americans. W. B. Hale, formerly of Chicago, is the capable general manager. It is a pioneer in the Mexico telephone field. There are indications of a spirited rivalry between the two companies. The New Telephone Company starts out, it is said, with a list of 2,000 subscribers.

The Mexican Telephone and Telegraph Company recently completed an extension of its long-distance line between Monterey and Sabinas Hidalgo, state of Nuevo Leon.

Michigan Telephone Business.

At the annual meeting of the Michigan State Telephone Company held in Detroit Philip H. McMillan was elected a director to succeed his brother, the late William McMillan. Colonel Frank J. Hecker was succeeded on the executive committee by Henry Russell. The regular quarterly dividend of 1½ per cent. on the preferred stock was declared. N. W. Harris, Chicago; Isaac Sprague, Boston; W. A. Jackson, Detroit; Elwood T. Hance, Detroit; Dudley E. Waters, Grand Rapids, and others were elected directors.

Officials of the company are not opposing the taxation of telephone companies at their actual value instead of on a specific basis. They argue that the Michigan company can afford to pay taxes on such a basis, but their rivals will be forced to raise their rates in order to meet such taxation. One appraisement of the telephone and telegraph properties in Michigan is as follows: Western Union Telegraph Company, $1,123,690; Postal Telegraph Company, $304,399; American District Telegraph Company, $6,500; Michigan State Telephone Company, $9,443,290; Independent telephone companies, $4,146,590.

Indiana Telephone Items.

The St. Philips Telephone Company of St. Philips has filed articles of incorporation, with the declared purpose of constructing a telephone system in Posey and Vanderburg counties.

The directors of the Lebanon Telephone Company of Lebanon have voted to change to a full common-battery system and to erect a new exchange building.

The Central Union Telephone Company is continuing its efforts in the vicinity of South Bend and other localities in the northern part of the state to induce the Independent exchanges to handle the toll business of the Bell system, and the Central Union will then give up its local business in that part of the state. The Independent operators are discussing the proposition, but will not take individual action, preferring to delay the whole matter until the state convention, to be held in Indianapolis, May 15th.

A number of representatives of telephone companies appeared before the State Tax Board during the last week. L. B. Sale of Ft. Wayne spoke for the United Telephone Company; L. G. Parker of Louisville, for the Independent Long-distance Telephone and Telegraph Company and the Home Telephone Company of Bloomington and Seymour. H. W. Paddock appeared for the Central Union Telephone Company and filed an extension report, showing an increased wire mileage of his company in the state of nearly 50 per cent. E. G. Drew represented the Chicago Telephone Company, operating in Northern Indiana, and urged that the assessment against his company be not raised this year. He reported that 195 miles of additional wire was strung in Indiana during 1906. The Indiana wire was taxed at $90 per mile last year.

The annual reports of telephone companies operating in this state, now being filed with the Auditor of the state, show a decided increase in gross and net earnings for 1906 over those for 1905. The net valuation of property, exclusive of real estate, belonging to telephone companies, was also materially increased during the year 1906. S.

Telephone News from the Northwest.

The council of Minot, N. D., has served notice that the franchise of the Minot Light and Telephone Company will be revoked after six months. The company will resist in the courts.

The Callaway Telephone Company of Callaway, Minn., has been incorporated with $15,000 capital stock.

The Roseau Telephone Company of Roseau, Minn., will install a full metallic system and move to new quarters.

A franchise has been granted at Auburn, Neb., to the Auburn Telephone Company.

The Farmers and Business Men's Mutual Telephone Company has incorporated at Calamus, Iowa, with a capitalization of $10,000. Charles Modhorst is president, and Hans Johnson, secretary.

The Barneston (Neb.) Mutual Telephone Company has increased its capital to $7,000. R.

GENERAL TELEPHONE NEWS.

The stockholders of the Three Rivers (Mich.) Telephone Company have voted to increase the capital stock from $50,000 to $100,000.

The Home Telephone Company of Nashville, Tenn., has reincorporated with a capital of $1,000,000 by W. C. Polk and H. M. Perry. The company already has the nucleus of a telephone system in Nashville.

Six hundred pounds of wire was stripped from three blocks of telephone poles in the northwestern part of Chicago on April 11th by what the police believe to be professional wire thieves. The wire was the property of the American Telephone and Telegraph Company.

E. B. Smith, vice-president and general manager, and G. E. McFarland, superintendent of the Iowa Telephone Company, have just completed plans, it is stated, for the expenditure of several hundred thousand dollars by that company in improving its lines and exchanges in Iowa. About $60,000 will be expended in Des Moines for a large addition to the switchboard, substituting underground cable for overhead lines and extensions.

A telephone bill in course of enactment by the Legislature of the province of New Brunswick gives the local government authority to take over any telephone system in the province upon giving four weeks' notice to the company affected. The bill also provides that the government may control tolls and may order a reduction when they are considered too high. In order not to discourage capitalists, no reduction shall be made until the company is able to pay a dividend of 8 per cent.

The following are among the telephone companies incorporated recently: Goodland (Kan.) Telephone Company; Ellsworth County Co-operative Telephone Company, Ellsworth, Kan.; Hooker (Okla.) Telephone Company; Fargo Union Telephone Company, Fargo, Okla.; Grant County Rural Telephone Company, Pondcreek, Okla.; Farmers' Mutual Telephone Company, Shattuck, Okla.; Whisky Creek Telephone Company, Hastings, Neb.; North Union Telephone Company, Capron, Okla.; Citizens Mutual Telephone Company, Holden, Mo.

CORRESPONDENCE.

Continental Europe.

Paris, April 2.—A hydraulic plant which is to be one of the most important in France will soon be erected upon the Tuyere River, in the central part of the county, and current is to be distributed from the station over a considerable extent of territory. The new plant will be of great benefit in the region, as it will aid in developing not only the electric-lighting system but also the different industries which can use electric motors, and it is already proposed to run a number of railway lines with the current. The Compagnie Thomson-Houston is now carrying out the work and it is to be pushed forward rapidly. At present the company has secured ground along the gorges of the Tuyère, near Cadene Bridge, which extends for a length of eight miles, and the hydraulic work of the plant is already commenced at this point. The Tuyère is one of the largest rivers of the central region and has a swift current, so that it will afford a large amount of power. A canal is to be run along the bank which will connect with the stream at a point not far from the bridge and will then proceed for a distance of eight miles. At the latter point the penstock will run down to the turbine house, giving a head of water of 800 feet or more. It is estimated that the total water supply will give no less than 32,000 horsepower for the turbines. Overhead lines are to be run covering a radius of 20 miles from the plant, according to the first project, and afterward the distance will, no doubt, be increased. Current will be used in the towns of Entraigues, St. Flour, Aurillac and others.

Turning to other recent projects which are to be developed in France, I may mention the following:

At La Rochelle the Chamber of Commerce decided to use electric light in some of the public buildings and is making arrangements with a committee of local engineers in order to carry out the proposed plan.

The Opera House of Nice is to have an increase in the electric lighting and a large battery of accumulators is to be added to the present outfit.

At Toulon the principal theater is also to have some improvements in electric lighting.

The Municipal Council of Saint-Nazaire is considering the question of granting a concession for the city lighting and power to one of the local companies.

There will soon be erected at the town of Corbie, in the Somme district, an electric plant of some size which will be used for the town and also for distributing current in the surrounding region. Current is to be used to a considerable extent upon the farms, where motors of different sizes will drive agricultural machines.

A plant is to be erected in the near future at Toulouse which will be used for water pumping besides for running a number of generator sets. It is expected to use considerable current for the city mains from this plant. Power will be obtained partly from the Garonne River by low-pressure turbines and partly from a garbage-consuming plant.

From Germany comes a new process for the electrolytic deposition of lead from acetate solution. In its essential features the method consists in the electrolysis of a solution of acetate of lead, acidulated by acetic acid. The anode is of lead, while the cathode consists of copper tubes or cylinders which can be given a rapid rotation by a suitable mechanical drive. The current density is stated to be as high as 50 amperes per square centimeter, and in certain cases this amount can be increased to 150 amperes. The deposit of lead is in the form of a compact crystalline layer.

In the latter part of February was opened the new electric railroad from Stockholm to Jarfva, Sweden, and during the first period there were run six trains per day in each direction. Two kinds of trains are used on the line. The first kind is made up of four cars of the four-axle type, two of the axles being fitted with electric motors. For the second train a smaller type of car is employed, having but two axles, and the cars are drawn by a single electric locomotive. In all cases there is a full outfit of air brakes which are supplied from motor-driven air compressors. On one section the trolley wire is suspended above the middle of each track, while on the second section it is suspended at one side. Two different forms of trolley are accordingly used. A. de C.

Great Britain.

London, April 6.—Another of those unexplainable electric-tramway accidents has occurred in which, after the overthrow of the car, everything has been found to be in working order. It happened on an electric tramway system in a London suburb on the south of the Thames on an incline with a right angle turn at the bottom. The whole car full of passengers were more or less seriously injured. No official explanation or theory will be vouchsafed pending the official investigation at the hands of the technical officers of the Board of Trade which is now taking place

The annual convention of the Municipal Electrical Association is to be held at Sheffield from June 24th to 29th. This association has for its membership all municipal electrical officials and its annual meetings are looked forward to as one of the events of the year. Among the subjects which will be discussed are three-phase distribution, depreciation, alternating-current distribution, extensions to outlying districts and the selling price of current. One noteworthy feature concerning these meetings is the refusal of the Local Government Board to allow the expenses of delegates appointed by municipalities to attend on their behalf.

It is very generally admitted that the British electrical industry is by no means in a robust state, but the annual report of that old established firm of electrical engineers, Willans & Robinson, shows that there is vitality if only the right methods are pursued to obtain it. For several years a sad tale has had to be told at each annual general meeting. During the last half year, however, there has been a remarkable revival, due in the main to the firm having taken up the manufacture of steam turbines. A profit of over $100,000 has been made, which, unfortunately, is swamped by the previous losses. But the signs are good.

Another unfortunate undertaking which is taking an upward turn is the Mersey Railway. During the last half year there has been an increase of 60 per cent. in the traffic receipts. This is a concern which the Westinghouse Company undertook to convert to electric traction some years ago under unusual conditions. It has been uphill work, but it looks as if success is at hand at last.

Complaints have frequently been heard of the want of co-operation among electrical manufacturers in Great Britain, from which it might be inferred that no effort has hitherto been made to form an association to look after manufacturers' interests. Such an association does exist in the shape of the National Electrical Manufacturers' Association, whose recently issued report shows, first, that strong efforts have been made toward co-operation by some concerns, and second, that a somewhat discouraging response has been made to the association's overtures. So great has been the outcry against the existing apathy, however, that things are likely to liven up considerably in the future. The annual meeting next week of the association should give a good indication of what the future will bring forth.

The shareholders of the Rand Central Electric Works having sanctioned the sale of their undertaking to the Victoria Falls Power Company; we have nothing to do now but await the development of the latter scheme. For the present all supply will be given from the existing works of the Rand company, but an additional 18,000-kilowatt steam station is in course of erection on the Witwatersrand, 6,000 kilowatts of which will be running in a little over a year. The whole works are expected to be completed by the end of 1908.

Another item of South African news concerns the Johannesburg tramways, which is of interest for more than one reason. In the first place the power house, which belongs to the corporation and supplies both tramways and lighting, is gas driven; it has been designed by English consulting engineers and practically all the plant is being supplied by British firms. There are about 30 miles of street railway now in operation upon the standard gauge of 4 feet 8½ inches. Double-deck cars have been adopted. Each car is fitted with two 35-horsepower motors and Brill trucks. G.

Dominion of Canada.

Ottawa, April 13.—The bill before the Ontario Legislature to amend the act relating to the transmission of electric power to municipalities in Ontario provides that any municipality may supply power to outside points. The hydro-electric commission is also empowered to take electric energy from companies developing power outside of the province.

It is stated that an important deal has been closed whereby the waterpower at the falls near Galetta, Ont., has been acquired by a new company. It is the intention of the company to develop the power for several purposes, including the erection of a power transmission line to be built from the developing plant to the town of Arnprior.

Fourteen American engineers and about a score of assistants have started work at Barnhart's Island, three miles above Cornwall, Ont., which is today practically owned by persons believed to be closely connected with the Pittsburg Reduction Company. It is given out that the idea is to build summer hotels, pavilion, race tracks, casino and an electric railway of 10 miles around the island. As the island is situated at the foot of the Long Sault Rapids, it is suspected that there is a big profit afoot to dam portions, if not all, of the Rapids and make there a great waterpower. It is also thought this may embrace a scheme of a big power merger covering all the St. Lawrence power on both sdes of the river for miles.

Toronto will not now expropriate the electric light company of that city, but will construct a plant of its own, having failed to agree to terms with the company. One point in difference was the contracts which the company has entered into with power companies for power at $35 per horsepower, which is much higher than the Ontario Hydro-electric Commission agrees to supply the same. The city declined to assume any obligations. The company has no exclusive franchise and does not attempt to contravert the right of the city to build its own plant. The civic authorities believe that they can build and compete for less money than it would cost to expropriate the Electric Light Company. W.

Winnipeg, Man., April 13.—At a meeting of the Muncipal Council of South Norfolk, Man., the clerk was instructed to communicate with the government as to the best means of installing a municipal system of telephones, as the by-law in favor of its installation was carried at the last election. Particulars regarding construction can be obtained from Francis Dagger, provincial telephone expert, Winnipeg, or from Adam Forbes, Rathwell, Man.

F. J. Cumming of Claresholm, the newly appointed superintendent of telephones for Edmonton, Alb., has entered upon his new duties.

The Lethbridge Electric Company of Lethbridge, Alb., is boring for gas and oil in that town.

P. E. Hart of the Allis-Chalmers-Bullock Company, Montreal, has been engaged as telephone expert for Kenora, Ontario.

The Alberta government has a crew at work building a long-distance telephone from Coleman to McLeod.

At a meeting of the Brandon City Council it was decided to at once apply to the government for assistance toward the construction of a municipal telephone system. Hon. J. W. Howden, minister of telephones, Winnipeg, Man., was seen in reference to the matter and agreed to at once arrange for the constructon of a municipal system in that town.

Negotiations are being made for an electric street railway to connect Nelson and Chilliwac, British Columbia. The British Columbia Electric Street Railway Company, Victoria, B. C., has been approached on the matter and is now looking into the preliminary work.

The town council of Virden, Man., has voted in favor of the construction of a municipal telephone system to be constructed at the earliest possible date. A. G. Macdougall is clerk.

The Medicine Hat (Alberta) Town Council has decided to have a municipal telephone system, and if the Bell company will not sell out, the town will build a competitive system. F. G. Forster is mayor.

This summer the Bell Telephone Company will build a long-distance telephone line from Prince Albert to Regina, Sask., a distance of 248 miles. F. C. Patterson is district manager at Winnipeg.

The first government-built telephone service in Canada is now completed and will be in operation in a few days. The line runs from Banff to Calgary, Alb.

On April 22d the ratepayers of Morden, Man., will vote on a by-law to raise $22,000 for the construction of an electrical plant. S. Scott is interested.

The McLeod (Alb.) Telephone Company is getting its system in shape and will build a long-distance line to connect with the government line to the north of McLeod. R. F. R.

New England.

Boston, Mass., April 13.—The Stanley Electric Company has awarded the contract for building an additional factory 200x150 feet in Pittsfield, Mass.

The Greenfield, Bernardston and Northfield Street Railway Company has been organized.. It has a capital of $75,000 and will build an electric railway between Greenfield and Northfield, Mass. John Wilson, president of the Greenfield Board of Trade, heads the directors.

The General Electric Company has bought 7,000 square feet of land in Lynn, Mass., adjoining property the company bought several months ago. The company will build extensions to its plant.

The Avon Manufacturing Company has equipped its Lewiston, Me., mill with five electric motors, which will be operated by electricity generated at the Deer Rips.

The Boston Transit Commission has awarded the contract for building the section of the Washington Street tunnel, which passes under the East Boston tunnel at the head of State Street. Patrick McGovern received the contract at $182,935, or $187,335 if underpinning were necessary.

The Massachusetts House of Representatives has killed the bill which changes the present law governing the municipal acquirement of gas and electric-light plants. The present law requires a two-thirds vote of two successive city councils and a ratification by the voters. The new bill proposed a majority vote of one city council and a popular ratification.

The Boston School Board has voted to appoint a committee of three oculists and two electricians to report on the best lighting of schoolrooms.

The Marlboro Electric Machine and Lamp Company has recently shipped 95,000 incandescent electric lamps to a New York house from its Marlboro, Mass., factory. The company is filling an order for 500,000 incandescent lamps at its Central Falls (R. I.) factory and it has refused another large order, owing to the scarcity of help.

The West End Street Railway Company proposes to issue 8,400 shares of common stock at a par value of $50 per share.

Eighty students of the Lawrence Scientific School of Harvard University have been counting the passengers who board street cars between Harvard Square and Craigie Bridge, in order to obtain data on which to determine the number of stations that will be necessary in the proposed Cambridge, Mass.,

subway, which is the burning question of the hour in that city.

One hundred and fifty linemen employed by the Rhode Island Street Railway Company, the Pawtucket (R. I.) Electric Lighting Company, the Narragansett Electric Lighting Company and the Providence (R. I.) Telephone Company, struck on Wednesday for more pay and shorter working hours.

The Connecticut legislative committeee on railroads has made a favorable report on the resolution incorporating the Bridgeport and Danbury Electric Railway Company, with a capital of $2,000,000. The company proposes to build an interurban electric railway between Bridgeport and Danbury, Conn., via Trumbull, Monroe, Newton and Bethel. The bill authorizes the sale of electricity for light, heat and power in the towns in which the company operates, with the exception of the territory occupied by the United Illuminating Company of Bridgeport, and the Danbury Gas and Electric Light Company. B.

New York.

New York City, April 13.—A writ of mandamus has been granted by Supreme Court Justice Crane, ordering the Department of Water Supply, Gas and Electricity to permit the Flatbush Gas Company to open Ocean Parkway at Avenue I so that the electric wires may be laid from the subways to the company's mains. Justice Crane, however, in his decision, said the arrangement by which the company laid down its overhead wires and placed them underground and took a contract for furnishing the city with light for three years was not to be construed as a perpetual franchise. This action by Justice Crane disposes of a matter that has been before the courts for a long time and is a decided victory for the company.

The West Shore Traction Company has received the consent of the State Railroad Commission to increase its capital and to issue first-mortgage bonds to the extent of $900,000. The company will build an electric road in Rockland County, from Carteret Road, on the New Jersey line, to Tompkins Cove.

It is asserted that the Interborough-Metropolitan company will bid only for the new West Side tunnel from Forty-second Street down and the new East Side tunnel from Forty-second Street up, depending on the present subway system to fill the remainder.

Authority has been granted to the Coney Island and Brooklyn Railroad Company by the State Railroad Commission to increase its capital from $2,000,000 to $3,500,000. The company proposes to use the proceeds of the sale of the new stock in the general improvement of its equipment and for the construction of power house and transformer stations needed in order to enable the company to give successful service.

That a halt was called none too soon in the city's programme of huge and expensive undertakings is shown by a list presented to the Board of Estimate, of improvements to which the city is committed amounting to $199,650,000. This does not include more than $100,000,000 worth of big enterprises, work on which is already in progress, nor does it include any part of the $162,000,000 Catskill water supply. The list was prepared by Chief Engineer Nelson P. Lewis of the Board of Estimate, by direction of the mayor. It was called forth by the recent report of the Advisory Board that the city's large expenditures had brought it so near the limit of its borrowing capacity that a rigorous policy of retrenchment was advisable.

Attorney-general Jackson has assumed the offensive to quash the proposed American (Bell) and United States Independent Telephone merger. He not only brings suit for the dissolution of the combination, but, through Justice Betts, has secured an injunction prohibiting the consummation of the agreement to transfer the United States to the American. The court's final decision in the case is expected to have a bearing on other important cases.

According to programme, the bids for the construction of the section of the new subway loop in Centre Street, between Pearl and Canal streets, have been opened by the Rapid Transit Commission. Only two bids were received, one from the Cranford Company of Brooklyn, and one from the Degnan Contracting Company of New York. The bid of the Cranford Company, which is constructing the Brooklyn subway, is for $3,775,000 for the subway and $30,000 additional for the pipe galleries. The bid of the Degnan company, which built the subway in lower Broadway, is for $2,952,000 for the loop, and $83,000 for the pipe galleries. D. E. P.

Southeastern States.

Charlotte, N. C., April 13.—The Georgia Railway and Electric Company will expend at least $100,000 in additions to its present plant at Atlanta.

The Southern Power Company, which is extending its power transmission lines, is making plans for a $100,000 distributing plant and equipment to be located at Spartanburg, S. C. The power will probably be drawn from the Ninety-nine Islands development on the Broad River, about 25 miles distant.

The state of North Carolina has authorized the Bryson City Light and Power Company to construct an electric-light plant to supply lights to Bryson City and other towns in Swain County. The capital stock is $50,000, with $10,000 subscribed. R. J. Abbott, J. L. Gibson and others are stockholders.

The annual meeting of the New Orleans Railway and Light Company was held April 8th, at which time the 15 directors were re-elected and President E. C. Foster submitted his annual report, showing that $2,500,000 had been expended for improvements during the last year. The gross earnings for the year ended December 31, 1906, were $5,773,000, an increase of $679,480, while the net income for the year was $798,000. The total operating expenses were over $3,000,000.

President R. L. Williams of the Portsmouth (Va.) Traction Company states that his company has raised and is expending over $3,500,000 in improvements in that section. A $1,000,000 power plant will soon be put in operation and the company will handle a large proportion of the visitors to the Jamestown Exposition.

The Macon, Americus and Albany (Ga.) Electric Railway Company has been granted a charter by the state to build a 199-mile line from Macon to Albany.

The Georgia Railway and Electric Company has created a department of publicity, with Mr. E. F. Johnson in charge.

Pelham, Ga., has voted bonds for lights, water, etc.

Chattanooga, Tenn., is making an effort to secure the location of a rumored new plant of the Westinghouse Electric and Manufacturing Company.

The Green River Manufacturing Company, with $250,000 capital, has been organized to develop a waterpower in Henderson County, N. C., and erect a manufacturing plant. S. B. Tanner and J. A. Durham of Charlotte, N. C., are interested.

R. L. Weide of Washington, D. C., is engaged to make plans for an electrical development representing an outlay of $1,500,000 on Linville River in Burke County, N. C. The development proposed is in a deep gorge in the mountains of North Carolina on a mountain stream. L.

Ohio.

Toledo, April 13.—At present it would seem that the bulk of the actual electrical business in this state is in the light and power field. Electric signs are selling in large numbers; electric cooking utensils are in great demand, and in Cleveland, Cincinnati, Toledo, Columbus and other points where there is an active commercial electric plant, a vigorous and persistent advertising fight to introduce the use of electric utensils for cooking is being made. Particularly in Toledo and Cleveland is this fight telling, and power-supply men of both cities are authority for the statement that it is having a material effect on the sale of electricity.

Bryan and Montpelier, Ohio, and Evansport, Ind., are having a lively tilt in an effort to secure the power house to be erected at one of the three places by the Northwestern Ohio Electric Railway Company. The contract calls for the construction of 34 miles of road from Montpelier through Bryan to Defiance, and work will be commenced not later than May 1st of this year.

Frank E. Butler, representing the De Forest company, is now in Toledo looking over the ground with a view to establishing a wireless-telephone station. The station may be placed on the top of the 16-story Nicholas Building.

From Lorain, Ohio, comes the announcement that another Ohio belt line of trolleys is to be built very soon which will connect the towns of Oberlin, Elyria, Amherst, Lorain and Oak Point. Definite details are withheld in the announcement, but the intimation is made that the plant emanates from the Everett-Moore syndicate.

At a meeting of the Northern Ohio Traction and Light Company, held at Massillon, Ohio, last week, it was practically decided that this traction company will not build the contemplated line through Dalton, but that an effort is being made to extend the West Brookfield road on to East Greenville. The new line between Barberton and Wardsworth was put in operation last week.

The City Council of Mt. Vernon, Ohio, granted a renewal of the franchise to the Mt. Vernon Electric Street Railway Company last week. The franchise has not been accepted by the company as yet, but, judging from the statement of W. H. Abbott, one of the officers of the company at Cleveland, there is likely to be some trouble before it is accepted. The ordinance as passed by the council stipulates that the company must furnish free lights for city buildings, engine houses, library and two electric arches. It is on the question of these free lights that the fight will come.

The Marion Electric Supply Company, with office and business room on South Main Street, has passed into the hands of J. B. Yazell and D. J. Shelton. Robert L. Bruce, the former proprietor, sold out his entire interest in the business.

The new dynamo, switchboard and accessories for the new city lighting plant of Continental, Ohio, is in process of installation.

The Shoepf syndicate has announced its route for the line from Lima to Bellefontaine. Waynesville, Lewiston and Huntsville will be included in the line. The road will circle the south bank of the Lewiston reservoir, and, with this exception, will be practically an air line between termini. Cars will be running between Waynesfield and Lima before winter, and it is hoped to have the line completed to Bellefontaine early in the spring of 1908. It is also announced, in a semi-authoritative way, that this summer will see the construction of an immense power station at Lima, to care for the several Kelsey-Schoepf lines operating out of and through that city.

The Dayton and Xenia and the Dayton, Covington and Piqua electric-railway companies are having plans prepared for a union freight station on Kenton Street, between Third and Fourth, in Dayton, Ohio.

Specifications are being prepared for the electrical work of a seven-story department-store building for John R. Coppen, to be erected in Covington, Ky. The specifications are being prepared by James Gilmore of Cincinnati. It is probable that an electric elevator will be installed.

The new $100,000 wholesale-grocery building to be erected in Cleveland for the Eldredge-Higgins Company of Columbus, will require considerable electric work.

The Lakeside Company of Lakeside, Ohio, has closed a deal with the Toledo, Port Clinton and Lakeside Electric Company by which the popular resort is to be furnished with light the year round. The Lakeside Company had planned to install a new dynamo in the electric-light plant in order to secure better service, but the railroad company made a very advantageous proposition, which the Lakeside Company decided to accept.

The John L. Walker Company of Hamilton, Ohio, plumber and gasfitter, has arranged to move into a new location on Court Street, and when the change is made, it will enlarge the plumbing branch and also add an entirely new department, that of electrical supplies of all kinds.

The Dayton Citizens' Electric Company has put into service the new power plant in East Third Street. The underground system is also practically complete. The new building is constructed of concrete and steel and is of modern construction. It is equipped with two 1,000-kilowatt turbo-generators of the Westinghouse type and a General Electric switchboard. Cyrus E. Mead is secretary and manager of the company. H. L. S.

Michigan.

Grand Rapids, April 13.—Official announcement is made of the completion of the big dam of the Grand Rapids-Muskegon Power Company at Croton, its equipment with machinery and the intention to have it producing electric power by May 15th. For the last year the company has been at work on this Croton dam. It is said it will make the company's power rank second to Niagara, developing 60,000 horsepower. The company will furnish 4,000 horsepower to the Grand Rapids Railways Company for the operation of its cars, but only half of this amount will be furnished this summer. The company purposes furnishing light to private houses and stores and will be ready to undertake this work by May 1st. The company will carry a big line of fixtures. In addition the general office building is to be remodeled, the offices will be moved to the second floor and the first floor given over to equipment for demonstration purposes. The company was capitalized at $7,500,000, and more than $3,500,000 has been expended to date in building and equipping plants and running car lines.

With the strike on the Michigan United Railways and the change in ownership of the South Haven branch of the Pere Marquette to an electric railway company, there has been great activity in electric road circles the last week. The only real gain to the employes as a result of the strike of the Michigan United Railways is the increase demanded in the wage scale. Recognition of the union is not a part of the agreement, nor the issuing of annual passes as demanded by the employes. The new wage scale is 19, 21 and 23 cents an hour on the city lines and 23, 24 and 25 cents on the interurbans; all motormen and conductors are to be reinstated and take their runs, as before the strike.

The first authoritative statement by the Kalamazoo, Lake Shore and Chicago Railway Company was given Wednesday morning by the president of the company, S. J. Dunkley, regarding the deal with the Pere Marquette system by which this road secures control of the South Haven and Eastern branch of that system. Briefly, the plans of the company provide: To cover the distance between Kalamazoo and South Haven, via Lawton, a distance of 60 miles, in 1 hour and 20 minutes; to make it possible for a passenger to travel from Kalamazoo to Chicago for $1.50; to lay a spur of track to Paw Paw Lake; to locate a handsome depot in the central part of Kalamazoo; to convert the road between Kalamazoo and South Haven into a third-rail electric system at an early date.

It is announced that J. J. Tweedle and others will form a company to furnish electric power from a dam at Leland, where 600 to 700 horsepower can be produced. The company has customers at Sutton's Bay, Leland, Provemont, Omena and Northport.

The Bay City Traction and Electric Company has decided to begin the construction of an addition to its plant that will slightly more than double its output. It will install new turbine engines throughout and add 1,000 horsepower to the boiler capacity. Two new dynamos will be placed and the cost of the improve-

ment, including the new building, will be about $100,000. The present plant was built five years ago at a cost of about $125,000. L. W. B.

Indiana.

Indianapolis, April 13.—The bondholders of the Lafayette Gas Company, the Indiana Natural and Illuminating Gas Company, the Ohio and Indiana Gas Company, the Logansport and Wabash Valley Gas Company, and the Ft. Wayne Gas Company have formed a plan to merge these properties under the management of one company to be known as the Indiana Consolidated Gas and Light Company. The new company will have a total capital of $6,750,000. It is surmised that the company contemplates furnishing electric light, as well as gas, on a large scale.

A new natural gas territory has been discovered seven miles east of Noblesville. The Noblesville Gas and Improvement Company has brought in several wells which rival the best wells known during the palmy days of natural gas development. The company is putting down 20 more wells.

The City Council of Brookville has awarded a contract to the Cincinnati and Aurora Lighting Company to light the city for 20 years at $54 a light, moonlight schedule.

Under the new law foreign corporations coming into Indiana to establish and conduct electric-light or other public utility business must obtain a permit from the secretary of state and also file an annual report, setting forth the condition of the plant.

The United Gas and Electric Company of New Albany has filed notice with the secretary of state of its intention to enlarge the company's territory so as to furnish water, heat, light and power to New Albany and vicinity and also to the city of Jeffersonville and vicinity.

A mortgage for $10,000,000 has been filed at Indianapolis by the Terre Haute, Indianapolis and Eastern Traction Company, in favor of the Fidelity Trust Company of Philadelphia, as trustee, to guarantee an issue of $10,000,000 bonds. The mortgage covers five interurban roads, which Hugh J. McGowan and associates recently acquired by purchase and lease, and constitutes the final step to the big traction merger. S. S.

Illinois.

Peoria, April 13.—According to the report of the commission appointed two years ago by Governor Deneen the proposed deep waterway is practical. The report has been sent to the House with a message from the governor recommending that the commission be given authority to develop the waterpower between Lockport and Utica and that the commission be authorized to sell the power, and that part of the revenue obtained from the sale of the waterpower be made to contribute to the construction of the deep waterway.

The Cuthbert Electric Manufacturing Company of Chicago has been incorporated with a capital of $26,000 to manufacture electrical specialties. Incorporators are John Cuthbert, George E. Black and Robert J. Frank.

C. L. Gates has purchased the Palmyra electric-light plant, which will be managed by his son, Earl Gates.

The La Harpe Electric Light and Power Company has purchased a new storage battery to carry the lighting load after the plant has shut down at night.

The Carthage Electric Light and Power Company will furnish the power for the new interurban railway to be built from Nauvoo and Carthage to Fort Madison, Iowa.

J. J. Finn, president of the Springfield and Southeastern, has returned from New York and announces that the road has been financed and will be operating by next fall.

The University of Illinois debating team defeated the team representing the University of Nebraska at Urbana this week. The local team upheld private ownership of street railways while the visitors were for municipal ownership.

The first car was run to East Peoria from Bloomington this noon on the new road of the Peoria, Bloomington and Champaign Traction Company. Owing to the bridge being unfinished here the line cannot be opened for some time as yet. General Manager L. E. Fischer and a party of officials made the trip. Ground has been purchased in East Peoria for a coal mine, and work will be commenced at once on sinking a shaft. With the opening of this mine the coal problem of the traction company seems to be solved, as it can haul the coal to either of its large power houses. V. N.

Northwestern States.

Minneapolis, April 13.—Condemnation proceedings have been begun by C. C. Cokefair of Duluth, and associates along the Mississippi River in Stearns, Wright and Sherburne counties. The Cokefair interests already have secured waterpower rights at Clearwater, Monticello and Otsego, Minn., and propose to construct a large power plant and furnish power to Minneapolis and neighboring towns.

John Absher of Wagner, S. D., has applied for an electric light and power franchise at Mitchell, S. D.

L. B. Hanna of Fargo, N. D., is investigating the feasibility of building a trolley line from Wahpeton, N. D., to Breckenridge, Minn. Should the line be built it would eventually be extended to Fargo.

Plans have been approved for the new power dam across the Mississippi River at St. Augusta, Minn. It will be 484 feet long. O. T. Haugen of Grand Rapids, Wis., will oversee its construction.

The South Dakota Gas-Electric Railway Company has announced that it will have a line completed at Huron, S. D., by September 1st.

E. E. McKee has been voted an electric-light franchise at Canfield, Iowa.

G. Meissner of Oconomowoc, Wis., and others are promoting a trolley line connecting Beaver Dam, Oconomowoc, Neosho, Hustisford and Juneau.

There is talk of installing an electric-light system at Platte, S. D.

A. H. Frantz, city clerk, is taking bids for the installation of an electric-light plant at Friend, Neb.

There is talk of establishing a municipal electric-light plant and waterworks system at Kearney, Neb.

Electric-light plant bonds have been voted at Tekamah, Neb. R.

Pacific Slope.

San Francisco, April 11.—The electric-light and power situation has improved in San Francisco and throughout California since the heavy rainstorms (which interrupted the service on transmission lines) ceased, and the fire damage to the main power station in this city has been partly repaired. Several isolated plants are being installed in this city in new buildings. The first unit of the new electric power plant in the Kohl Building has been installed and given a test run. Two additional units are being installed on a three-wire system, giving the total capacity sufficient to supply also one or more outside buildings in the vicinity.

The Building Trades Council of San Francisco, following the action that caused all members of its affiliated unions employed on the Fairmount Hotel to quit work, expelled Electrical Workers' Union, No. 6. The latter organization later withdrew its men from the job and the work on the big hotel building went on with the Building Trades Council in full control. The members of the other unions, with the exception of the plumbers, returned to work, and the building will be ready for the grand opening on April 28th, the anniversary of the fire, which damaged it to the extent of $1,000,000 when it was approaching completion last year. The 400 members of No. 6, while they made this concession to avoid marring the celebration of the rebuilding of San Francisco, have not given up entirely. Last Sunday they held a mass meeting and demanded that the present Building Trades Council under the management of President P. H. McCarthy be dissolved and another one formed that would give what they considered a fair trial. They have since held a special meeting and ordered a walkout of all members of No. 6 at work on buildings in the city. About 350 men were thus called out.

The threatened strike of the 300 or more telephone operators employed by the Pacific Telephone and Telegraph Company in San Francisco has not yet been declared. Officers of the company have been doing all in their power to prevent the movement among the girls toward the forming of a union.

The Western Power Company is considering the question of securing a site for a very large steam reserve plant of large capacity in San Francisco or Oakland as an auxiliary to its 180-mile hydro-electric transmission line now under construction. Work is being pushed on the enlarging and extending of the Big Bend Tunnel in connection with the company's initial power plant. This is to have a capacity of 60,000 kilowatts at first and is capable of extension. The repeated floods, interrupting the service of nearly all of the waterpower transmission systems emphasize the necessity for reserve plants of large capacity.

The management of the Los Angeles aqueduct enterprise, which is estimated to cost $25,000,000, has received a telegram from Washington stating that the Forestry Department has approved the application for permission to build a power plant on Division Creek. This creek is in the Owens River Valley and the power plant is to be used in connection with the municipal water project. It is proposed to hold a special election in May to vote upon the issue of bonds to cover the cost of constructing this 240-mile aqueduct and reservoir system.

I. F. C. Wheatman and his associates have made an application for an electric-light and power franchise for a company to be known as the Escondido Electric Power and Light Company, and are said to have plans on foot to supply light and power to the city of Escondido, Cal. A.

PERSONAL.

E. P. Dillon, for many years electrical engineer for the Colorado Springs Electric Company, is now general manager of the Pike's Peak Hydro-electric Company.

M. E. Wallace, former superintendent of the Wilmerding (Pa.) Westinghouse air-brake works, has been transferred to Hamilton, Ont., where he will have charge of the Westinghouse company's air-brake and electric plant. Otto W. Buenting has been appointed to succeed Mr. Wallace at Wilmerding.

H. L. Wills, former contract agent of the Georgia Railway and Electric Company at Atlanta, has been appointed manager of the Savannah Light and Power Company.

Among other honorary degrees conferred by the Western University of Pennsylvania at Pittsburg, in connection with the dedication of the Carnegie Institute, was that of LL. D. on Sir William Henry Preece of England.

Emil J. Zimmer, vice-president of the Pacific Telephone and Telegraph Company, who was seriously injured by an accident in which his carriage was struck by a United Railroads car in San Francisco, is now expected to recover.

O. D. Collins, former superintendent of the Home Gas and Electric Company at Redlands, Cal., has been appointed superintendent of the proposed Redlands and Yucaipe electric railway. Mr. Collins' old position will be filled by F. P. Meserve.

Adolph H. May has gone to San Francisco and assumed the position of superintendent of the Pacific Division of the Western Union Telegraph Company. He has been manager of that company's Salt Lake City office for the last three years.

Albert Henry Stanley, late general superintendent of the Public Service Corporation of Newark, N. J., has been appointed general manager of the Underground Electric Railways Company of London, England, at a salary, it is said, of $25,000 a year.

D. M. Sawyer, newly appointed superintendent of the Peoria, Bloomington and Champaign Traction Company, has arrived in Peoria and will take up the work of operating the road. Mr. Sawyer has been superintendent of the Springfield and Northeastern Traction Company and comes from Decatur, Ill.

Patrick Calhoun, president of the United Railroads of San Francisco, has just arrived in the city, to take charge of the situation and defy the prosecutors of the "graft" investigation, who assert that the overhead trolley privileges on Market and other streets, secured soon after the fire, were obtained by bribery of city officials.

Edward H. Wise of Johnstown, Pa., has been elected general manager of the Citizens' Electric Light, Heat and Power Company of Altoona, Pa. Mr. Wise was for 19 years head of the electrical department of the Cambria Steel Company at Johnstown, Pa. Louis D. Hess of Altoona, who was reported to have been appointed to the position, did not take the appointment.

Hon. George Grenville Benedict, president of the Vermont and Boston Telegraph Company when it built the first telegraph line between Boston, Mass., and Burlington, Vt., died at Camden, N. C., on April 8th, after an illness of six weeks. For 40 years he was editor-in-chief of the Burlington, Vt., Free Press. He was born in Burlington on December 10, 1826. He served in the Civil War, served two terms in the Vermont Senate and was president of the Vermont Historical Society at the time of his death.

Ora Blickenstaff, who has served as a conductor on the Indianapolis and Northwestern electric railway for the last two years, and who was known as the "capitalist conductor," has resigned, to give his entire attention to the work of the Grand Central Traction Company, organized to build an electric railway from Indianapolis to Evansville. Despite the fact that Mr. Blickenstaff is worth $175,000, he worked as a faithful conductor for two years to obtain the experience he desired and for the purpose of learning the business.

Edward J. Nally has been promoted to be first vice-president and general manager of the Postal Telegraph-cable Company. For a number of years Mr. Nally was general superintendent of the western division of the company, with headquarters in Chicago. He was made a vice-president and director of the company last September and removed to New York. Mr. Nally is one of the most capable telegraph men in the country and is also a man of high character and delightful personality. He is justly entitled to the flood of congratulations and good wishes which he will receive.

Mr. F. Johnson has resigned from the sales organization of the General Electric Company, St. Louis office, and has accepted the position of St. Louis district manager of the Wagner Electric Manufacturing Company. Mr. Johnson has been associated with electrical matters in St. Louis for eight years, having been connected with the sales organizations of the General Incandescent Arc Light Company and the Stanley-G. I. Company prior to their absorption by the General Electric Company. Mr. Johnson can be located in the new offices in the Frisco Building, recently opened by the Wagner company to handle its St. Louis business.

ELECTRIC LIGHTING.

The Jay Brown manufacturing plant and the electric-light plant of North Manchester, Ind., were recently destroyed by fire, with a loss of $20,000.

The fire walls protected part of the machinery and building.

J. P. Thon will install an electric-light plant in Owatonna, Minn.

E. Andrews will install an electric-light plant in his sawmill at Kamiah, Idaho.

L. B. Thornton has sold his electric-light plant at Clifton, Tex., to Galbreath & Fox.

Franklin, La., will spend $25,000 in improvements to its municipal electric-light plant.

R. A. Talbot has been granted a franchise for an electric-light system in Rock Valley, Iowa.

T. H. Slover has been granted a 40-year franchise for an electric-light plant in Davis, I. T.

The Albuquerque (N. M.) Gas, Electric Light and Power Company has increased its capital stock of $500,000.

The Denver Gas and Electric Company is making improvements in its generating equipment and has ordered a 6,000-horsepower steam turbine.

The Bryson City (N. C.) Light and Power Company has been incorporated for $50,000 by R. J. Abbott, J. L. Gibson and others to construct and operate an electric-light plant in that city.

"Light from Gaseous Conductors within Glass Tubes—the Moore Light," will be the subject of a paper by D. McFarlan Moore before the American Institute of Electrical Engineers on April 26th.

Ambrose Petry and others of Detroit, Mich., will erect a large power house at Newcastle, Ind. They purpose to expend about $1,000,000. The promoters, it is stated, recently purchased the holdings of the Newcastle Light, Heat and Power Company.

The plant of the Sullivan (Ind.) Heat, Light and Power Company was recently sold to Michael McMorrow of Sullivan and C. R. McGaughey of Brazil, Ind., for $16,000. The new owners propose to spend about $15,000 in making improvements to the plant in order to furnish better lighting service.

According to the Levant Herald, the Turkish Ministry of Public Works has approved the plans for the establishment of an electric power station at Saloniki for electric lighting and traction in the town. The works will be carried out under the supervision of Hamdi Bey, inspector of telegraphs (Constantinople), and Menekche Effendi, municipal engineer (Saloniki, Turkey).

The last of the 28 boilers for the Northern Colorado Power Company's electric plant at Lafayette, Colo., has been installed. The two steam turbines are soon to be installed. Electric power is now being used at the plant on the big crane, which handles all the heavy machinery. The wires are up between Lafayette and Boulder and between Lafayette and Longmont and it is expected that the current from the plant will be furnished to these towns about the middle of May.

New plans to supply electric light and power in the city of Minneapolis, Minn., have been begun by a company recently organized at Duluth by C. C. Cokefair. The waterpowers at Clearwater, Otsego and Monticello are said to be under control of the company. It is said that the company's plans for the future are allied with those of the subway company, headed by J. S. Porteus. Should the subway company be granted the franchise which it seeks the Cokefair company would probably have opened to it a means of distributing its electricity throughout the business portion of the city without the necessity of securing a franchise of its own to use the streets for its wires.

The United States government, after two years of consideration, has just awarded to the Westinghouse companies a contract for the complete electrical equipment of the power station now being erected in connection with the new congressional buildings in Washington, D. C. It will be a most modern plant, located about four blocks south of the capitol, in Garfield Park, and will, when finished, furnish heat, light and power for the group of buildings immediately surrounding the capitol, namely, the Congressional Library, the new Senate and House Office Buildings, and the capitol itself. The contract calls for four 3,000-horsepower turbo-generators. The machinery will all have to be delivered before the end of the present year, when the plant is expected to be in full operation.

The control of the electric-lighting business in the Lackawanna Valley, from Carbondale down, and in a part of the Wyoming Valley from the county line to Pittston, is the next development that may be expected in the reported movement to combine all of the light companies in that section. The Electric Company of America, which is said to control all the companies in Scranton, Pa., including the Lackawanna company, has been making inquiries concerning the sale of the Carbondale company and the Avoca Electric Light Company. It is said that a movement is under way to purchase the electric-light company at Susquehanna. The deal, if carried through, would give the Electric Company of America control of all the principal companies from Susquehanna to Pittston.

The Chicago Securities Corporation was incorporated in Trenton, N. J., on April 15, with an authorized capital of $1,200,000. The company is given various powers, including the right to acquire the stock and securities of other corporations and to produce and deal in natural and artificial gas and electricity.

ELECTRIC RAILWAYS.

A. F. Williams of Topeka, Kan., has been granted a franchise for an electric street railway in Tulsa, Indian Territory.

The Abilene (Texas) Street Railway Company has been incorporated with a capital of $100,000 by J. M. Wagstaff, George L. Faxton and others.

Consul J. E. Dunning of Milan, Italy, reports that a new high-speed electric railway, 90 miles in length, to give Milan additional seaport connections, is projected for early construction. The letters of American firms sent to the consul will be turned over to the agents of the projectors.

By the burning out of one of four 300-kilowatt direct-current generators at the Commerce Street power house of the Milwaukee Electric Railway and Light Company at Milwaukee, Wis., on April 1st, the street-railway service in the northern and northwest districts of the city was demoralized for a time.

T. W. Pratt of Huntsville, Ala., has been granted a franchise to build and operate an electric railroad and an electric-light and power plant at Bridgeport, Ala. The company expects to connect Bridgeport with Copenhagen and South Bridgeport at once, and later extend the system to Jasper, Huntsville, Scottsboro and Stevenson.

The capacity of the power plant of the Denver (Colo.) Tramway Power Company, at Fourteenth Street and the Platte River, will be doubled. About $100,000 will be spent in extensions and improvements. The company furnishes all power for the Denver City Tramway Company. An order has been placed for a 4,500-horsepower steam turbine.

The Ohio Valley Finance Company, which is building an electric railway from East Liverpool to Steubenville, Ohio, has concluded a contract with the Westinghouse companies for the power-house equipment that will operate the road. This will include three 1,000-horsepower turbo-generators, as well as rotary converters and requisite switchboard apparatus.

A. S. Kimberly, C. B. Judd and C. A. Ross of Chicago, and Calvin Manning of Ottumwa, Iowa, have recently purchased and are now in possession of the Albia Electric Light and Power Company at Albia, Iowa. The Engineering Construction and Securities Company of Chicago, of which Mr. Ross is vice-president, is now engaged in the construction of an interurban electric railway from Albia to Hocking, Iowa.

The Mysore State of India has authorized the construction by the Mysore Manganese Company of an electric railway from the Shimoga railway station to the manganese mines near Kumsi in the Shimoga district. The United States consul-general at Calcutta says: "I have been assured by an American at the head of an important tramway that American engineers and American-made materials used in the construction of electric plants of this kind are popular and in demand."

A proposition has been submitted to the City Council of Cheyenne, Wyo., for the establishment of a street-railway system in that city. Parks Bros., bankers of Kansas City, Mo., who are said to be seeking a franchise, have agreed to have the system in operation within 90 days after the franchise is granted them. The line is to be an up-to-date electric system, to pass through the business and residence sections of the city, out to Fort Russell, the lakes north of the city and to the several pleasure resorts. The rapid growth of Cheyenne during the past few years has made it necessary to provide some means of street transportation. If the proposition of Parks Bros. is not accepted negotiations will be opened with others.

In the United States Circuit Court for the District of New Jersey a preliminary injunction was granted in a suit brought by the General Electric Company to restrain the Sunday Creek Company from the further use of series-parallel controllers manufactured by the Morgan-Gardner Electric Company of Chicago, Ill., it having been held in a prior suit that such controllers infringed the Knight and Potter patents, Nos. 587,441 and 587,442, issued August 3, 1897. These patents cover what is generally known as the "K" type of controller, or the type in which the motors are changed from series to parallel connection by the shunting of one motor as opposed to the method in which the circuit is opened while the change from series to multiple connection is made. The controllers involved in this case were used on mining locomotives. It is declared that under the patent agreement existing between the two companies, only the General Electric and Westinghouse companies can manufacture these controllers.

PUBLICATIONS.

Dodge & Day, engineers, Drexel Building, Philadelphia, have issued a handsome pamphlet, No. 16, on "Methods and Work of an Engineering Organization." The illustrations are a noteworthy feature.

The Rock Island Battery Company of Cincinnati, Ohio, is presenting to the trade catalogue No. 12, in which it calls attention to its well-known Rock Island dry cells which the company manufactures in three sizes but only one quality—which is "the very best on every test."

The field of electrical supplies is thoroughly covered in the latest price list, dated April, 1907, of the Central Electric Company, Chicago. The price list applies to the company's 1906-1907 catalogue, No. 24, and is up-to-date in every particular. It will be found valuable in the hands of every holder of the company's catalogue.

The Massachusetts Chemical Company of Walpole, Mass., has just received from the printer the first batch of its new catalogue. This catalogue is neatly arranged, with cuts and full descriptions of the insulating specialties and other goods made by the company. It is bound in loose-leaf style, and additions will be made to it from time to time. The company will take pleasure in mailing a copy to any interested person upon request.

An illustrated supplement of Jeffrey conveying machinery for sawmills, lumber mills and woodworking industries has been issued by the Jeffrey Manufacturing Company of Columbus, Ohio. The book is designated No. 57 B. It is profusely illustrated, many of the pictures being reproduced from photographs of Jeffrey machinery in operation, and demonstrating the great variety of industries for which this company's rapidly growing line of machines and specialties is adapted. This catalogue and 11 others will be sent free to those interested.

The Wesco Supply Company, St. Louis, Mo., has just issued a new bulletin, No. 75, pertaining to the products of its new telephone factory. The bulletin covers a complete list of magneto telephones and switchboards, as well as prices on materials and supplies for telephone line construction. The company attributes the large demand for Wesco telephones this season to the standard of quality which it has persistently maintained in the preparation of all its telephone equipments.

The Expanded Metal and Corrugated Bar Company of St. Louis, Mo., has issued a book of views of work done with the corrugated bar. Some information is given about the bars, together with formulæ and tables for use in designing. It is stated that a continuous mechanical bond, independent of adhesion, is necessary to insure the permanence of reinforced-concrete construction. The book states that the true function of reinforcement is not only to prevent cracks, but to subdivide a given stretch into a great number of very small cracks. The corrugated bar, it is claimed, insures such action. The views shown should prove of interest to construction men.

In its artistic and well-printed catalogue No. 315, the Sprague Electric Company, 527 to 531 West Thirty-fourth Street, New York city, describes and illustrates its line of electric fans. In the cover design of the catalogue appears the head of a young woman, supposedly painted on a ladies' fan. Announcement is made of the fact that the company's Lundell direct-current fan motors have been greatly improved for the season of 1907, with a view of embodying in one fan all the features of the solid base desk, the swivel and trunnion desk, and the swivel and trunnion bracket types. In addition to its line of direct-current fan motors, the Sprague Electric Company offers a line of alternating-current desk and bracket fan motors, also a line of ceiling and column fan motors. A list of appliances for fan motors appears on page 26.

SOCIETIES AND SCHOOLS.

The American Street and Interurban Railway Association, with its affiliated societies, will hold its 1907 convention at Atlantic City, N. J., on October 14th to 18th, inclusive. The convention halls and the exhibit of the manufacturers will be on the Steel Pier.

About two-thirds of the exhibition sections in the large ballroom of the New Willard Hotel, Washington, D. C., have already been taken by the associate members of the National Electric Light Association. The convention committee is considering an unusually attractive display of electrical decorations, which will greatly add to the attractiveness of the exhibition as a whole.

The April meeting of the American Institute of Electrical Engineers will be held in New York on April 26th. D. McFarlan Moore will read a paper on "The Moore Light." Next month, on May 24th, F. J. Sprague will read a paper at the New York meeting on "Problems Relating to Electric Trunk-line Operation." On the same date, in Chicago, a special meeting under the auspices of the

high-tension transmission committee will be held. The annual convention of the Institute will be held on June 25th-28th at Niagara Falls

The proceedings of the second annual convention of the American Public Works Association, held at Atlanta, Ga., in September, 1906, have been published. The book, which is substantially bound in cloth, contains the by-laws of the association and other information concerning the organization useful to members. A good picture is given of the Georgia state capitol building at Atlanta.

The proceedings of the American Street and Interurban Railway Claim Agents' Association for 1906 contain a complete report of the third annual convention held at the State Fair Grounds, Columbus, Ohio, in October of last year. Over 130 pages are devoted to the answering and discussion of questions in the 1900 question box. S. L. Rhoades, chief claim agent of the Philadelphia (Pa.) Rapid Transit Company, is president, and B. B. Davis, claim agent of the Columbus (Ohio) Railway and Light Company, is secretary-treasurer of the association.

The seventh annual session of the Summer School for Artisans, held under the direction of the College of Engineering of the University of Wisconsin, will be begun on June 24th, continuing for a period of six weeks. Courses of study are offered in engines and boilers, applied electricity, mechanical drawing and machine design, materials of construction, fuels and lubrication, shop work and manual training. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work so that the student may take advantage of all the preparation he has obtained. A bulletin describing the work of the School for Artisans in detail will be sent on application to Frederick E. Turneaure, dean, College of Engineering, Madison, Wis.

At the recent meeting of the Railway Signal Association in Chicago considerable discussion took place on electric interlocking plants with a view of amending the specifications to be presented at the annual meeting of the association to be held in October. The discussion of a paper on "Installation and Maintenance of Storage Batteries," read by H. M. Beck, was directed chiefly toward the desirability of testing the condition of batteries by the voltage test and the specific gravity test, both methods finding favor with the members. It was suggested that there might well be, ultimately, a standard form of lamp which could be used with any kind of signal. It was thought possible to standardize the distance from the bottom of the lamp to the center of the lens and the distance from the rear of the socket to the lens, thus making lamps interchangeable.

MISCELLANEOUS.

Contracts for switches and signals for the terminals which it is constructing in New York have been let to the Union Switch & Signal Company by the Pennsylvania Railroad Company. The contracts are the largest of the kind ever let by any railroad company. They will cover the electric tracks from the Passaic River to a point on the Long Island Railroad, east of what is known as the Sunnyside Yard. The system will cover three great yards, besides the running of tracks. The work will include the complete switching, signaling and interlocking equipment for the entire distance, and it will take about a year to complete it.

An International Maritime Exposition will be held at Bordeaux, France, from May to November, 1907, inclusive, in commemoration of the one-hundredth anniversary of Robert Fulton's successful application of steam to navigation. The exposition, which has been organized by the French Maritime League, will be under the official patronage of the French government, it is said. All applications for admission and all communications should be addressed to the Commissioner General, 26 Cours du XXX. Juillet, Bordeaux, France.

An international exhibition will be held in Japan in the year 1912. The buildings to be erected by the government include two scientific buildings, two industrial buildings, two machinery and electric buildings, transportation building, marine product building, and 10 other large buildings. The site of the exhibition has not been selected, but the finance department and Tokyo municipal authorities are reported to have agreed to hold the exhibition within or in the vicinity of Tokyo, and the Tokyo Municipal Council recently voted an unconditional contribution of $1,500,000.

TRADE NEWS.

The Electric Storage Battery Company has moved its Oakland (Cal.) sales office to San Francisco and will temporarily occupy an office at 11 Hawthorne Street, at which place all business handled by this sales office will receive attention.

Under the provisions of the new tariff for British India, electric-lighting, galvanic, telegraphic and telephonic instruments are subject to an import duty of five per cent. ad valorem. Exception is made to this in the case of telegraphic instruments and apparatus, or parts of same, when imported by or under the order of a railroad company, which may be entered free of duty.

The Wagner Electric Manufacturing Company of St. Louis announces the appointment of Mr. F. Johnson as district manager of St. Louis territory. The completion of the new works of the Wagner Electric Manufacturing Company in the outskirts has made necessary the opening of a St. Louis district sales office, and this office will be located in the Frisco Building, Mr. Johnson or his assistants being available at all times for consultation on matters pertaining to the sales in the St. Louis territory.

The Crocker-Wheeler Company, Ampere, N. J., has found it impossible to handle its rapidly increasing business in electric motors and generators in Birmingham, Ala., from its New Orleans and Baltimore offices, and has been obliged to establish headquarters in Birmingham. The company's celebrated rolling-mill motors, built especially for this arduous service, are the "C-W" specialty, which has made the greatest impression in Birmingham. The new office, which is in the Woodward Building, Birmingham, is in charge of Mr. B. A. Schroder, who hitherto has taken care of the New Orleans territory of the company.

BUSINESS.

The Carey Electrical Construction Company of South Omaha, Neb., has been incorporated with a capital stock of $10,000.

The Novelty Incorporated Lamp Company of Emporium, Pa., has increased the capacity of its refilling plant at St. Marys, Pa., doubling the output, and is adding to its new lamp plant at Emporium, Pa. This is made necessary by the large number of orders arriving, due, the company says, to its policy of not increasing prices.

The Westinghouse Machine Company completed its third fiscal year on March 31st last as a regular business organization marketing and selling its own product. Until 1904 the Westinghouse Machine Company was a manufacturing concern, pure and simple, its product being made for another company, which sold it. It is interesting to note that during the last three years the business of the Machine company has been trebled in orders and output. The greatest impetus to the company's business was given when the Westinghouse-Parsons steam turbine was placed upon the market and when the company entered upon the manufacture of gas engines in large units. The orders which the company has secured during the first three months of the present year exceeded by far the aggregate of the business for the same period of last year, and there is every indication that the business during 1907 will show a healthy increase.

Allis-Chalmers steam-turbine contracts obtained during the last month included seven units, comprising standard Allis-Chalmers steam turbines direct coupled to Allis-Chalmers alternating-current generators. The Citizens' Light, Heat and Power Company, Johnstown, Pa., has ordered a 1,000-kilowatt unit and the Delaware, Lackawanna and Western Railroad has ordered a 2,000-kilowatt turbine and alternator for use in the Hampton collieries, about two miles out of Scranton, Pa. One 500-kilowatt unit was contracted for by the Bisbee Improvement Company of Bisbee, Ariz.; another goes to the Binghamton Light, Heat and Power Company of Binghamton, N. Y.; a third 500-kilowatt unit will be installed at Galveston, Tex., at the power plant of the Brush Electric Light and Power Company, while a fourth unit will be placed in the power house of the Northampton Electric Lighting Company, Northampton, Mass. The Savannah Lumber Company of Savannah, Ga., will install a 500-kilowatt unit, which is to be a duplicate of one ordered some time ago.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 9, 1907.

849,368. Electrically Heated Hot-water Bottle. Herbert W. Christian, Toledo, Ohio. Application filed January 8, 1907.

The bottle described comprises a receptacle for water having a filling opening and a second enlarged opening through its walls, an open metal sheath inserted through the enlarged opening and having the margin of the opening sealed around the same, a plug carrying the terminals of an electric circuit, detachably engaging the sheath, and an incandescent lamp adapted to be inserted into the sheath and connected with the terminals of the plug.

849,375. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed May 11, 1901.

In a telephone system are combined with a telephone line circuit, a cut off relay in the line circuit, a line relay, and a source of current also in the line circuit, a cord circuit, a battery connected with the cord circuit and adapted to furnish current for talking purposes, and means for connecting the battery and cut off relay in a local circuit when a connection is established with the line, the local circuit including part of the talking circuit.

849,385. Ore Separator. John W. Gibson, Milwaukee, Wis. Application filed April 2, 1906.

In a magnetic ore separator there are a shaking table, means for reciprocating the table, a number of horseshoe magnets extending transversely across the table, the pole pieces of the electromagnets of one series alternating with the pole pieces of an adjacent series, the table having gangue-discharging openings in alinement with the pole pieces. The magnetic ore is moved in a zigzag path across the table by electromagnetic means.

849,395. Conduit Box. Charles A. Hinsdill, Troy, N. Y. Application filed April 20, 1906.

The patent covers an outlet box for conduits.

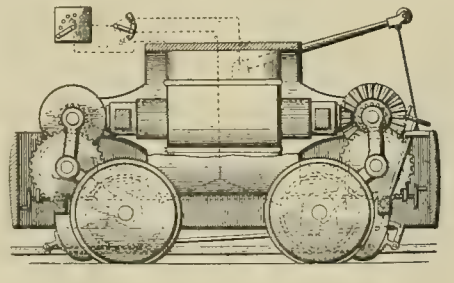
849,415. Plug for Sealing Underground Conduits. William L. McGowan, Philadelphia, Pa. Application filed April 28, 1905.

The plug consists of a front plate having a series of perforations formed with outwardly extending edges forming conical depressions upon the inner face of the plate adjacent to the apertures.

849,417. Coupling for Electrical Conduits. Joseph A. Neth, Dayton, Ohio. Application filed December 16, 1905.

An elongated coupling clamp consists of two parts with interior screw threads and adapted, when in position on the ends of the conduits or pipes, to engage a portion of the threads on each pipe or conduit end and to permit the ends of the pipes or conduits to be brought in contact with each other either before or after the two-part coupling clamp is placed in position.

849,432. Electric Locomotive. Elmer A. Sperry, Cleveland, Ohio, assignor to the Goodman Manufacturing Company, Chicago, Ill. Application filed November 26, 1902.



NO. 849,432.—ELECTRIC LOCOMOTIVE.

Features of this electric rack rail mining locomotive are a truck frame, a propelling gear or gears engaging the rack, car wheels resting upon a track, a motor or motors upon the locomotive, two sets of driving connections to the propelling gears, and a brake attached to each set of the driving connections. (See cut.)

849,443. Circuit-changing Mechanism. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed January 3, 1905.

An electromagnetic circuit-changing device comprises an electromagnet, an extension from each end of the magnet core, an armature and a flat spring secured to one of the extensions and extending in parallel direction toward the other projection, and a mechanical connection between the spring and armature near their outer ends, the armature lying between the magnet and spring and overlapping the other projection.

849,456. Indicator. George Brown, Sarnia, Ontario, Canada. Application filed April 2, 1906.

Combined with the throttle and reversing mechanism of an engine, are an electric indicator comprising a cylindrical casing having a number of series of insulated contacts secured thereto, a traveling contact member adjustable longitudinally and rotatably in relation to the cylinder to select and trace the series of contacts and connections between the throttle and reversing mechanism for respectively effecting the adjustment of the contact member.

849,457. Trolley Controller. Willis C. Burdon, Louisville, Ky., assignor of part to C. H. Jenkins and Thomas W. Moran, jointly, Louisville, Ky. Application filed January 27, 1906.

Details are described.

849,464. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 24, 1902.

Combined with a telephone line, are a cord circuit for establishing connections therewith, a supervisory signal for the cord circuit, and a relay to control the signal, the cord circuit having a connecting plug, a connection from ground through a retardation coil to one contact of the plug, whereby a path for current is provided which allows steady currents to pass to actuate the relay during connection, but which obstructs the voice currents.

849,473. Cash-checking Machine. Edgar Guess, Clapham, England. Application filed June 20, 1904.

The machine which is electrical consists of a switchboard having a series of sliding knobs, each one of which represents a different value equivalent to one or more cash units, a number of contacts equal in number with the number of units represented on the knob having the

highest value, a sliding contact adapted to pass over the contacts and make and break the circuit on the return movement. There is a dial in electrical connection with the contacts.

849,484. Printing Telegraph. Charles J. Menasco, Birmingham, Ala., assignor of part to Rufus N. Rhodes and part to Richard C. Bankston, Birmingham, Ala. Application filed March 5, 1906.

In a printing telegraph system are type-writing machines comprising each a local circuit selecting mechanism, which includes a sunflower and selector arm, electrically controlled devices to advance the arm, a coiled spring which acts both to hold the arm in engagement with the advancing means and to freely restore it to initial position when released from the latter means, and electrically controlled means to release the arm from the advancing means after it has advanced a determined distance.

849,503. Trolley Pole. Quinto Saudelli, Fall River, Mass. Application filed January 23, 1906.

The trolley pole comprises a base provided with bifurcated uprights in which are fixed transverse pins.

849,511. Brush for Dynamo-electric Machinery. Charles W. Speirs, London, England, assignor to the Morgan Crucible Company, Limited, London, England. Application filed November 26, 1906.

Combined with a commutator brush composed of compressed particles, is a metal strip secured to the brush, the strip being provided with a depressed portion having slots therein and a conductor having its end passing through the slots in the depressed portion of the strip and firmly retained in contact with the strip.

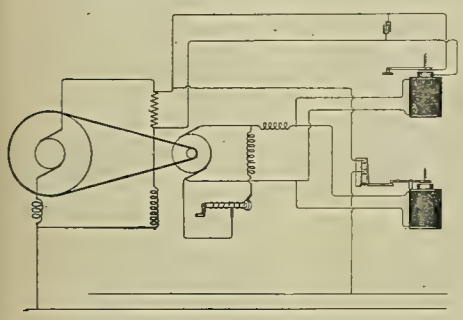
849,524. Process of Extracting and Recovering the Volatizable Contents of Sedimentary Mineral Strata. Delos R. Baker, Delaware, Ohio. Application filed June 23, 1902.

The process consists of the provision of two earth wells from the earth's surface to the subterranean strata in place, the transmission by means of conductors in the wells and by means of ground conduction between the wells through the strata of a current of electricity, the withdrawal in gaseous form from one of the wells of the products of the operation of the current upon the contents of the strata and the recovery of the withdrawals.

849,574. Illuminated Sign. Hugo Ruger, New York, N. Y. Application filed July 28, 1906.

The sign has a rotable member consisting of a framework, translucent panels, a support for electric lighting means within the panels, and extending trunnions, one of which is provided with circular contact pieces in electrical connection with the electric lighting means. The rotary member has supporting brackets, one of which has brushes for engaging the contact pieces.

849,582. Regulation of Electric Motors. Rowland Stebbins, New York, N. Y. Application filed November 9, 1906.



NO. 849,582.—REGULATION OF ELECTRIC MOTORS.

Combined with a motor and a regulator therefor arranged to preserve the motor speed constant, are a generator driven by the motor, the changes in the output of which operate the regulator, a circuit-breaker in the motor lead and means for causing the changes of the generator current to operate the circuit-breaker when the regulator fails to operate. (See cut.)

849,586. Electric Sign. Benjamin Wall, Allendale, N. J., assignor to the Metropolitan Engineering Company of New York. Application filed December 28, 1906.

The sign comprises a supporting plate, an open box-shaped character and incandescent lamp sockets secured in the face wall of the character.

849,593. Electric Igniter. William H. Blood, Jr., Wellesley, Mass. Application filed February 2, 1906.

The device includes means for enabling the spark rod to make sparks at a point distant from its circuit-closing contact.

849,615. Telephone Switch Box. Stephen C. Houghton, Rome, N. Y. Application filed January 21, 1907.

In the switch box are a pivoted telephone-supporting hook, having a cylindrical extension, an insulated support, two spring-acting strips supported thereby having inturned ends which extend above and engage the cylindrical extension and operate to raise the hook, and a switch member engaged by one of the spring-acting strips.

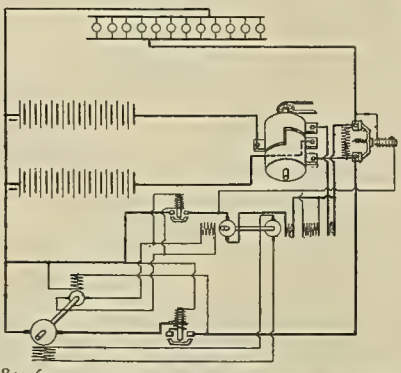
849,637. Automatic Cut-off. John D. Patton, Rosedale, Kan. Application filed December 8, 1905.

In the device described are an electrical conductor arranged in the form of a frame and having a cylinder journaled therein, a contact terminal supported by but insulated from the frame, a switch adapted to establish communication between the terminal and the frame, and contact terminals carried by the cylinder.

849,643. Composition or Compound for Brushes of Dynamo-electric Machines. Charles W. Speirs, Battersea, London, England, assignor to the Morgan Crucible Company, Limited, London, England. Application filed June 29, 1905.

A commutator brush consists of compressed or crystalline plumbago having incorporated with it metallic copper in finely divided condition, the flakes of plumbago being aranged in stratified planes parallel to the plane of pressure, and the metallic particles being so arranged as to form at one face of the brush an uninterrupted metallic surface, and being distributed through the mass in graduated proportions, the proportion of copper decreasing toward the opposite face of the brush.

849,644. Self-regulating System of Electrical Distribution. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company, New York, N. Y. Application filed April 28, 1905.



NO. 849,644.—SELF-REGULATING SYSTEM OF ELECTRICAL DISTRIBUTION.

Combined are a main generator, a work circuit, storage batteries, an exciter apparatus for the main generator having a winding in series with the work circuit for varying the electromotive force of the exciter apparatus in a direct sense to changes in load on the work circuit, and means for connecting the batteries alternately with the exciter winding and the work circuit and then with the main generator. (See cut.)

849,651. Alarm for Fire Escapes. Snowden Ashford, Washington, D. C. Application filed May 9, 1906.

The alarm comprises a yielding balcony floor or platform supported in equilibrium and projecting on the outside of a wall, an electric alarm having two independently adjustable terminals or circuits, and means connected with the floor or platform for actuating the alarm when weight is added to or taken off the floor or platform.

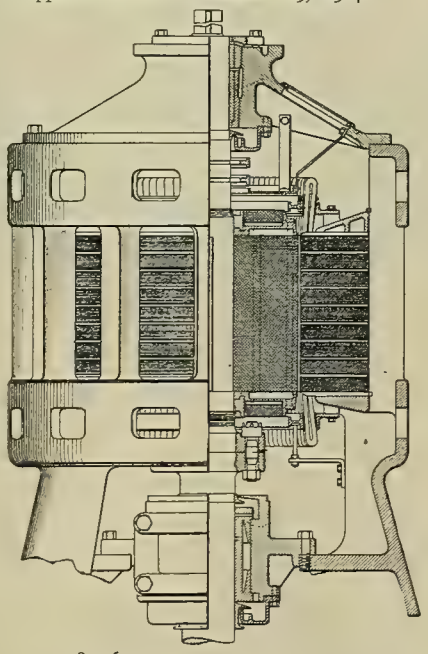
849,653. Electromagnetic Apparatus. Emile Bachelet, Tacoma, Wash. Application filed August 10, 1904.

The apparatus comprises a solenoid for electromagnetic apparatus of large external diameter and small internal diameter and short length, formed of a continuous wire, the wire having one terminal at the core and being looped at intervals to divide the solenoid into sections, and means for connecting one end of the wire to one terminal conductor.

849,666. Trolley for Electric Railways. Walter Edwards, Cedargrove, W. Va., assignor of one-third to George W. Keeney and one-third to William H. McQuillan. Application filed October 17, 1905.

The trolley comprises superposed horizontal sections having recesses forming a socket.

849,670. Dynamo-electric Machine. Samuel S. Forster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 29, 1904.



NO. 849,670.—DYNAMO-ELECTRIC MACHINE.

In the electric generator described are an internal field magnet, an external armature core, conductor portions extending from one end of the core, and an internal support for the projecting conductor portions formed of two parts normally connected together, one of the parts being of less internal diameter than the other from which it is separable to allow of the removal of the field magnet from its normal position within the armature core. (See cut.)

849,684. Electric Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 1, 1901.

Combined with an electric motor are a switch having a single open position, two thermal cut-outs of different current carrying capacity, and means for compelling the transfer of the current from that of greater current-carrying capacity to that of lesser each time the circuit through the motor is closed.

849,698. Electrical Indicating Apparatus. Albert A. Radtke, Chicago, Ill. Application filed October 23, 1905.

The device comprises a number of electromagnetic coils, switching mechanism adapted to maintain an energization of the coils while causing a change in the energization of the coils, and a rotatably mounted non-polarized armature subject to the magnetic influence of the coils, the armature having but one position of stable equilibrium due to any given energization of the coils.

849,703. Electric Railway. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 29, 1901.

In an electric railway a contact shoe comprises a flat metal plate adapted to enter a narrow lateral slot in a third-rail housing, the plate being provided with a perforated angular portion serving as a support.

849,705. System of Electrical Distribution and Regulation. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company, New York, N. Y. Application filed September 15, 1904.

In combination are a main generator, an exciter apparatus therefor, a storage battery connected with the main generator, a work circuit, and means for varying the electromotive force of the exciter apparatus in an inverse sense to changes in the electromotive force of the battery and in a direct sense to changes in the load on the work circuit.

849,706. Cooling Dynamo-electric Machines. Eddy R. Whitney, Swampscott, and Leonard A. Tirrill, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed October 19, 1903.

The machine comprises a stationary member and a rotary member, one of the members being located outside the other member, means carried by the rotating member for generating a cooling current, and a member for directing the current against the outer periphery of the outer member.

849,713. Dynamo-electric Machine. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 29, 1905.

The machine described has a slotted core, a main winding carried in the slots, retaining wedges for the winding provided with slots on their inner sides, and an auxiliary winding comprising conducting strips carried in the slots in the wedges.

849,731. Insulator. Siegmund Feuerstein, Rochester, N. Y. Application filed August 24, 1906.

The insulator comprises a body portion with an inverted conical part with flange at its lower end, and a cap fitted thereover and resting on the flange and having a wire-receiving groove and cement supported by the flange between the cap and the part and wire-retaining members extended across the groove and confined within the boundary of the conical part.

849,745. Attachment to Telephone Transmitters. Flora G. Moulton, Chicago, Ill. Application filed October 8, 1906.

In combination with a telephone transmitter and a U-shaped clamp thereon with a block between its arms, and a bolt through the arms and block, is an eye clamp on the bolt adjustable, simultaneously, in horizontal and vertical circles.

849,749. Controller for Electrically Propelled Vehicles. John S. Raworth, Streatham, England. Application filed January 25, 1906.

The method described of regulating the power and speed of mechanism driven by a number of electric motors, consists in first closing the shunt field circuit to bring the fields to their maximum excitation, then closing the armature circuit through the resistance with the armatures in series, gradually withdrawing the resistance and then breaking the series connection of the armatures with one another and establishing the parallel connection thereof but in series with the series field windings.

849,753. Speed-limiting Device. Fred L. Stone, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 21, 1903.

The speed-limiting device described used for rotary machines comprises a stationary contact and a spring-pressed movable contact mounted to rotate with the machine.

849,754. Incandescent Electric-lamp Support. John Sullivan, Fall River, Mass. Application filed October 24, 1906.

The support comprises a base having a raised central portion formed with a cord duct and with wire ducts leading into the cord duct, and wire connections disposed at the outer ends of the wire ducts.

849,762. Automatic Pressure-controlled Electric Switch and Air Gauge. Louis H. Westphal, Davenport, Iowa, assignor to the Automatic Electric Pump Company, Davenport, Iowa. Application filed April 24, 1905.

In a pressure-controlled electric switch are combined a fixed contact, a movable contact mounted on a spring, a swinging arm to which the spring is attached, a notched block adapted to engage the free end of the arm, a spring carrying the block, an adjustable support for the spring and a reciprocating rod.

849,767. Temperature Regulator. Bert Barton, Dryden, Mich. Application filed May 18, 1906.

In the apparatus described an armature which is hung on the rock shaft is arranged between a pair of electro-

magnets. There are electro-magnetic connections between the thermostat and the electromagnets.

849,709. Sparking Device for Internal-combustion Engines. Francis W. Brady, Englewood, N. J. Application filed August 11, 1904.

In an internal combustion engine having a combustion chamber are combined an electrode extending within the chamber, a bushing in a wall of the chamber, a nut at the outer end of the bushing, a second electrode passing through the bushing and nut, the second electrode having a shoulder located between the nut and the combustion chamber and adapted to bear against the nut, and means for intermittently bringing the electrodes into contact.

849,773. Third-rail Protecting Mechanism for Electric Railroads. Hamlet Corrigan, Pittston, Pa., assignor of two-thirds to Charles Francis Curry and Michael H. Keating, Pittsburg, Pa. Application filed May 3, 1906.

In a third-rail electric railroad there are in combination a curved track, a conductive third rail composed of straight sections disposed adjacent to one of the rails of the track at different distances therefrom, protecting tubes enclosing the rail sections and provided with longitudinal slots for exposing the heads thereof, and rotary slotted sleeves disposed on the tubes and adapted to oscillate to expose or cover the rail sections.

849,797. Igniter for Explosive Engines. Elden P. Lamb, Rockland, Me., assignor to the Camden Anchor-Rockland Machine Company, Rockland, Me. Application filed June 1, 1905. Renewed November 27, 1906.

Combined with the latch for operating the movable electrode in the electric igniter, are means for tripping the latch.

849,820. Spark-ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company, a corporation of New Jersey. Application filed April 6, 1905.

The apparatus comprises a generator with a field magnet provided with curved pole faces, an armature having a single coil journaled concentrically between the faces, and field magnet poles adjustable in proximity to the pole faces and having supplemental pole faces also concentric with the armature.

849,842. Safety Gate Controlling Means. Charles S. Heller, Philadelphia, Pa. Application filed October 3, 1906.

Combined with a safety gate are a source of current supply, and a conductor divided into sections for supplying current to an electrically-operated car, a solenoid connected between one of the sections and the source of supply having means for operating the gate, and an alarm device or devices connected in shunt to the solenoid.

849,850. Telephone System. Leopold F. Müller, Passaic, N. J. Application filed August 7, 1905.

The system described comprises a pair of line wires connected to a battery, a pair of batteries having a positive wire in common, a pair of negative wires connected to the pair of batteries, the signal being connected to one of the last-mentioned negative wires, the transmitter to the common positive wire, and the receiver to one of the line wires and a series of line wires connecting the stations.

849,871. Trolley. Richard W. Walker, Topeka, Kan. Application filed October 15, 1906.

Details are described.

849,889. Automatic Gas Lighter and Extinguisher. Napoleon Corbeil, Charlestown, Mass. Application filed August 21, 1905.

The device comprises an electrical device for igniting the gas supplied by a pilot burner, connections being provided for controlling the operation of the electrical igniter by the movements of the gas supply valve.

849,908. Steel Supporting Structure for Electric Transmission Cables. Albert K. Mansfield, Batavia, Ill. Application filed April 12, 1906.

The structure comprises a laced angle-bar pole, a cross-arm fixed to the pole comprising four angle bars arranged about a central axis and laced together, and means mounted upon the cross-arm for supporting a cable thereon.

849,919. Transmission of Signals. Alfred Perrin, Grenoble, France. Application filed May 23, 1904.

This method of transmitting mechanical signals consists in causing one frame carrying different pendulums at a receiving station to be oscillated by pendulums synchronous to the first pendulums and situated at sending stations, each pendulum of the receiving station oscillating with the synchronous corresponding pendulum of a sending station.

849,934. Electrical Rosette. George B. Thomas, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed December 13, 1905.

The rosette has a base and a knob with a central hole, terminal plates, a lateral outlet from the central hole for the wire ends to the side of the knob between the terminal plates and opposite this lateral outlet a radial slot from the central hole to the side of the knob, this slot extending to the base of the rosette, between the terminal plates.

849,939. Ground-wire Attachment. Clarendon L. Tichenor and Charles D. Stoneburner, Washington, D. C. Application filed March 19, 1906.

A fixture for connecting a wire to a metal pipe, comprises jaws hinged together at one end and having alined apertures in their opposite end portions for the reception of a wire, and means connecting the end portions of the jaws.

849,964. Nautical Signal. Frederick C. Berwick, New York, N. Y. Application filed March 11, 1905. Renewed October 13, 1906.

In the signal are combined a sound producing device, a visual signaling device, a normally closed valve, a spring-restrained lever normally holding the sound-producing device inoperative, a bell crank lever having one arm connected with the spring-restrained lever, a circuit breaker carried by the bell-crank lever for making and breaking the circuit, and means for operating the bell-crank lever to cause the simultaneous sounding of an alarm and the flashing of a light.

849,981. Electrical Hair Curler. Hans Deierl, Munich, Germany. Application filed January 16, 1907.

An electrical hair curler combines a casing, a handle of insulating material at each end of the casing, and a lug carried by the handle, an electrical heating resistance within the casing, and means for connecting the resistance with a source of current.

849,994. Acute-angle Crossing for Electric Railways. Edward E. Gilmore, Philadelphia, Pa. Application filed September 27, 1905.

An overhead crossing for electric trolley systems comprises a body having guiding arms integral therewith, the guiding arms provided with grooves, extensions removably pivoted to the guiding arms and means carried by the extensions for clamping the trolley wire within the grooves of the guiding arms.

850,020. Trolley-wire Holder. Valcoure J. La Bauve, Houston, Texas. Application filed May 9, 1906.

A detailed description is given.

850,027. Indicator. Morris J. Lynch, Ottawa, Kan. Application filed November 17, 1906.

The indicator described comprises an inclosing casing having a trackway therein, signs arranged to travel by gravity along a portion of the trackway, operating mechanism for propelling the signs along the remaining portion, a motor for actuating the operating mechanism, means for holding the signs, means for releasing the signs from the holding means, means for normally holding the motor out of operation, and electrical means for simultaneously actuating the sign-releasing means and throwing the motor into operation.

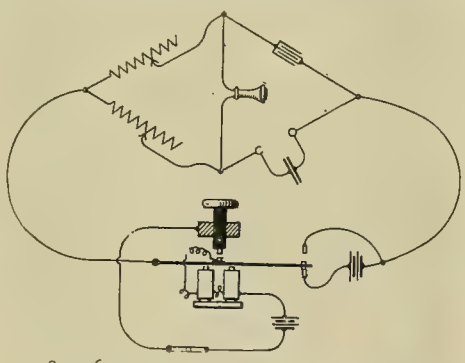
850,036. Telegraphone. George Morin, Havana, Cuba. Application filed June 6, 1905. Renewed September 27, 1906.

Combined are a revoluble disk provided upon both of the faces with magnetic record surfaces, a carriage movable relatively to the center of the disk, separate magnetic members actuated by the cariage and disposed upon opposite sides of the disk, and means completing an electic circuit through both of the magnetic mechanisms.

850,063. Amusement Target. William E. Shaw, Boston, Mass., assignor to Charles S. Bird, trustee, East Walpole, Mass. Application filed June 6, 1906.

The target comprises a face, a circuit closer movably mounted on the face, an electric circuit including terminals, adapted to be closed by the circuit closer, a magnet, an armature, an electric circuit exterior to the target and including electrically-operated devices, a controller for the exterior circuit, and actuating means for the controller normally held inoperative by the armature.

850,064. Apparatus for Measuring Electric Capacity. Harry Shoemaker, Jersey City, N. J. Application filed October 9, 1906.



NO. 850,064.—MEASUREMENT OF ELECTRIC CAPACITY.

Combined are a Wheatstone bridge, a known capacity connected in one arm thereof, an unknown capacity connected in another arm thereof, a vibrator and a source of energy, the bridge as a whole connected in series with the vibrator and source of energy, and means for discharging the capacities after each charge controlled by the vibrator. (See cut.)

850,065. High-potential Measuring Instrument. Harry Shoemaker, Jersey City, N. J. Application filed October 29, 1906.

The instrument comprises a tube of relatively small bore, a seal movable therein, a chamber communicating with the tube, a second chamber communicating with the tube, separated electrical terminals in the second chamber, means bridging the terminals to absorb electrical energy, and current-restraining means external to the chamber and in circuit with the terminals.

850,079. Telephone Repeater System. Nathaniel G. Warth, Columbus, Ohio. Application filed February 5, 1907.

Combined in a telephone repeater system are a twin-repeater apparatus comprising two units, each having a receiver element and a transmitter element united in repeater relation, a main-line circuit having telephones in circuit, induction-coil windings in the line circuit for the repeater, and associated induction coil windings having in circuit therewith both the receiving and transmitting elements of the repeaters which are operated inductively with the main-line circuit.

850,081. Automatic Pressure-controlled Electric Switch and Air Gauge. Louis H. Westphal, Davenport, Iowa, assignor to the Automatic Electric Pump Company, Davenport, Iowa. Application filed October 3, 1905.

In a fluid-controlled electric switch are a movable arm, a contact connected with the arm, a contact fixed relatively to the arm, a spring engaging the free end of the arm and adapted to retain it in closed position, and means for positively actuating the arm in both directions, the means being actuated in one direction by fluid pressure and in the opposite direction by a spring.

850,100. Mining Signal System. Norman S. Richmond, Oshkosh, Wis. Application filed April 9, 1906.

In the system described are a pair of terminal wires having connection with a suitable source of electrical supply and extending down the mine shaft, a signal wire also extending down the mine shaft, signaling means at each of a number of levels of the mine connected between the signal wire and one of the terminal wires, an engineer's signal at the engineer's station also connected between the signal wire and the terminal wire, and signal switches at each of the levels adapted to make connection between the signal wire and the other terminal wire.

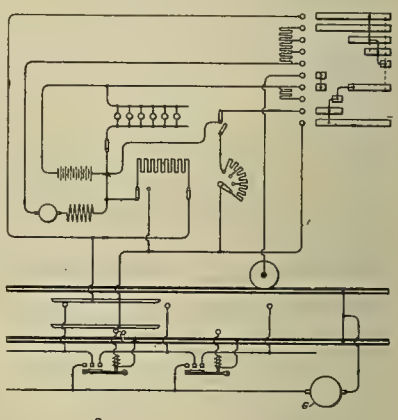
850,101. Drop for Electric Circuits. William H. Robins, Minneapolis, Minn., assignor to the American Bank Protection Company, Minneapolis, Minn. Application filed December 6, 1905.

Combined with a normally open alarm circuit, are a normally open local circuit, a circuit closer in the circuit having a drop arranged when released to close the alarm circuit, a sliding pin in the local circuit, guides for the pin, a spring coiled on the pin and arranged to hold the same in yielding contact with the drop, and a stop for limiting the movement of the pin.

850,116. Core Separator. John P. Mallett, Madison, Wis., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1905.

In a dynamo-electric machine is an annular core formed of laminated material divided into sections and having conductor-receiving slots separated by teeth formed at its periphery, and separators or spacers between the sections extending from a point adjacent the inner surface of the core to the peripheries of the teeth, the separators having ventilating passages formed in them.

850,117. Electric Railway. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 24, 1902.



NO. 850,117.—ELECTRIC RAILWAY.

In an electric railway, combined with a feeder, are conductor sections, switches for connecting the feeder to the conductor sections, motors and an auxiliary source of power carried by the car, and a controller for completing a circuit through the auxiliary source and actuating coils for the switch to initially energize the latter and for connecting the auxiliary source in series with the motors and the coils. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 15, 1907:

425,435. Brush Holder for Dynamo-electric Machines or Motors. F. A. LaRoche, Philadelphia, Pa.
425,470. Distribution of Electric Currents. E. Thomson, Lynn, Mass.
425,488. Contact Device for Electric Railways. F. O. Blackwell, New York, N. Y.
425,489. Electric-railway Contact. F. O. Blackwell, New York, N. Y.
425,507. Electric Snap-switch. C. J. Hamilton, Philadelphia, Pa.
425,511. Telegraph Transmitter. F. W. Jones, New York, N. Y.
425,518. Elevated Cable-railway. W. M. Morgan, Kansas City, Mo.
425,568. Thermo-electric Battery. J. Edelkamp, New York, N. Y.
425,579. Electric Meter. V. Popp, Paris, France.
425,594. Electric Call. J. B. Currier, Lowell, Mass.
425,597. Receiving Apparatus for Cable Telegraphy. P. B. Delany, New York, N. Y.
425,625. Electric Temperature-controller. E. H. Parker, Evanston, Ill.
425,627. Electric Car-motor. E. Peckham, New York, N. Y.
425,630. Electric Call. D. H. Rice, Lowell, Mass.
425,631. Telephone Bell and Connection. D. H. Rice, Lowell, Mass.
425,720. Safety Attachment for Electric-railway Trolleys. F. C. Wheeler, St. Joseph, Mo.
425,757. Electric Heating Apparatus for Electric-railway Systems. M. W. Dewey, Syracuse, N. Y.
425,760. Measurement of Electricity in Distribution Systems. T. A. Edison, Menlo Park, N. J.
425,761. Incandescent Lamp. T. A. Edison, Menlo Park, N. J.
425,767. Electric Railway. T. A. Evans, San Francisco, Cal.
425,801. Electric-lighting System. F. Johnson, Brooklyn, N. Y.
425,818. Secondary Battery. J. F. McLaughlin, Philadelphia, Pa.
425,819. Secondary Battery Electrode. J. F. McLaughlin, Philadelphia, Pa.
425,853. Electric Circuit for Telephone Purposes. A. W. Berne, New Orleans, La.
425,862. Multiple Telephony. J. J. Carty, New York, N. Y.
425,863. Telephone System. J. J. Carty, New York, N. Y.
425,963. Electric Switch. E. P. Warner, Chicago, Ill.
425,964. Electric-railway System. D. G. Weems, Baltimore, Md.
425,965 and 425,966. Electric Railway. D. G. Weems, Baltimore, Md.

WESTERN ELECTRICIAN

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Municipal Excavation by Electric-Hydraulic Mining System.

By Frank C. Perkins.

The great force of water under high pressure for removing dirt and loose ore in mines is taken advantage of in a large number of mines and has been in service for this work for many years, but it is only recently that electric-hydraulic mining methods have been employed for municipal improvements in removing earth. The accompanying illustrations show the apparatus and methods of operation utilized in the adaptation of this hydraulic mining system for removing the earth from the Denny Hill district in the city of Seattle, Wash.

Until recently the removal of dirt has been accomplished by the use of steam shovels, traction engines and wagons, but in this up-to-date western city the salt water from Puget Sound is utilized to cut away the existing hill on the site occupied by the Hotel Washington, in the heart of the city of Seattle, the water being forced a a pressure of 105 pounds per square inch through a four-inch nozzle, as shown in an accompanying illustration.

The municipal waterworks was at first to be utilized for this service, but on account of the hard blue clay encountered at certain portions of the Hill a complete electric pumping plant was installed, as the water pressure of the city waterworks was insufficient. The unique successful equipment was installed under the direction of Mr. H. W. Hawley, and the electric motor-driven pumping station was installed by the Caldwell Brothers Company of Seattle and Tacoma.

The electric motor-driven pumping plant has a capacity of 3,500 gallons of water per minute, the salt water being raised from Puget Sound to an elevation of 160 feet above low tide to the corner of Virginia Street and Second Avenue in Seattle and discharged under a pressure of 105 pounds per square inch through the nozzle of a "hydraulic giant." The pipe line is about half a mile in length from the pumping plant to the point of operation and the pumps are required to work under a total head of 430 feet.

The electrical equipment includes a two-phase synchronous alternating-current motor of the Westinghouse type of 600 kilowatts capacity, shown in the picture. For starting purposes this unit also carries the rotor of an induction motor on the extended shaft, this two-phase starting motor having a capacity of 40 horsepower and operating at a pressure of 440 volts, while the large synchronous motor operates directly on the two-phase circuit of 2,400 volts. The large motor operates at a speed of 327 revolutions per minute, the current for operating the same having a frequency of 60 cycles per second, being obtained from the power lines of the Seattle Electric Company. The induction motor is controlled through an auto-starter mounted on a separate panel of the switchboard, shown in one of the pictures, and has a synchronous speed of 400 revolutions per minute.

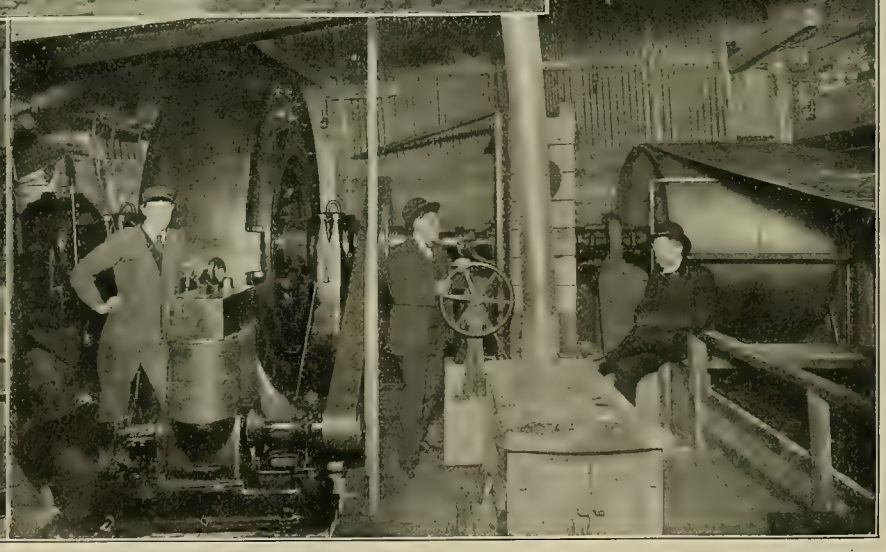
A transformer is utilized for supplying current at 440 volts to the two-phase starting motor through the starting-motor panel on the switchboard, while a special feeder panel is provided for the 2,400-volt two-phase motor. The switchboard with the two panels is equipped with the usual bus-bars and measuring instruments, including voltmeters and ammeters, as well as a synchroscope and automatic oil circuit-breakers. The exciter is a bipolar Edison dynamo driven from a pulley mounted on a main shaft of the large synchronous motor.

The electrically driven pump is of the Worthington type, designed for salt water and fitted with brass impellers and shafting. The thrust bearing of the turbine pump is shown through the open door in one of the pictures. The pump is of the four-stage type and is driven by a belt from a pulley equipped with a special clutch connecting the same to the large synchronous motor. This 30-inch turbine pump operates at a speed of 500 revolutions per minute and is designed for delivering 4,000 gallons of water per minute against a head of 430 feet. This electric pump was carefully tested, a special measuring weir being constructed for the purpose. The belt is four feet wide and drives the pump from a pulley mounted on the main driving shaft, the latter being of hammered steel 6½ inches in diameter, and the tension of the belt is taken care of by an idler placed near the smaller pulley.

An accompanying illustration shows the tremendous force of the four-inch jet of water when the "hydraulic giant" is in action, and indicates the rapidity with which the earth is removed by this method of utilizing the electric-hydraulic mining system for work of this character.

"Hydraulic Giant" Removing Dirt.

Switchboard Room.



Interior of Temporary Pumping Plant.

EXCAVATING BY ELECTRIC-HYDRAULIC MINING SYSTEM IN SEATTLE, WASH.

Cornell Branch of the Institute.

The regular meeting of the Cornell University branch of the American Institute of Electrical Engineers was held on April 16, 1907, in the main lecture room of Franklin Hall. Dr. Steinmetz's paper on "Lightning Phenomena in Electric Circuits" was abstracted by Mr. J. C. Peebles; Professor Creighton's paper on "New Principles in the Design of Lightning Arresters," by Mr. E. D. Payne, while Secretary H. H. Norris gave the results of the paper by Messrs. Rushmore and Dubois on the multi-gap lightning arrester. All the abstracts were prepared and delivered in accordance with the recently published suggestions of Prof. George C. Shaad. The advantages of a systematic method of abstracting papers was demonstrated. The meeting proved to be one of the most interesting of the year.

Direct-current Motor Drive in a Large Wholesale Grocery Establishment.

The use of individual direct-current motors to run machines in manufacturing plants, in order to secure the greatest convenience and at the same time to reduce operating expenses to a minimum, is very well exemplified in the electrical installation in the wholesale grocery establishment of the Durand & Kasper Company, West Lake and Union streets, Chicago. From the point of economy the results

COFFEE-ROASTING ROOM, SHOWING MOTOR-OPERATED ROASTERS.

achieved are worthy of note. A saving of $3,300 was effected in the consumption of coal during the first year of the installation, to which may be added the salary paid to a second engineer, whose services were dispensed with when the electrical equipment was completed. During the month of January, 1903, the company's coal bill amounted to $835, while under the new order of things in the corresponding month of 1906 the value of coal consumed was only $367.

The building of the Durand & Kasper Company is a large six-story structure, equipped with modern machinery incident to the preparation and putting up of coffee, spices, baking powder, preserves, extracts, dried fruits, etc. The electrical equipment throughout is of Westinghouse type. The generating plant in the basement consists of a 110-kilowatt direct-current generator running at a speed of 580 revolutions per minute, operating at 220 volts for both lights and power, and belted to a steam-engine. In all, over 30 motors are used throughout the building, ranging in capacity from ¾ to 20 horsepower each.

In installing the motors care was observed to place them in such positions that their operation would not be interfered with by the various conditions existing in different departments. Accordingly, the greater number of the motors are mounted on the ceilings and concrete walls of the building. In the coffee department, for instance, it was not deemed advisable to place the motors on the floor on account of dust. On the other hand, ceiling mounting was not considered suitable by reason of the steam and chaff escaping from the coffee (usually at an angle of 45 degrees) during the roasting process. So, in the coffee-roasting department, two of the motors of 15-horsepower capacity and weighing 1,800 pounds each are mounted on the concrete wall by means of channel irons bolted to the wall.

In the extract and baking powder department, on the first floor, are two motors of 7½ and ¾-horsepower capacity, respectively, fixed to the ceiling. On the second floor, in the preserves, refinery and bottling room are three motors of 3½-horsepower each, mounted on the ceiling. On the third floor are four motors mounted on the ceiling and walls—two in the syrup department, each of 7½ horsepower, one of 7½ horsepower in the dried-fruit room, and one of 10 horsepower in the mincemeat section. One motor only of 7½ horsepower is used on the fourth floor. All styles of mounting are resorted to on the fifth floor, in the coffee rooms, namely that on the walls, ceiling and floor. On this floor are twelve motors, five of 7½ horsepower, one of 10, two of 5, one of 15, one of 3½ and two of ¾-horsepower. The largest motor in use is that in the spice room, on the sixth floor, of 20-horsepower capacity. In the flour department, on the same floor, are two 10-horsepower and two 7½-horsepower motors, and in the sugar department is one 13-horsepower motor, mounted on the wall.

The bus bars of the switchboard in use are built up of laminated copper. The board has a three-pointed switch, from which a reading can be had of light, power or the total load at any time. Since the installation, almost two years ago, there has not been a shut-down or any trouble experienced. For the first three or four months the plant was operated almost 24 hours daily. An important point to consider in the business of the Durand & Kasper Company is that it means a great loss to shut down the plant for a minute or two, as thereby five thousand pounds of coffee might be burned.

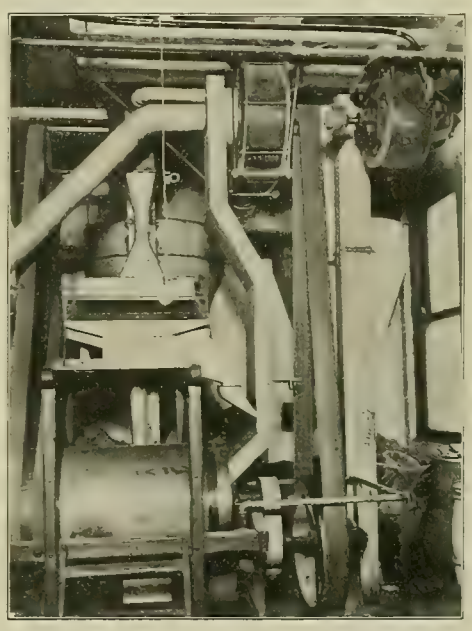
The feeders in use run from the switchboard to the power cabinets on each floor of the building, which contain fuses for the motors. The building is lighted with one thousand 16-candlepower incandescent lamps and with 12 arc lights.

John A. Popp, for ten years master mechanic with the Durand & Kasper Company, planned the installation of the machinery.

Electrodeposition of Metal on Lace.

Improvements in the method of coating lace with metal form the basis of an interesting invention of John A. Daly of Washington, D. C. The object is to cover or electroplate the finest laces and gauzy fabrics with a metal of uniform thickness, and any knitted, netted or woven fibrous or textile openwork material similar to lace can be treated.

In preparation the lace is stretched on a frame and the fibers are then coated with a thin, even coating of shellac. This may be applied with a brush to both faces of the lace. The shellac is thoroughly dried and serves to stiffen the lace. When the stretched lace is dry, the surface is covered with an aqueous solution of nitrate of silver and allowed to dry partially; but before the silver nitrate has thoroughly hardened the surface is again painted or covered by an aqueous solution of sulphide of potassium. The effect of this application of potassium sulphide is to decompose the nitrate of silver, the products of such decom-



MOTOR ON CEILING IN WHOLESALE-GROCERY ESTABLISHMENT DRIVING COFFEE-MILLING MACHINE.

position being sulphide of silver and nitrate of potassium.

The lace is now washed in water, which removes the soluble nitrate of potassium, leaving the lace covered with a coating of sulphide of silver, which is a conductor of electricity. This coating is comparatively inert and will not destroy the fiber of the lace by its caustic properties. The lace so prepared is then connected with a number of thin copper wires, which lead to or extend through a number of points on the surface of the lace. The object of having a number of such connections is to have the electrodeposit begin in a number of places and spread rapidly, so as to save time and also to give a substantially uniform coating of electrodeposited metal.

Having been coated and wired, the lace is then suspended by the wires or otherwise in a plating bath, and electrical connections are made with the wires and bath, so that an electrodeposit of metal may take place on the surface of the lace, the sulphide of silver serving as a conductor for the electrodeposit. Any metal or alloy capable of electrodeposition may be deposited on the lace in the usual way.

After the wired lace has been in the plating bath a few minutes it is removed, and the wires are withdrawn from the lace. The lace will now be found to be covered with a thin coating, which is termed a "preliminary" coating of the electrodeposited metal from the bath. It is next immersed in an alkaline bath to neutralize any acid remaining. It is then washed. The lace is now spread or stretched out and brushed over on both sides with a scratch brush to bind the crystalline metal of the deposit more firmly together and to the fibers or threads of the lace. The brushing down with a scratch brush compacts the metal on the threads, serving to exclude acids during the subsequent treatment. After the metal is compacted by the scratch brush no further wiring is required than the usual wire or metallic connections, such as are usual in electroplating. When so connected and again immersed in a plating bath, the electrodeposit of metal may be continued to the desired thickness.

When it is desired to retain the lace in flexible condition, the first step of coating the lace with shellac is dispensed with. The nitrate of silver is applied directly to the lace.

Heretofore a conductor has sometimes been made by treatment of lace with nitrate of silver. This material is so caustic that it sometimes destroys the fine fibers or threads of the lace and renders the coarser threads and masses of the lace weak and easily broken, like charred wood. By neutralizing the caustic properties of the nitrate almost immediately this defect is avoided, and the strength of the lace is substantially preserved.

By compacting the metal mechanically, as by the use of a scratch brush, after the preliminary deposit in the bath, Mr. Daly says that the basic metal is made stronger and finer, and a better finished as well as a stronger article of metallized lace results.

The invention is covered by a recent United States patent.

The Lac du Bonnet Waterpower Development.

Sixty-five miles from Winnipeg, Man., on the Lac du Bonnet River, is one of the most modern waterpower installations in Canada. It was in 1901 that the Winnipeg Electric Company conceived the idea of harnessing the waters of the Winnipeg River with a view to furnishing electrical energy to Winnipeg. In 1905 this company amalgamated with the Winnipeg Electric Street Railroad Company, and from then on the development of the power proceeded without interruption. There were many engineering difficulties to be overcome.

To obtain the necessary water a channel had to be cut to the upper river, near Otter Falls, 120 feet wide, with a clear depth of eight feet at normal low water. The channel was eight miles long, with a drop of five feet to the mile, equaling a total head of 40 feet. In cutting this channel it was necessary to blast with dynamite about 447,000 cubic yards of granite, which was lifted out of the passageway by means of derricks. With the rate of flow of water through this channel, and the available head, there can be developed 30,000 horsepower. To maintain the levels the year round the water was backed eight miles above the power house, by means of cofferdams, to an average elevation of between eight and nine feet.

The electrical apparatus is fully modern and complete in every detail. The main units in the power house consist of four 1,000-kilowatt and five 2,000-kilowatt revolving-field 60-cycle 2,300-volt three-phase generators coupled to turbines, several 100-kilowatt 125-volt direct-current exciters coupled to turbines, and two 175-kilowatt 125-volt exciters coupled to three-phase 2,300-volt induction motors. The switches are sectional and are separated by walls. There are 15 transformers. The voltage in

15-HORSEPOWER MOTOR MOUNTED ON CONCRETE WALL DRIVING EXHAUST FANS.

operation is stepped up from 2,300 volts to 60,000 volts for transmitting to the sub-station at Winnipeg, a distance of 65 miles.

The power and transforming houses are absolutely fireproof, being built of structural steel and brick throughout. The general arrangement of the sub-station in Winnipeg is the same as that at Lac du Bonnet. The most essential feature in the station construction is the protection of life and

machinery throughout. From the power house there are run duplicate transmission lines, the steel towers being similar to those used by the Toronto and Niagara Power Company between Toronto and Niagara Falls. The towers, as well as the compressors and centrifugal pumps used in the equipment of the plant, were supplied by an American firm. The transmission lines cross the Winnipeg River with a span of about 760 feet on 72-foot towers, each weighing about six tons. The standard towers are placed 500 feet apart and are 40 feet high. Each tower weighs about 2,400 pounds.

The cost of the complete plant will amount to about $4,000,000, and it is felt that this electrical equipment will make Winnipeg possible as a manufacturing center, which the high cost of fuel for the operating of a steam plant and the necessarily high cost of power have hitherto precluded.

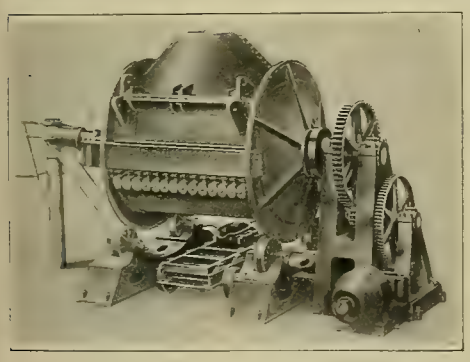
A Modern Electrically Operated Copper Converter.

A modern converter plant is now being erected by the Orford Copper Company at Constable, N. J., under the supervision of Mr. E. Franki, chief engineer. All of the machinery installed there has been designed to meet the most exacting conditions. The evolution of machinery for converting copper has consisted of a progressive series of improvements, due principally to the many practical experiments made by the various operators at different plants throughout the world. By combining those ideas of the various operators which were found to yield the best results and eliminating the defects it has been possible to build a converter which has many advantages over converters used a few years ago.

The converter equipment of the Orford Copper Company's new plant consists of three electrically operated stands and nine shells 84 inches in diameter by 126 inches long. The accompanying picture shows one of the electrically operated copper converters in the plant. The parting joint between the bottom half and top half is considerably higher than in other designs, the idea being to keep this just as high as possible and away from the extreme action of the molten copper.

For turning the shell each stand built for the Orford Copper Company is provided with a 30-horsepower Allis-Chalmers direct-current variable-speed multipolar enclosed-type series-wound motor for 110 volts and 600 revolutions per minute, which is geared up to the main drive shaft so that the maximum speed of shell is reduced to 1½ revolutions per minute. In plants where alternating current is available induction motors are used to turn the converters, and for this service they offer a number of special advantages.

The motor shaft is connected to the worm shaft by a coupling which also acts as a brakewheel for the solenoid brake, and on this extension is keyed a single-thread steel Hindley worm that runs in an oil bath and meshes with a solid worm wheel, thus making the first reduction. On the worm-wheel shaft is secured a cast-steel pinion, which in



MOTOR-DRIVEN COPPER CONVERTER.

turn transmits its energy to a cast-steel gear, both having shrouded teeth and designed for taking care of severe shocks.

Motors for turning converters have very severe work to perform, and in this case the maximum starting torque of motor is several times greater than the full-load torque. All possible chance of the shells turning when the current is turned off is prevented by an automatic braking device. There is a sheet-steel housing for each frame which covers all the driving gear and motor complete, to prevent dirt from getting into the operating parts.

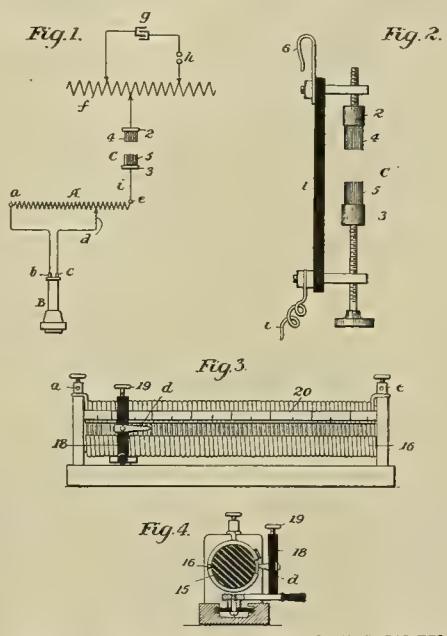
Messrs. C. H. Repath, engineer, of the Anaconda Copper Mining Company, F. E. Marcy of Salt Lake, J. A. Dyblie and B. H. Bennett originated many of the special features which are incorporated in this machine.

Improvements in Wave Meters and Transformers for Radio-telegraphy.

Two devices for use in the operation of electric oscillation systems, as, for instance, radio-telegraph systems, have been invented by Joseph Murgas of Wilkesbarre, Pa., and United States patents have been recently granted on the inventions. One is a meter for measuring the length of waves in radio-telegraphy; and, since the determination of the wave length involves a determination of the frequency, the invention also covers means for measuring the frequency in such systems. The other device is an electric transformer especially adapted for use in connection with radio-telegraphy.

Referring to the wave meter, Fig. 1 is a diagram of connections; Fig. 2 is a side view of an electrostatic means which is preferably employed for coupling the wave meter with the system to be examined; Fig. 3 is a side elevation of the inductance coil; Fig. 4 is a cross-section thereof, and Fig. 5 is a longitudinal section and perspective view of the static telephone receiver.

The apparatus comprises an inductance coil (A), to one terminal (a) of which one terminal (b) of an electrostatic telephone receiver (B) is connected, the other terminal (c) of the receiver having a connection with a sliding contact (d), bearing against the turns of the coil (A). The other terminal (e) of the coil (A) is coupled with the system to be investigated, preferably by electrostatic means (C), comprising opposed electrodes separated by a dielectric. The system to be investigated is shown, for instance, as a well-known oscillator circuit adapted for use in a transmitter of a wireless-telegraph system and comprising an inductance (f), a condenser (g) and a spark-gap (h). Preferably the closed circuit, comprising the coil (A) and telephone receiver, is coupled with the system under investigation through a conductor (i) of



METER FOR MEASURING WAVE LENGTHS IN RADIO-TELEGRAPH SYSTEMS.

considerable length, so that the circuit will be removed from the range of the noise caused by the sparking at the gap (h).

Referring particularly to Fig. 2, the electrostatic coupling means (C), which may also be termed a "still discharger," comprises an insulating bar (1), on which are supported the opposed electrodes (2) and (3), the opposed ends of which are each provided with a number of needle-like prongs (4) and (5). Preferably the electrodes are mounted so as to be adjustable with relation to each other. This may be accomplished by mounting one or both of them upon screws, as shown. One of the electrodes is connected to a hook (6), which serves to make contact with the conductor to be examined, while the other electrode is connected with one terminal of the coil (A) by means of the wire (i).

The telephone receiver (Fig. 5) may have the usual insulating body (7) supporting the usual diaphragm (8), which constitutes one of the electrodes or plates of a condenser and is electrically connected to a terminal (c). The other electrode or plate (9) of the condenser is secured to a screw (10), rotatably mounted and adapted to engage with screwthreads in a metal plate (11), fixed to the body and forming an electrical connection between the electrode (9) and the terminal (b). The outer end of the screw is provided with a knurled head of insulating material (12) for convenience in turning. For indicating the angular position of the screw a pointer (13) is secured to the screw, and its position may be read upon an adjacent suitably graduated dial (14), s cured to the telephone body. The pitch of the screw being known, the separation of the electrodes can be ascertained from the position of the screw with the aid of the pointer and dial. The distance of the electrodes being known, the capacity of the device as a condenser can be readily ascertained by calculation in a well-known way. Not only does this instrument act as a condenser, but the diaphragm is vibrated as the charges pass electrostatically from the diaphragm to the other electrode and emits a sound which is

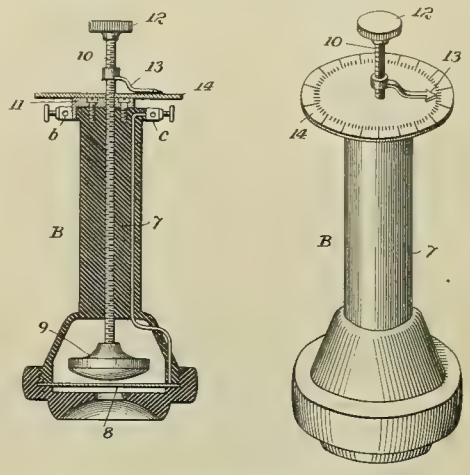


FIG. 5. STATIC TELEPHONE RECEIVER USED IN WAVE-METER READINGS.

louder as the charges are stronger, and therefore a condition of resonance exists when the sound is loudest.

The inductance coil (A) (Fig. 3) comprises a suitably supported core (15) of insulating material on which is wound a continuous insulated conductor (16), each turn of which has a bared portion, so that a sliding contact (d) may contact successively with them as it is moved longitudinally of the coil. The contact (d) is mounted upon an insulating sliding carriage (18), which also carries a terminal (19) for effecting connection with the contact (d). To the ends of the coil the terminals (a) and (e) are connected, and adjacent to the bared portions of the turns a scale (20) is located, the scale having a graduation opposite each turn and calibrated to read the number of turns from one end of the coil. By observing the turn in contact with the slider and its adjacent graduation the number of turns included between the slider and one end of the coil—that is, the number of turns in the closed circuit—can be directly read.

The electrostatic telephone receiver, which is also a condenser, and the inductance coil are connected in a closed circuit which is coupled electrostatically with the system which is to be examined. The intensity of the charges passing to the closed circuit can be regulated by adjusting the separation of the electrodes of the electrostatic coupling means.

The period of the closed circuit depends upon its constants, inductance and capacity, and as for a given adjustment of the telephone-receiver electrodes the capacity is readily ascertained, and from the number of turns of the inductance coil the inductance may readily be found. The period or frequency can then be calculated in a well-known manner. If the closed circuit is in resonance with the system to be investigated they will, from the definition, have the same period, and from the known period of the system the wave length can be ascertained by well-known calculation

The closed circuit is adjusted to resonance with the system to be examined by varying the capacity of the electrostatic telephone receiver and the num-

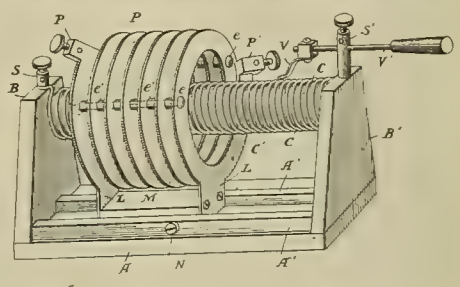


FIG. 6. TRANSFORMER FOR RADIO-TELEGRAPHY.

ber of turns of inductance included in the circuit, or both, and when the resonant condition is reached the receiver emits its loudest sounds. Readings are then taken.

Referring now to the transformer, of which Fig. 6 is a perspective view, the inventor says: "My invention is not limited to the precise details of construction shown therein, but may be varied by those skilled in the art to adapt the invention for various purposes for which it is capable of being used. I provide a suitable support for the operative parts of the transformer and have shown it in the present instance as comprising a base (A), hav-

ing end flanges or uprights (B) (B'), and these latter serve conveniently to support the secondary (C) of the transformer. This secondary may be variously constructed, and I have shown it as comprising a tube (C'), which should be of insulating material, such as hard rubber, and in the surface of which is preferably cut a spiral thread (c). Around this tube or support (C') is wound the wire forming the secondary coil (C), and this wire is bare and is laid in the threads (c) of the tube (C') so as to provide for an invariable distance between the various turns of the secondary.

"In order that the secondary may be included in any desired circuit, one of the terminals of the secondary coil (C) is connected to a binding post (S), conveniently mounted on the upright (B), while upon the other upright (B') I have shown another binding post (S'). In order that any desired number of turns of the secondary can be included in the circuit and made effective I provide a sliding contact, shown in the present instance as comprising a contact (V), mounted on a rod (V'), which is arranged to slide or be adjusted in the binding post (S'). This contact (V) can thus be moved and adjusted so as to include any desired number of turns of the secondary coils, the contact sliding and bearing upon the face of the wire of the secondary.

"The primary (P) of the transformer is made up of a suitable number of turns, preferably in the form of a flat metal, and in order that this may be cheaply and effectively made I provide a number of split or cut flat-metal rings which can readily be stamped or formed out of the desired material, and in order to provide a primary of any desired length it is only necessary to connect the adjacent ends of each two rings in some suitable way so as to form a continuous spiral. The ends of the outside rings of the spirals may be formed into binding posts, as (P') (P'), by means of which the primary can be conveniently connected in circuit.

"In order that the various coils or rings may be maintained at fixed distances from each other, some suitable spacing and holding means must be provided, and I have shown rods (e), preferably of insulating or non-conducting material, as hard rubber, extending through openings in the rings and provided with spacing pieces or tubes (e'), surrounding the rods (e) and arranged between each adjacent pair of coils or rings. The outside or end washer may be in the form of a nut screwed upon the end of the rod in such a way as to firmly clamp the rings together.

"Some means for supporting the primary with relation to the secondary must be provided, and while these may vary I have found it convenient to form the outer rings of the primary coil with legs (L) (L), and these may be secured to a plate (M), preferably of insulating material, which will not only serve to maintain them in proper relation but form a carriage for the primary.

"It is not only desirable to be able to adjust the secondary so as to include more or less of the turns of the coil in the effective portion of the secondary circuit, but it is also desirable to adjust the primary symmetrically with relation to this effective portion so that it may be relatively adjusted with relation to the middle of the effective portion of the secondary, and with this apparatus it will be seen that the contact (V) can be adjusted so as to include any desired number of the turns of the coil of the secondary in the circuit thereof, and the primary surrounding the secondary can be adjusted by moving its carriage upon the base, so that the primary will occupy a symmetrical position with relation to the effective portions of the secondary actually included in the circuit."

Electrical Supplies for the Isthmus.

The office of the purchasing agent of the Isthmian Canal Commission, Washington, D. C., is calling for proposals until May 7th for the following electrical supplies: Fifty thousand pairs glazed china cleats; 10,000 glazed clay tubes; 25,000 porcelain split knobs; 750 Edison plug cut-outs, National Electrical Code standard; 2,300 fuses; 430 knife switches; 100 enclosed cartridge fuses; 200 snap switches; 160 wall switches; 250 switch boxes; a large quantity of Chapman receptacles and plugs, plates, rosettes, key sockets, bushings, porcelain attachment plugs, wall receptacles, Meridian lamp fixtures, protective fuses and non-arcing lightning arresters, all for inside work; 6,400 incandescent lamps, frosted and clear; 200,000 feet triple-braided weatherproof copper wire; 130,000 feet double-braided rubber-covered copper wire; 20,000 feet stranded galvanized iron wire cable; 25,000 feet braided, twisted, cotton-covered, rubber-insulated, double-conductor flexible lampcord; 2,000 feet silk-covered lampcord; 45 pounds tested fuse wire; 20,000 feet waterproof insulated leading wire; 500 pounds insulated connecting wire in two-pound spools.

Eastern capitalists propose to invest $600,000 in utilizing the waterpowers of Holston River for the purpose of generating electricity for lighting and power purposes in Bristol, Tenn.

A New Voltage-regulating Device for Maintaining Synchronism.

A device recently brought out in France by George Mendel relates to an automatic regulating device placed in a synchronous electric transmission between two moving devices and which allows of automatically varying the voltage of one or the other of the electric motors which work these devices. In the case here described the regulator is disposed for the synchronous working of a phonograph and a biograph.

Referring to Fig. 1, (A) is the top of a phonograph box whose shaft is driven by an electric motor, (B) is a biograph whose movement is made in synchronism with that of the phonograph by a motor (C), (D) is a synchronizing device of a known system placed in the circuit of the motor (C) and formed essentially of two concentrically rotating parts (a) and (b). The part (a) takes its movement from the phonograph by an electric transmission, using an electromagnetic rack upon a toothed wheel. Each time the current passes in the electromagnet (d) of the phonograph, the electromagnet (c) works the toothed wheel so as to rotate it. The other revolving piece (b) is worked directly from the biograph by means of a flexible shaft (e). Battery (E) works the two electromagnets (c) and (d), while (F) runs the motor (C). The object of the invention is to cause a perfect synchronism by regulating the voltage of this motor.

Mounted on one of the two moving pieces (a) (b) a brush (f) (Fig. 2) is connected by the mass to one pole of the battery (F) and placed against a drum (g) carried on the second piece. On (g) are placed a certain number of contacts (h) (i) (j), which are also connected with the contact rings (k) (l) (m). Over these latter are the brushes (n) (o) (p) going to the points (q) (r) (s) of a rheostat (G), (Fig. 1). The brush (f) is here shown mounted upon disk (b), which is run from the biograph, while the other part (g) revolves from the phonograph's action.

The operation is as follows: The rheostat is shifted so that the middle point (r) corresponds to a current for a mean speed of motor (C) equal to that of the phonograph, while (q) and (s) are placed so that (q) gives a lower voltage and (s) a higher voltage to the motor, by the different resistances. Shaft (a) is turned by hand in the direction allowed by the ratchet so as to bring the contact (i) against the brush (f). Here, as soon as the phonograph is running, the current distributed by the brush (v) of this shaft acts intermittently on the ratchet wheel of (a) so as to work it in synchronism with the phonograph.

The shaft (a) is turned by hand in the direction of the arrow (Fig. 2), and as soon as the contact (h) comes against brush (f), the circuit of battery (F) is closed, and the current passes by the low-voltage part of the rheostat, acting on motor (C) so as to give the start, working the biograph and also the moving piece (b). The moving part (a) continues to turn with a certain gain upon (b) and places its middle contact (i) under brush (f) so that current passes by the mean-voltage part of the different alternators, with one or more compensating wires, like those which are used upon direct-current compound-wound generators. Again, the magnetic shunt can be placed in the main line from the station bus-bars or in the secondary of a transformer thus situated. Other methods of connecting can also be used.

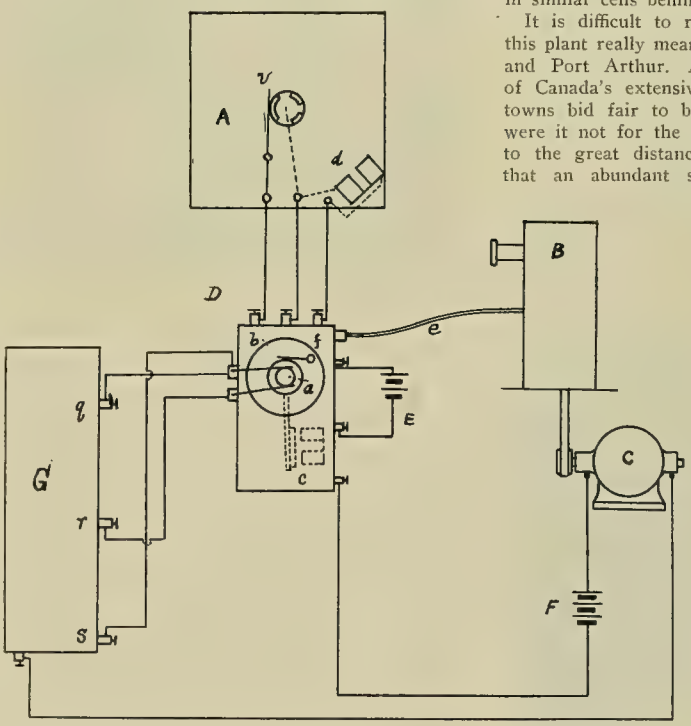


Fig. 1.

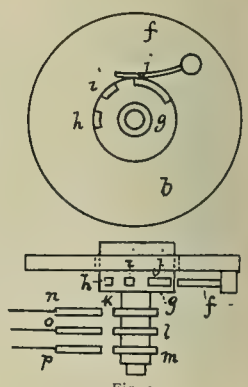


Fig. 2.

MENDEL'S SYNCHRONIZING APPARATUS.

Kakabeka Falls Power Plant.

A project long discussed and variously considered in Canada has at last been crystallized into fact by the Kaministiquia Power Company, and consequently Fort William, Ontario, is now being supplied with electrical energy generated at Kakabeka Falls, on the Kaministiquia River, 25 miles west of Fort William. The power is transmitted to that town by two lines on a single right-of-way, and is there distributed from a sub-station. The electrical equipment is of the most modern and approved pattern.

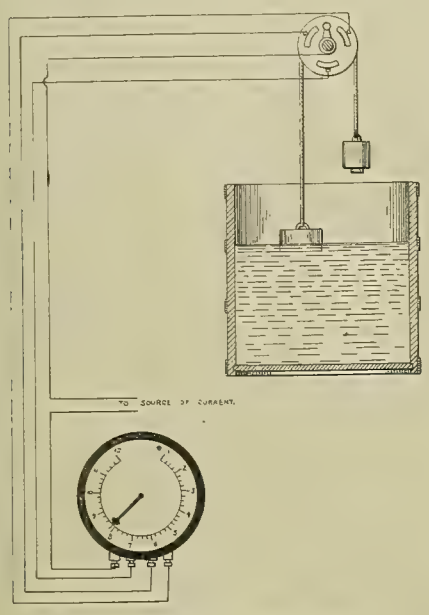
At the generating station the equipment consists of two 5,000-kilowatt 4,000-volt three-phase alternators, each direct-connected to a 6,786-horsepower twin reaction water turbine; two 150-kilowatt 125-volt direct-current generators, each direct-connected to a 250-horsepower turbine, and two banks of three transformers each, each transformer being of 2,200 kilowatts capacity, of the air-blast type, 2,300 to 14,475 volts. The electricity is conducted in lead-encased cables laid in ducts in the floor and extending from the generators to selector switches located in cells near the transformer air chamber. For handling the heavy parts of the machines a 35-ton Niles crane has been installed. The crane motors are supplied with current from the exciter generators.

The switchboard is thoroughly up to date in the manner of control and also in the apparatus used. No voltage higher than 125 volts is found near it. The transformers are set in concrete cells in a gallery beneath the 4,000-volt buses, and the current transformers are placed on concrete shelves in similar cells behind the high-tension oil switches.

It is difficult to realize what the installation of this plant really means to the cities of Fort William and Port Arthur. Admirably located at the end of Canada's extensive system of waterways, these towns bid fair to become great industrial centers were it not for the difficulty of fuel supply, owing to the great distance from the coal fields. Now that an abundant supply of electrical power is available at reasonable rates, the growth of these cities may be materially accelerated. Already a number of big industries are nearing completion, while several others are projected. These comprise the Atitokan Iron Company, the Canadian Northern Iron and Ore Company, the Meisel Manufacturing Company, the Seamens-Kent Woodworking Company and the Canadian Iron Foundry Company, while the Northern Steel Company of Collingwood, Ont., is negotiating for the erection of a plant for manufacturing wire and nails. This is only a partial list, but it is sufficient to indicate that the twin cities, as they are called, are to profit by abundant electrical power.

New Water-level Indicator.

A simple water-level indicator, developed by A. A. Radtke of Chicago, has recently made its appearance. It is an electrical device, and can be installed by anyone having a little electrical knowledge. The apparatus at the tank, as shown by the accompanying diagram, consists of a small drum carrying two cords, one attached to a float and the other to a counterweight. At one end of the drum is a brush contact, which successively passes over three fixed contact plates when the drum rotates. Four wires serve to connect the contact drum with the instrument. The indicator is so con-



A NEW WATER-LEVEL INDICATOR.

structed that it can be attached to any lighting circuit. The current required is one-quarter ampere.

The feature of this indicator is that a complete series of indications is given, showing at all times the height of the water in the tank. The distance between the instrument and the tank from which the indication is desired does not affect its operation.

This device is also adapted to other uses, in fact, to any application where the indication of the motion of a moving part is desired at a distance Batteries may be used to furnish the current when a lighting circuit is not available.

Gasoline-electric Road for Washington.

Two hundred and fifty miles of interurban railway will be constructed in Central Washington by the Inter-Valley Traction Company, which has just received a franchise to use the Yakima County highways, west of Spokane, for 50 years. It is estimated by H. B. Scudder, president of the company, that the line can be built and equipped for $10,000 a mile.

Gasoline-electric motor cars will be used on the line, each engine having sufficient power to haul several passenger coaches with seating capacity for 40 persons, and freight cars of 16 tons capacity will also be operated. The company expects, ultimately, to tap the headquarters of the Yakima River, tapping rich farming, timber and mineral districts. Money is being raised by subscription, and it is given out officially that the capital stock of $250,000 has been fully subscribed. The officers of the company are Yakima men, as follows: President, H. B. Scudder; vice-president, W. A. Bell; secretary, M. B. Miles; treasurer, W. L. Steinweg.

Bad Language By Wireless.

Some interesting secrets were divulged by the last witness to give evidence on behalf of the Admiralty before the British Parliamentary committee on the Berlin Radio-telegraph Convention. This witness testified that a large proportion of the messages passing between ships and shore stations along the south coast of England were routine messages and signals between operators which frequently took the shape of bad language. In consequence vessels desiring to send bona fide commercial messages were frequently compelled to wait considerable periods before such messages could be taken up.

THE IOWA CONVENTIONS.

With an attendance, all told, of about 250, with a number of good papers and with the most pretentious exhibit of electrical apparatus yet shown at the Iowa conventions, the seventh annual convention of the Iowa Electrical Association and the fourth annual convention of the Iowa Street and Interurban Railway Association, held at Clinton, Iowa, on April 18th and 19th and April 19th and 20th, respectively, are to be added to the list of successful meetings of these flourishing organizations. The sessions were held and the exhibits displayed in the Lafayette Inn—a new hotel, which, while giving good accommodations in some respects, was not large enough to accommodate all without some confusion and discomfort. Next year the conventions will return to Des Moines, which is centrally located and which has ample hotel accommodations. But the visitors took away only the kindliest feelings for the electrical men of Clinton, who were very hospitable. The Iowa and Illinois Railway Company, the Clinton Street Railway Company, the Tri-city Railway Company of the neighboring city of Davenport, the Clinton Gas Light and Coke Company, the Iowa Telephone Company, the Wapsipinicon Club and the local lodge of Elks extended courtesies which were greatly appreciated. Mr. P. P. Crafts, general manager of the Iowa and Illinois Railway, was in charge of the local arrangements, and all who attended are indebted to him for his unwearied attentions. Mr. G. E. Lamb, president of the same company, was also kind enough to place his houseboat Chaperon at the disposal of the visitors for a ride on the Mississippi River on Friday afternoon.

The exhibits were shown collectively in the basement of the hotel, and while the display was not large, measured by the standards of the national associations, it was entirely creditable. Smaller apparatus, as lamps, instruments, heating and cooking devices and various specialties, were shown.

Iowa Electrical Association.

President A. W. Zahm of Mason City called the first session to order on Thursday morning and introduced Mayor H. U. Crockett of Clinton, who delivered a brief address of welcome, to which Mr. Zahm responded on behalf of the association. The president then delivered his annual address. He said the municipal-ownership movement is losing ground. Municipal ownership will add to taxes instead of decreasing them. It is no longer a popular issue, but is nevertheless to be continually guarded against by fair treatment of customers. Regulation of rates by commission seems to be inevitable in Iowa, and if fairly undertaken and carried out is to be welcomed. Mr. Zahm also pointed out that with improved high-efficiency lamps it is no longer necessary to fear the gas man.

Secretary L. B. Spinney of Ames reported that the steam indicator donated by George S. Carson of Iowa City last year had not been used during the year as much as it should have been. He called attention to the benefit in testing to be derived without charge from Mr. Carson's generosity.

After various announcements and the transaction of some routine business the following-named committee on nominations was elected by vote of the members: W. J. Greene, Cedar Rapids; Austin Burt, Waterloo; P. P. Crafts, Clinton; F. J. Hanlon, Mason City, and Mr. Dodd, Charles City.

Cost of Operation per Dollar of Income.

Professor Spinney then gave a valuable statistical report on "Cost of Operation per Dollar of Income," which is given in full elsewhere in this issue. Mr. Burt remarked that the investigation was of great value. Investment is usually considered to be about five times gross income. Professor Spinney's table therefore shows a net profit made by the companies of about six per cent., which is inadequate. That is, with 30 per cent. profit on gross income there would be but six per cent. profit on investment. L. D. Mathes of Dubuque said that the report showed, among other things, the great advantage of standard methods of accounting. Such standardization will be of especial value when the regulation of charging by state commission is brought about, as will surely be the case. A liberal allowance for depreciation should be made. Central-station men should be sure their profits shown on paper are actual cash profits.

Central-station Economies.

Gus Lundgren of Cherokee, Iowa, then read a practical paper on "Central-station Economies," which contained several shrewd hints that were received with laughter and applause. Following are extracts from Mr. Lundgren's paper:

"The question should be not 'How cheap can this system be constructed?' but rather 'How cheap can it be operated and how long will it last?' I am of the opinion that there are many men interested in electric central stations who wish that they had thought of these things before constructing their system.

"Plans should not be made for all the shafts, pulleys and clutches that can be thought of, for the modern station man knows that many of these are good for nothing but to use up coal, oil and water, and require a good share of the foreman's attention. But, on the other hand, use this money for securing a scale for the fuel, a meter for the boiler feed and the necessary wattmeters on the switchboard. If you think that you do not need these scales and meters, then please go to the merchant and ask him how he knows what to charge for a pound of sugar. If he turned at you and asked you the same question about your current you might, if you told him the truth, have to say that you did not know. Then if someone should come to you to inquire your rates for current to run an electric motor of three horsepower five hours a day for one month, in order to do justice to him and to yourself you would have to say that

GEORGE S. CARSON, PRESIDENT IOWA ELECTRICAL ASSOCIATION.

you did not know, and of course you could not expect to get that inquirer for a customer. This may seem to be putting it strong, but it is a fact that there are many electric stations in which there are many thousands of dollars invested that have no means of knowing the cost of current. How can this be a safe investment? With no protection to the stockholders or to the customers, is it a wonder that failures in the electric central-station business are reported?

"If the meter on the boiler feed shows that more water than usual has gone through it, it may be that this water has not been evaporated but instead has found another place to go, consequently a leak is found. Then, again, if the coal and water correspond all right, but it is found that more coal and water have been used per kilowatt-hour, it is time to put the indicator on the engine to ascertain the condition of the engine valves. A leak between the boiler and engine may be found or a leak in any of the steam pipes. They will usually show up and should be repaired at once.

"The writer was at one time working in a station where the use of the engine indicator aided in finding the trouble with the engine. We found a very badly set valve, and after this had been corrected it resulted in the saving of $1.30 worth of coal from midnight until morning. This I consider a good saving for an engine of 75 horsepower.

"In testing coal, before closing a contract the scales and meters may be used for finding the evaporating power of the fuel. The question is, how many kilowatt-hours can be made per dollar's worth of coal? We do not care what kind of coal is being used, for a good talk from an agent will not convert water into steam.

"The old-fashioned way of making a flat rate will either beat the customer or the central-station men. The merchant will either measure or weigh the goods he sells, and if the central-station man is going to succeed he must do the same. The writer has had some experience in that line. We have put meters on the wires of the old flat-rate customers just to see which of us was getting the best of the deal, and in nearly every case we found that the customer was getting the best of us. I recall one instance of a customer that was paying $5.70 a month flat rate, and computing by the meter readings he never used less than $10 worth of current per month, figuring current at the rate it cost us on the station switchboard."

Mr. Lundgren told, at the conclusion of his paper, of making a six-night boiler test about a year ago in his plant. He found that 55 pounds of water was being evaporated per horsepower-hour. A new unit was added and recently a similar test showed the evaporation of 36 pounds of water per horsepower-hour. He gave another instance of

[Continued on page 366.]

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Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Institute of Electrical Engineers (special high-tension meeting), Chicago, May 24th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

GAS AND electric-light people do not get on well in England. Here, for instance, is the Electrical Times of London, in a February issue, with a page devoted to "Gas Accidents," the head-line being in large black type. Thus the tale begins:

On January 27th another fatality occurred as the result of an escape of gas. Every week one reads of explosions and cases of poisoning. Without taxing our memory much, we can call to mind immediately two people poisoned in Liverpool on October 5th through leakage from a faulty gas tap; two ladies killed at Acton on October 13th as the result of the water seal having evaporated in a gasolier; on November 3d a Liverpool dentist was poisoned; three days later three children were asphyxiated at Whitechapel; another week passed, and two people were poisoned at Bradford. And so on runs the grim record of gas fatalities, touching impartially at Birmingham, Nottingham, Stockton and Norwood. It is now the turn of West Ealing, and the accident is due to the celebrated chandelier death trap.

And so on.

It seems to us that this sort of thing is unwise. Undoubtedly gas causes many accidents, but once in a great while electricity causes an accident also. The electrical man has nothing to fear by the comparison, but why should he stop his energetic campaign for new business to throw stones at a competitor—if gas can be considered a competitor. Let him devote all his strength and energy to invading the great field for light and power that lies before him without wasting time by turning aside to indulge in acrimonious discussion. That is the view generally held in the United States, at any rate. It must be admitted, however, that conditions are somewhat different across the water. But it may be doubted whether they are so very different as to vitiate the principle of salesmanship that it is not good business to decry one's competitor's wares.

AMONG the state electrical and street-railway associations the Iowa Electrical Association and the Iowa Street and Interurban Railway Association occupy a prominent and useful place, and their meetings of last week added another to the really useful "Iowa conventions." Practical subjects were discussed, although much less attention was paid to the new high-efficiency incandescent lamps than one would suppose. The waning of the municipal-ownership propaganda was noticed and it was decided to lend the influence of the association (that is, the electrical association) to the important work of the Co-operative Electrical Development Association. Some interesting statistics on the cost of operating electric-light plants were given, although, unfortunately, under the diverse systems of accounting that obtain in small plants—and in large ones, too, for that matter—it was difficult to obtain a large number of returns showing with precision the relative costs of the various items that enter into the expense account of the business. There was an excellent practical paper on the possibilities of ice manufacture for electric-light companies, and good contributions on central-station economies, electric heating devices, selection of steam engines, gas producer engines, electrical distribution, central-station advertising and the Nernst series lamp with individual transformer for small-unit street lighting.

The street-railway men discussed topics of timely interest, including the handling of freight by electric lines, steam motors, amusement enterprises, interurban cars on city tracks and train dispatching. Following the custom of former years, the conventions overlapped—that is, the last day of the electrical convention was the first one of the street-railway association. This is an inconvenient arrangement for the not inconsiderable number who want to attend both conventions, and it would seem that in a three-day period the time could be assigned so that there would be no overlapping. Each association might have a day and a half, or one might have two days and the other one.

TELEPHONE RATES should be measured rather than "flat" in the opinion of the Special Telephone Commission which recently made a report on the telephone situation in the city of Chicago to a committee of the City Council. This commission consisted of Prof. D. C. Jackson, William H. Crumb and George W. Wilder, and its elaborate report, aside from its local importance, contains much material of general interest. Measured rates are recommended for these reasons:

They require each user to pay for his service in proportion to what he uses. This makes it possible for the telephone operating company to base its rates for each class of service on the actual cost of the service, thereby bringing the service within the means of the largest number of people and expanding it so as to be of the maximum usefulness in the city.

Measured rates largely cut off frivolous and otherwise useless messages, thereby leaving the subscribers' lines open for all important messages.

The reduction of calls per telephone following the general use of measured rates results in a great reduction of the unavailing calls, which are now approximately one-third of the total calls in Chicago, and it thereby reduces the expenses of operating, and this makes a general reduction in the rates practicable.

The introduction of measured rates tends to level off the load curve, reducing the relative height of the peaks, so that the actual cost of operating for each message passed through the hands of the telephone company becomes less, and this also tends toward making a reduction in the price of telephone service practicable.

However, a partial use of flat rates may be applied in connection with residence and neighborhood exchange telephones, because of the smaller average use of such telephones and also because the use of the individual telephones in these classes does not differ so greatly from the average use as in the case of business telephones. Four-party lines are condemned, but three-party residence lines are recommended for trial.

Logically speaking, the commission is quite right in its opposition to flat rates, and with equal logic the principle can be applied to all branches of the telephone-exchange business. But, as is admitted in the report, it is wise to permit unlimited-service rates in some classes of service: and these exceptions to a theoretically desirable principle may be more numerous and widespread in practice than the commission seems to suppose.

FOLLOWING the ratification by the voters on April 2d of the street-railway ordinances, the decision of the Illinois Supreme Court of April 18th declaring invalid the essential portion of the Mueller law has apparently given the finishing stroke to the hopes of those who favor the municipal ownership of street railways in Chicago. The Mueller law was passed by the Legislature three years ago to give the cities of Illinois power to "own, construct, acquire, purchase, maintain and operate street railways." To provide the necessary funds the cities were authorized to issue bonds or street-railway certificates payable out of future earnings of the property. Such certificates were to be a lien only on the property acquired. A test case was instituted attacking the validity of the law, and the Circuit Court of Cook County decided in favor of the law. An appeal was taken from this decision, and now the Supreme Court has reversed that decision, declaring the law unconstitutional. It is held that the issue and sale of the certificates and the execution of the trust deed would create an indebtedness in violation of Section 12 of Article 9 of the constitution.

The Supreme Court says that it has nothing to do with the policy of municipalization of street railways in the cities of this state. It is its duty to enforce the provisions of the constitution as it finds them written in that instrument. The final paragraph of the opinion accompanying the decision reads as follows: "Having reached the conclusion that the proposed issue of $75,000,000 in street-railway certificates of the city of Chicago, and the execution of said trust deed or mortgage to secure their payment, will create an indebtedness of the city of Chicago beyond the constitutional limit, the decree of the Circuit Court will be reversed and the cause remanded to that court, with directions to overrule the demurrer to the bill of complaint."

It was rather expected, on both sides of the street-railway controversy, that the law would be upheld, and the ordinances which are now in force were drawn with that probability in view. However, there does not now seem to be any likelihood that municipal ownership can be carried into effect during the life of the ordinances, which is 20 years, although various other plans have been discussed.

Engineering Societies Building Dedicated.

The dedication of the Engineering Societies Building, 29 West Thirty-ninth Street, New York city, for the construction of which Andrew Carnegie gave $1,500,000, took place in the auditorium of the building on the afternoon of April 16th, as mentioned in the Western Electrician last week, the exercises continuing the following day.

Forty-three colleges and technical schools and many scientific societies were represented in the audience of the 16th which heard President Arthur T. Hadley of Yale, Mr. Carnegie, E. E. Olcott, president of the United Engineering Society, and Charles F. Scott, chairman of the building committee, deliver stirring addresses. There were present also at the ceremony Sir William Preece, president of the Institution of Electrical Engineers of England, and Ambassador Creel of Mexico.

From the balcony Mrs. Carnegie saw the meeting opened with the setting maul which she used in laying the corner-stone of the building on May 8, 1906. After prayer by Dr. Edward Everett Hale, chaplain of the United States Senate, a telegram of congratulation from President Roosevelt was read by T. C. Martin, president of the Engineers' Club. A message from President Diaz of Mexico was also read.

The ceremonies were presided over by Charles Wallace Hunt, to whom Architect Herbert D. Hale formally turned over the keys of the building, Mr. Hunt in turn passing them on to Mr. Olcott. President Hadley delivered an address on "Professional Ideals of the Twentieth Century," and declared that a combination of ethical and technical standards would produce the best professional service.

"It is not enough," said Dr. Hadley, "to know the special sciences on which the practice of a profession is based. A man ought to have clear conceptions of the public service which his profession can render and the public duties that its members owe. Thus, and only thus, can the engineer, the lawyer, the physician or a member of any learned profession rise to the full dignity of his calling.

"There are two quite distinct qualities which must be combined in order to secure the best professional service; two quite distinct tests which work must meet in order to be pronounced first-class. One of these is the technical standard; the other, for want of a better word, may be called the ethical standard.

"This larger view of the professional obligations is not so fully recognized as it should be. We have in the nineteenth century made so much progress in the technical training of doctors and lawyers and engineers that we sometimes forget that there is need of anything more than technical training. We have let the old idea of public leadership, which was prominent in the minds of the great professional men of past centuries give place to another and narrower ideal, which is fully satisfied when a man has made himself a technical expert. Many a man of real eminence in his calling deliberately rejects the wider conception of professional duty which I have here indicated. Perhaps he recognizes the claims of public service, perhaps he does not; but in any event he believes that these claims rest upon him as a man rather than as an engineer or a lawyer. In his professional capacity he says he is hired not to tell what the law ought to be, but what it is; not to advise how a railroad can do the most public service, but how certain men with certain ideas of their own can best use the differential calculus to get those ideas carried out.'

Ambassador Creel of Mexico voiced the greeting of President Diaz. Charles F. Scott's address was an historical one. On being introduced Mr. Carnegie said:

"The Scotch have a saying that fools and bairns should never see a thing half done. I do not want to associate myself with fools and bairns, but I think I may add that donors should never see a thing half done.

"Whenever we coalesce to do some good, a unification takes place and a consolidation; and whenever men meet to conspire against the public good —to do some evil—they find themselves unable to trust each other. That's why you needn't lie awake nights and worry about the future and about what problems society is going to meet. As sure as the sunflower turns toward the sun, so the human race turns toward better things.

"This is the rock on which I rest, and on which I meditate sometimes. Nor can you deny this, that, quite apart from whatever evil exists, there is that principle of improvement inherent in us. Today is better than yesterday and tomorrow will be better than today. So I look forward to the future of this building, and I know that the organizations to which it is devoted will advance and continue to meet the developing needs of our age."

In the evening the officers of the various engineering societies gave a reception and banquet in the auditorium.

On the afternoon of Wednesday, the 17th, the dedicatory exercises were resumed. Addresses were made by Dr. Samuel Sheldon, president of the American Institute of Electrical Engineers; Dr. Frederick R. Hutton, president of the American Society of Mechanical Engineers; Dr. John H. Hammond, president of the American Institute of Mining Engineers, and Mr. T. C. Martin, president of the Engineers Club. Mr. Martin, who is chairman of the Institute land and building fund committee, has worked indefatigably on the preliminary arrangements. The John Fritz medal was presented to Dr. Alexander Graham Bell. Medals for distinguished services were given to Ralph W. Pope, the popular secretary of the American Institute of Electrical Engineers, Frederick R. Hutton and Rossiter W. Raymond.

The mining engineers on Thursday afternoon heard a paper dealing with the excavation and tunnel work now being done in New York and vicinity, read by H. T. Hildage. On Thursday evening Brigadier-general William Crozier, chief of ordnance, spoke on his department as an engineering organization. On Friday afternoon the mining engineers heard papers on technical subjects. On Friday evening there was a smoker and vaudeville entertainment in the concert hall of Madison Square Garden for the members of the three founder societies.

The handle of the key which figured in the exercises bears the design of a laurel wreath with the crests of the three founder societies. Underneath a piece of rock crystal lie three grains of gold from the original gold discovered by John Marshall on Sutter Creek, California, in 1848.

Institute Discussion of the Rowland Telegraphic System.

In the preceding issue of the Western Electrician extracts were given from a paper on "The Rowland Telegraphic System," read by Louis M. Potts, constructing engineer of the Rowland Telegraphic Company of Baltimore, at a special meeting of the American Institute of Electrical Engineers, held in the Engineers Building, New York city, on April 15th. President Sheldon in calling the meeting to order invited Sir William Preece to preside over the meeting. Following was the discussion in part:

Ralph W. Pope, New York: In approaching the discussion of a system of this kind we should divest ourselves of any prejudice against the Morse system, which obtains in the case of those who are not practical operators and familiar with the code. I may say that I learned telegraphy on the Hughes printing telegraph 49 years ago. I learned the Morse telegraph without any idea that the Morse system would eventually prevail over the printer. The Hughes printer, which was new at that time, was invented by a musician in Kentucky, and I think that one of the pair which I first operated was the second which was then in use, the first, I think, being between New York and Philadelphia, and the second, on which I learned, was between Great Barrington and Pittsfield, Mass. In those days, when an inventor brought out a new system a company was organized to exploit it. Consequently, we had in the old times the magnetic system, the House system and the Bain system. The House printing telegraph, the invention of Royal E. House, was a triumph of electro-mechanical skill. Between New York and Boston it could not be worked on account of the rapidity of the vibrations, and consequently the Hughes system, requiring but one vibration to each letter, was preferred and eventually superseded the House system.

The telegraph is the oldest, and I will also say the most important, development of the modern applications of electricity. The electric light has its rival in gas, the electric railway has its rival in steam, and the telephone is applicable only to short-distance transmission, but for worldwide communication, for the general distribution of intelligence, and that application of electricity which would be the last we would part with, telegraphy stands at the head. It appears to me that the general use of the Morse system is due to its simplicity and its application to all conditions. The speed of the Rowland system and, in fact, all the claims set forth in the paper, in comparison with the Morse system, I consider well substantiated. The speed of 40 words a minute can be attained by a Morse operator, but it still remains to be seen whether we can develop a system which will send messages in each direction at the rate of 40 words a minute.

The advantage of the delivery of messages in this form over the old tape-printing system is very desirable, and I am glad to know that this system has reached its present state of perfection. I can hardly believe that the distinguished inventor of this system would ask that any better monument to his memory could be erected than the establishment and the continuation of a system bearing his name, and it is my hope that it may be continued and in the future be on a par with the Morse system of today.

Dr. A. E. Kennelly, Cambridge, Mass.: It is remarkable that, although electrical applications have developed so rapidly and assumed such a position of importance in this and other countries in electric lighting, power transmission and various other applications of electricity, the electric telegraph has almost stood still and marked time. The telegraph is the only apparatus which has maintained its original ground and kept on the earth. Telephones have been driven off the earth, even so huge a machine as the railroad motor has been driven off. The telegraph has stood, and at considerable disadvantage to itself, because it not only suffers from its own internal disturbance, but from vagrant disturbances from other systems in its neighborhood. It is the convenience of telephony which has tended to keep progress in telegraphy in abeyance. The rate of growth of telegraph messages has been slower than the rate of increase of population, according to recent published reports. It does not seem possible to get a more economical operation of the system, and consequently anything which will enable us to rob the mails more than we do now, in the use of the telegraph, must be effected by some entirely new method.

At the present time there is not only the fixed charge upon lines and apparatus, but the cost of the operator's time at the central station, and intermediate stations as well, and also at the receiving station. These matters seem to be impossible of elimination on the Morse system. We cannot flatter ourselves that any system such as the one described tonight will eliminate the Morse system everywhere. The Morse system is admirably adapted for way traffic, for traffic of no great pressure, and for use in stations where messages are few and far between. We can hope for something to take the place of hand telegraphy where the telegraph traffic is great and the pressure keen. One way is to duplicate the Morse circuits, quadruplex them, if possibile, and the other is to have something entirely different. We must have something which shall eliminate the telegraph operator on high-pressure trunk circuits. The hand Morse must be eliminated. The Wheatstone system did that in part, because it enabled a number of sending operators to work together on one wire, and the same number of receiving operators to work together on the same wire, but here is one apparatus which will enable the Morse code to be completely eliminated—a simple mechanism to be operated from both ends of the line, keyboard to keyboard, typewriter to typewriter. That is an ideal system if the inertia of the removing parts can be reduced to so small an amount as to make the speed equal and of the same order as that which can be secured by instruments of the Bain type.

William Maver, Jr., New York: It has long been well known to telegraph engineers and managers that the ideal system of telegraphy is one in which the messages may be transmitted without previous preparation at a high rate of speed and be received at a distant station on page form in printed Roman letters. There have been many difficulties in the way of the production of this ideal system, and therefore the degree of success which has been reached by the Rowland system, and I might say by the Barclay and Murray systems, is highly encouraging. I had the pleasure of seeing Professor Rowland's original apparatus some years ago, when it was crude. Today it is in a very fair state of practical operation.

There is no question as to the utility of the Rowland system for the purposes to which it has thus far been applied. It is possible it may find its best field for comparatively short distances.

The speed of operation of the system is given as 600 messages per hour, and that is for comparatively short overhead wires. I think, on long circuits, that speed for single wires could be reduced. The basis of the telegraph current used in this system is said to be an alternating current. This is no doubt true, but it is a singular fact, as it appears, that the signaling currents are made of pulsations of continuous current. That is evident from the oscillograms. Mr. Potts states that the current necessary for the operation of the relays of this system is about 35 milliamperes. That is about the current required to operate the ordinary Morse duplexes and quadruplexes, and I might say, similar polar instruments.

It is asserted that the presence of the human element in the Morse system introduces corresponding inaccuracies. It has long been an axiom among telegraph engineers and managers that the receiving operator on the Morse system is a check on the sending operator. In many cases in actual practice the receiving operator corrects many errors of the sending operator, and these errors may be caused by line trouble happening momentarily, and no machine at the receiving end can do in that sense what the receiving operator with his human mind does. Consequently, it involves service messages for the correction of the errors that are caused, with the consequent delays. The engineers of the Rowland system are to be congratulated on the success they have achieved. They are fortunate in having the system in operation under practical conditions, where its defects, if any exist, will become apparent and opportunities for further development and improvements of the system will doubtless be found.

E. F. Northrup, Philadelphia: A gentleman who spoke this evening said he wondered why Professor Rowland turned his attention to telegraphy. He had a disease which he knew would probably kill him, and he could not get a life insurance. He told me that he had many problems in physics of the highest importance which he would love to work out, but that he felt it was his duty to try and leave a heritage to his family which would have a monetary value. The Rowland system is peculiar in this respect, that it is a kinetic system, as distinguished from a static system. I mean by

that, that current is passing over the line at all times, and not only when a message or signal is to be sent, and the paradox of the system is that, in duplexing, if the signal is being sent simultaneously from opposite ends, there is no current at that instant on the line.

One feature of the system is its immense flexibility in the matter of the distribution of the messages. Professor Rowland laid the foundations of innumerable methods of distribution of the messages which the flexibility of the alternating current admitted.

Gano S. Dunn, Ampere, N. J.: In looking at the paper which has been presented I am forced to the conclusion that if it were read by the general public and they saw the paragraph which rates its capacity at 600 messages per hour, they would be inclined to ask Mr. Clowry, who in the newspapers a few days ago explained the reason for the increase in rates of the telegraph company, how long it will be before these rates shall be again reduced to a very small amount, in view of the enormous difference between 600 messages per hour and 17 messages per hour, which he stated as the capacity of the present telegraph. It is not the capacity for transmission that limits the telegraph business today.

The Rowland system, which I believe will surely come into large use, is, after all, applicable only to trunk companies between large cities, to places where you can have experts to watch it, places where the volume of business will justify its use, but, as a general proposition, it will never displace the old instruments. Their simplicity has won for them their present place. In the Rowland system the typist takes the place of the operator, but the typist would not be able to rearrange any disarranged parts in the message, and if, as sometimes happens, in the old-fashioned telegraph office, when the manager's back is turned, the boys should throw an inkwell which would hit the apparatus, the apparatus would be out of business for a while. I think the statements I have just made are borne out by the proportion of quadruplex apparatus today compared to the number of instruments in the country; roughly speaking, there are 30,000 offices in this country, and I doubt if there are 3,000 quadruplexes. Quadruplexes increase the wire capacity over that of a single wire, to almost four wires. If there were a great demand for quadruplexes, there would be more introduced. The proportion noted seems to indicate the balance between the advantages gained by their introduction, and the disadvantages met through their application.

Although the Rowland system will increase the wire and the operator capacity from 25 to 75 messages an hour, and make some further decrease by not requiring a receiving operator, but instead a skilled mechanician, I believe these advantages will be almost overbalanced by the enormous complication of the Rowland apparatus. I think its success must be looked for in the large offices where there are trained experts and a high scale of organization, but it is my opinion that for many years to come 90 per cent. of the clicks over the land will be made by the Morse.

Sir William Preece, London, England: I have had 55 years' experience in all branches of the practical application of telegraphy, and it is one of the prides of my life to think that I have had something to do, directly or indirectly, with every single practical application of electricity. I commenced first with the telegraph, and my heart still goes out to the telegraph. In my early days I was brought into contact with Faraday, and I believe I am today the only living pupil of Mr. Faraday. My early acquaintance with Dr. Kennelly was in poring over Faraday's researches. In 1853 we laid down underground wires between London, Liverpool and Manchester, 212 miles long, and we had serious effects due to static induction. We did not understand it. We called in Faraday and Sir George Wren, and I worked, with these two great philosophers for many months and carried out all the experiments Faraday wished to have carried out, and have some of the records still.

The first automatic system of telegraphing was that invented by Bain. The currents were transmitted through punched paper and marks made on strips of paper saturated with Prussian potash. They made blue marks, and I have many of the marks made in those days to show the influence of static induction in retarding and elongating the currents that came out at the distant end when a mere dot was sent in at the sending end. Many years after this my first acquaintance with Edison arose from his coming over to England with an automatic system based on this chemical recorder, and he had placed at his disposal a cable coiled in one of the tanks in the cablemakers' works. He asked me what I thought would be the length of a dot through 1,000 miles of cable. I had in mind 1,000 miles of cable laid out straight, and I told him I thought a dot would come out about six inches. He said, "What do you think it would be in the case of a cable coiled in a tank?" I said, "I really cannot tell." "Why," he said, "I wanted to know what the length of that dot would be." When that dot came out it was 28 feet long. That was Edison's experience of the effects of static induction. It was an experience of great service to those who are transmitting currents in long underground cables. That led to a very extensive system of underground cables and there is no doubt we shall learn a good deal of the influence of the alternating current in working to great distances.

The question now before us is the relative merits of automatic telegraph and manual telegraph. We have not heard very much as to the relative merits. I commenced with a system that transmitted 1,500 words a minute. It was capable of transmitting 3,000 words a minute. Why didn't we use it? Because there was no business for it. This question of automatic versus manual telegraphy, after all, is a question of business, a question of the number of words you want to transmit, not the number of words you can transmit. I have grown up in the last fifty years in developing automatic systems of all kinds, but the one in which I am peculiarly interested is the development of the Wheatstone system. When I left the Postoffice service in 1889 we had worked up the Wheatstone system so that it would give us 650 words a minute on our longest circuit. We did not want 650 words, for the simple reason we did not have 650 words a minute coming in. It is a question of the messages to come, and those having practical knowledge of the working of the telegraph system know that, in the telegraph business of a country, there is a curve precisely similar to the curve we know so well—the load curve of the generating station, for whatever purpose it is used. You have messages pouring in according to the business hours of the day. In England we have a peak load every morning between 11 and 12 o'clock. It subsides during luncheon hour, and comes up again in the afternoon. In England we have only one time over the country; here in America you have three times—Eastern, Central and Western—and the result is you have your peaks come in different times of the day. There is three hours difference between San Francisco and New York time, and the result is your load curve for your business in this country is different from the load curve we have in England, the consequence being that no fair comparison can be drawn between the rate at which the messages are transmitted per day or per wire between the two countries, and it comes down to this that you want to have that very best system which will carry your work through to the best advantage of those who use the telegraph.

In England I think we have the automatic system in an absolute state of perfection. I do not think there is any system that will beat the Wheatstone system for business as it is. It may be that if we increase our load curve and get a load factor for the whole day of 50 or 60 or 70 per cent., then we will want automatic systems. Automatic work is essential and absolutely imperative on submarine cables, but submarine cables are different from the aerial wires we use. There is a great distinction between telegrams which are always short, and newswork, which is very considerable at times. In England it is enormous. Our news business is much greater than in this country. There is not a single English country town of any magnitude that does not issue an evening paper full of news sent by automatic telegraph, and there we find that 400 words a minute is ample to supply all the newspapers with what they want. I want to point out that, however new and perfect an automatic system may be, there will always be some features concerning it which may not be entirely satisfactory.

The conception of using a wire for many circuits, octuples, as in the Rowland system, is a very great advantage. The reason why the quadruplex has not grown much in England, and I do not think it has grown much in this country, is because of the fault that it throws out, and you lose the advantage of quadruplexing the four circuits, or octuplexing with eight circuits. Therefore, a fault on the line, with these systems, is very serious. That is the reason why there is a tendency to fall back on the duplex method. The tendency was to use copper very much for speed, but the price of copper has gone up so much it has rendered that practically impossible.

Mueller Certificates Held Invalid.

The certificate provision of the Mueller law (which certificates, it was proposed, should furnish the means for raising $75,000,000 for the city of Chicago to buy the street-railway systems) was held unconstitutional by the Supreme Court of Illinois on April 18th. The reason given for the decision was that the Mueller certificates, by offering to secure the holders with a mortgage on Chicago's streets for 20 years, pledged something beyond the mere physical property of the street railways and therefore involve the city's general revenue to that extent.

The decision does not affect the other provisions of the ordinances recently ratified by the voters.

Deposits of stock of the underlying companies of the Chicago Union Traction Company with the trustee are coming in rapidly. It is planned to get enough stock deposits to reorganize the companies under the name of the Chicago Railways Company, which will carry out the provisions of the new ordinances on the North and West sides.

The Chicago Jovian Club "Operetta."

The electrical fraternity in general, and particularly the Sons of Jove all over the United States from Texas to the Atlantic coast, will be interested to know that the Chicago Jovian Club has undertaken a novel entertainment which will be given in full measure of Jovian enthusiasm. It is essayed to produce an "operetta" on May 16th at 8 p. m. at the Y. M. C. A. Auditorium, Chicago. This so-called musical comedy, or, as one of the Jovians put it, this "alleged operetta," will be entitled "The Isle of Jove."

Without going into the details of the elaborate programme which it is proposed to render on the night of May 16th, it may be said that the enthusiasm already displayed in the prepartion of this electrical social function is remarkable. Already at a luncheon of the Jovian Club as much as $285 for tickets was subscribed in a little less than eight minutes. Since that time several of the boxes have been sold, and altogether, even at this early date, a very entertaining evening is practically assured. Thus far, too, quite a remarkable aggregation of amateur talent has been secured, and the aim has been to draw the majority of the "actors and actresses" from the ranks of well-known electrical Chicagoans.

As an indication of the enthusiasm with which not only the Sons of Jove but the western electrical fraternity in general is receiving this audacious venture, it should be stated that commendatory words have already been received from Cleveland, South Bend, Valparaiso, Lafayette, Fort Wayne and Texas as well, although the project is only two weeks old. A number of Sons of Jove from these localities will make a special effort to be on hand the night of the function.

Tickets can be had by mail or otherwise from A. D. Blocker, manager of the operetta, at 139 Adams Street, care of Edison company, Chicago. All seats reserved both in orchestra and balcony; there is no second gallery. As the house seats only 965 people, exclusive of the boxes, the importance of early application for tickets will be readily appreciated. It may be said that the Y. M. C. A. Auditorium is an ideal little theater and there is not a poor seat in the house. The seats are large and roomy, and the entire theater is lighted by electricity, and it is fireproof; the stage fittings are modern.

Relative to the management of the operetta it should be stated that Mr. A. D. Blocker quite a number of years ago managed Mrs. James Brown Potter during her appearance as amateur actress in the "Russian Honeymoon" prior to her appearance on the professional stage. The "Russian Honeymoon," it will be remembered, was staged by David Belasco. These performances, three in all, were given at the Madison Square Garden, New York city, and were repeated in Orange, N. J., one night. Incidentally it may also be said that Mr. Blocker managed this entire production during two seasons for Mrs. Potter and Mr. Belasco. The second season, however, "A Romance of a Poor Young Man" was given, also under Mr. Belasco as stage manager.

In addition to Manager Blocker and C. A. S. Howlett, who will act as musical director, the "directory theatrical" consists of the following-named gentlemen, all Sons of Jove in good standing: W. P. Crockett, treasurer; Perry Boole; E. F. Kirkpatrick, George H. Erich, S. A. Rall; Frank L. Perry, "playwright."

BOOK TABLE.

A Text-book of Electro-chemistry. By Max Le Blanc, professor in the University of Leipzig, Germany. Translated from the fourth enlarged German edition by Willis R. Whitney, Ph. D., director of the research laboratory of the General Electric Company, and John W. Brown, Ph. D., director of the research and battery laboratory of the National Carbon Company. New York: The McMillan Company, 1907. Pp. (5½ by 8⅝ inches), 338, with 52 illustrations. Price, $2.60.

The book is intended to be of help to students of science, to such persons as, having completed their studies, are already in practice, and to all persons interested in electro-chemistry. The author, who has endeavored to write as clearly and as simply as possible, has given his efforts to overcome the difficulty of including all of the essentials of the science without unduly increasing the size of the book. A consistent system of notation has been used throughout the work, and it has been attempted to make the nomenclature conform to that of the best recent textbooks of electricity and chemistry. Chapters are given on the following subjects: "The Forms of Energy and Their Measurement and the Fundamental Principles Relating to Electrical Energy;" Development of Electro-chemistry up to the Present Time;" "The Theory of Electrolytic Dissociation;" "The Migration of Ions;" "The Conductance of Electrolytes;" "Electrical Endosmose, Migration of Suspended Particles and of Colloids, Electro-stenolysis;" "Electromotive Force;" "Electrolysis and Polarization." In the supplement the subject of "Storage Cells or Accumulators" is treated. Much time and care have been taken in the preparation of the work.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XIII.—Characteristics and Uses of Alternating-Current Motors.

Synchronous Motors.

It was only the invention of the induction type of motor about ten years ago which made the alternating current feasible for general power purposes, and so successful has this type of motor proved that today alternating-current motors for nearly all classes of work are almost as commonly used as direct-current motors.

In the early days of the industry the synchronous motor was the only available type, and it possessed many drawbacks for general power purposes. Any alternating-current generator of the single-phase type will operate as a synchronous motor when supplied with an alternating electromotive force, in the same way that any direct-current generator will operate as a motor when supplied with direct current. In the case of the single-phase synchronous motor, however, the machine is not self-starting and requires to be brought up to synchronous speed with the generator by some outside source of power. When it is brought up to synchronous speed it may then be connected to the circuit and will run at a constant speed so long as it is not overloaded. In case of an overload, however, it will fall out of step with the generator, which causes it to stop running.

It will be readily seen, therefore, that such a motor is not well adapted to general power purposes, as the difficulty of providing some means of bringing it up to speed and afterward applying the load is sufficient to condemn it for most purposes. Motors of this type, however, are used to some extent for motor-generator sets and for rotary converters. They have the advantage of drawing a leading current from the line, which in a measure offsets the lagging current of other inductive apparatus on the circuit, thereby somewhat improving the power factor of the load as a whole.

Polyphase alternators used as synchronous motors are self-starting without any field current, but will not carry any load in this condition. When they reach synchronous speed the field circuit must be closed, after which the load can be applied.

Induction Motors.

The polyphase induction motor, however, is by far the most important type of alternating-current motor and differs greatly in its construction from any motor heretofore considered. It consists of two principal parts, one of which is stationary and the other revolving. The stationary or outer portion is known as the primary, or stator, and the revolving element the secondary, or the rotor. The stator consists of laminated sheet-metal punchings, which are fastened to an outside cast-iron frame, the latter acting merely as a support and being in no way a part of the magnetic circuit. The interior face of the stator is slotted so as to form a large number of projecting teeth, and the primary winding is arranged in two or three overlapping groups which lie in the slots of the primary. The secondary element or rotor also consists of a core of laminated iron, slotted around its surface, and the winding consists of copper bars or rods lying within these slots, all of the rods being securely fastened to two copper rings, one at each end of the rotor. This winding is what is commonly known as the squirrel-cage type, or cage winding.

The supply circuit is permanently connected to the primary winding, and there is absolutely no electrical or mechanical connection between the stator and the rotor, except the bearings, so that the machine contains no commutator, collector rings or brushes. The current passing through the primary winding induces a current in the secondary, and a rotating field is produced, which causes the rotor to revolve and produce power. One of the most noticeable features of this type of machine is its entire simplicity. There are no parts to adjust, and the absence of any moving electrical contacts removes any danger from sparking, so that this type of motor can be used with safety in the neighborhood of inflammable materials or gases.

A motor with this style of winding is a constant-speed machine, the speed, however, varying slightly with the load. Its synchronous or no-load speed is equal to the number of alternations per minute of the supply circuit divided by the number of poles for which the motor is wound. When the motor is loaded, however, the speed is slightly reduced in proportion to the amount of the load, and the difference between the no-load speed and the full-load speed is known as the slip. The slip varies considerably, according to the nature of the load, but approximately five per cent. may be considered an average value.

These machines are self-starting under load and possess a large starting torque, varying from two to three times the full-load torque. When starting under load, however, they draw a very large starting current, and for this reason, except in the case of small motors, they are not connected directly to the supply circuit at starting, but some device is adopted by means of which a considerably reduced electromotive force is first applied to the motor, and this electromotive force is gradually increased until a full line voltage is reached.

A similar type of motor is used for variable-speed work, in which the rotor differs somewhat from the one just described. The variable-speed rotor is wire-wound for two or three phases, as the case may be, and the ends of the two or three-phase windings are brought out to two or three collector rings carried on the shaft. By means of brushes resting on these collector rings variable resistances can be inserted in the rotor winding. While considerable variation of speed can thus be produced the induction motor does not permit of nearly as wide a range of speed variation as do direct-current motors.

Single-phase Railway Motor.

Another alternating-current motor which is coming into considerable use is the single-phase railway motor, which is yet another distinct type of motor. This motor is very similar in construction to the direct-current railway motor in common use, but its fields as well as its armature core are made of laminated sheet steel. The great trouble heretofore experienced with these motors was the excessive sparking at the brushes: but this has been largely overcome by the use of high-resistance leads, by means of which the armature coils are connected to the commutator segments.

The characteristics of this machine are very similar to those of a direct-current railway motor; but these motors will be considered more in detail under the head of electric railways.

Motor-starting Devices.

All kinds of motors require some device for starting, by means of which the flow of current can be checked until the motor gains sufficient speed to develop the necessary counter electromotive force to oppose further increase of current. In the case of direct-current motors there is but very slight resistance to the flow of current through the armature when the machine is not running. Armatures are wound so as to have as little resistance as possible, in order to obtain efficient machines, and therefore applying the full voltage of the line directly to the brushes when the machine is standing still amounts practically to a short-circuit, which would destroy the armature before it could acquire any great degree of speed.

For this reason it is essential to provide starting arrangements whereby the current is applied gradually to the motors. In the case of constant-speed direct-current motors this is accomplished by inserting resistances in series with the armature, which are gradually cut out as the machine acquires speed, and which at full speed are entirely cut out of circuit. This device is called a starting-box and consists of an arm which moves over a number of contacts between which are connected coils of wire of high resistance. As the arm passes each successive contact the sections of the resistance wire connected between the contacts passed over are cut out of circuit, thus permitting increasing quantities of current to be applied to the motor. The last contact point on which the revolving arm rests is connected directly to one of the brushes of the motor, and by the time the arm reaches this contact the motor should have acquired full speed.

On starting boxes of this character comparatively small resistance wires are generally used, which heat up rapidly, and will therefore only carry the full-load current of the motor for a few moments. It is therefore important that the arm be moved over the face of the contacts in a comparatively few moments, stopping but a few seconds on each notch, just long enough to allow the motor to accelerate slightly at each step. If the resistance is held in the circuit longer than this it will be heated up to the point of destruction.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Relating to Wattmeters.

G. W. H., St. Paul, Minn.: When a wattmeter is calibrated to be correct on 60 cycles, will it register correctly on 133 cycles? If not, what will the error be approximately?

Answer.

If the meter is of the commutator type there will be, practically speaking, no difference whatever between the readings on 60 and 133 cycles. If the meter is of the induction type and is calibrated for 60 cycles it will run slow when operating on 133 cycles. The percentage which it will run slow may vary, as it does in different makes, from five to 15 per cent., and in some of the old types of induction wattmeters the error may possibly be as high as 20 and 25 per cent.

Is there any danger of potential coils burning out by change of system?

Answer.

Changing an induction meter calibrated for 60 cycles to a system of 133 cycles will not do any damage to the potential coils. As a matter of fact, the application to the potential coils of a higher rate of alternation will reduce the volume of current through them by virtue of the increased inductance. Such a change would actually reduce the current rather than increase it, and consequently the potential coils should run cooler than they would on 60 cycles.

How can a meter be changed from a 60-cycle to a 133-cycle meter?

Answer.

The simplest method of making this change is to remove turns of wire from the impedance coil until the increase in speed comes up to normal. In the case of induction meters that are provided with a means for varying the air-gap in the iron core of the impedance coil the desired results may be obtained by simply increasing the air-gap, thereby reducing the impedance and allowing more current to flow, which increases the speed.

Why won't the Duncan direct-current meter register correctly on alternating-current systems? Please explain.

Answer.

The Duncan meter does register correctly on alternating currents. This is due to its series field coils and armature circuit being practically free from both inductance and capacity. In direct-current work the load in watts is equal to the amperes multiplied by the volts, but in the measurement of alternating currents the load in watts is equal to amperes multiplied by volts multiplied by the cosine of the angle by which the current is displaced from the pressure.

If the meter be subjected to a direct-current load of 10 amperes at 100 volts the watts will be 1,000 or 10×100, and the speed will be proportional, but in the case of measuring alternating currents the load in watts is equal to current $\times$ pressure $\times$ the cosine of the angle by which the current is displaced (lagging or leading) from the pressure.

Now if the meter be subjected to an incandescent-lamp load of 10 amperes, 100 volts, and alternating current, the true watts will be $10 \times 100 \times 1 =$ 1,000 watts, in which 1 is the cosine of 0 angle of displacement on account of the lamp load being non-inductive; and since both series and short-circuits of the meter are inductionless the torque and speed of the armature will be precisely the same as in the case of the direct-current load. The meter is also correct on inductive loads.

Legality of Municipal Ownership Questioned.

The right of municipalities in the United States, and more especially in California, to own public utilities is the point at issue in a case brought before Judge Olin Wellborn, of the United States District Court for the Southern District of California. The suit was instituted as a test by the Edison Electric Company against the city of Pasadena, Cal., to determine the right of the latter to buy the plant of the former. The electric corporation raises the contention that it is unconstitutional, under the fourteenth amendment of the Constitution of the United States, for a city to obtain such ownership. The claim is made that no municipality in California may engage in competition with private citizens, because the California law provides immunity from taxation to cities, thus affording them an unfair advantage in violation of the constitutional amendment referred to.

The Iowa Conventions.

[Continued from page 361.]

economy. At an expense of $200 one transformer was substituted for eight. This resulted in a saving of current that had been wasted before, amounting to $2 a day. The speaker had seen three transformers hanging at the rear of one store. Some people thought they were meters. George S. Carson of Iowa City commended Mr. Lundgren's paper highly.

Methods of Increasing Business.

At the session of Thursday afternoon several papers on subjects connected with the increase of central-station business were read. The first was by Errett L. Callahan of the Chicago office of the General Electric Company, and was entitled "Increasing the Central-station Day Load." It related to the use of heating devices. Mr. Callahan pointed out that these devices are in favor with the public because of their simplicity and adaptability for everyday use. They can be attached to the usual outlets or receptacles. The central-station man can supply 75 per cent. of the heating demand without providing increased transformer, meter or plant capacity. The heating business is largely a day load. "Comparing operating costs with the addition of a fair heating load and the station's business before heating devices were used, the revenue derived from heating devices can be estimated at about 95 per cent. clear profit." Mr. Callahan gave helpful suggestions on the establishment of a heating department, the work of solicitors, show-window display and advertising. The electric flatiron should be the entering wedge for other electric heating and cooking devices. Demonstrations are very useful, and the speaker in complimentary terms referred to the recent domestic-science lectures and exhibit at Dubuque, previously mentioned in the Western Electrician. As to cost of current, Mr. Callahan gave a table showing that at the five-cent rate (kilowatt-hour) the cost for electricity for all cooking and baking during a period of eight months was 1½ cents per person per meal. The consumption was 287 watt-hours per person per meal. It is true that a portion of the electric-kitchen outfit load comes on the early evening peak in the winter months, but in the summer it will not.

Mr. Cole of Grinnell, Iowa, said his experience with electric heating and cooking appliances in his business had been satisfactory. One admirable feature is that the wife can prepare the breakfast at the dining-room table, dispensing with a servant. The electric waffle-iron is an excellent device; there is no danger of burning the waffle, which comes out crisp and toothsome.

To a questioner, Mr. Callahan said that with electric cooking the rate, he thought, should not be below six cents. The increase of business ought to make that rate profitable. However, individual conditions must govern.

Mr. Burt thought the gas people had the better of the cooking proposition at the present time.

Mr. Mathes thought the Union Electric Company of Dubuque had spent more on electric heating than any other company in the state. He referred to the recent 15-day demonstration in Dubuque conducted by the Dubuque Woman's Club. The movement there was entirely educational. There was nothing for sale. Every electric heating or cooking device in which the central-station company had confidence was demonstrated. The purpose was to show what can be done in the household with electricity. Mr. Mathes considers the smaller devices, as the chafing dish, intensely practical and within the means of everybody who can afford electric illumination. The electric flatiron is a great invention—a great step forward in domestic science. A complete washing can be put through electrically within three hours. Washing machine, wringer, drying cabinet and flatiron are all electrically operated. This demonstration was accomplished at the recent Dubuque exhibition and attracted a great deal of attention, as, of course, a family washing and ironing could not be done in three hours, with ordinary domestic appliances. "We must push the smaller devices, which are not prohibitive in first or operating cost, gradually working up to the larger units," said Mr. Mathes. "We have started. We have a number of practical devices that will hold their own with all competitors. The future remains with the good sense of the individual central-station manager. Go a little slow on the heavier devices and push the smaller devices—water heaters, pads, coffee percolators, chafing dishes, etc."

Prof. A. H. Ford of Iowa City said the value of the electric cooking device lay in the fact that the heat is delivered exactly where wanted without waste at that particular point. Heating large bodies of water, air or other substances by electricity is not economical, but in confined localities it is economical as well as very convenient. J. R. Cravath of Chicago and others took part in the discussion.

Rufus E. Lee of Clarinda read an excellent paper on "The Manufacture of Ice in Connection with Electric Light Heat and Power Plant." Speaking from actual experience, Mr. Lee favored the establishment of ice factories with electric-light plants. His paper will be published in a future issue of the Western Electrician. Mr. Zahm also favored the establishment of refrigerating plants in connection with electric plants.

J. Robert Crouse of the Co-operative Electrical Development Association, Cleveland, Ohio, reported, to his regret, that he had been unable to prepare a paper on "Co-operation," owing to pressure of other duties. Mr. Crouse sent a letter briefly explaining the purpose of the co-operative movement. He said that the manufacturers had subscribed during the last 15 months over $133,000 to the movement. President Zahm added a few words of explanation.

Mr. Longnecker gave a brief account of the water-softening installation in Centerville. He believed the water-softener had more than paid for itself in improving the quality of the boiler-feed water. He thought a softener good for any plant where the company has hard water to contend with.

On motion of Mr. Burt, the sympathy of the association was extended to Mr. Frank McMaster of Chicago, who is not in good health and is recuperating at a North Shore sanitarium. Mr. McMaster was to have presented a paper on "Nernst Lamps for Street Lighting" before the convention. General regret was expressed at his illness, which, fortunately, promises to be only temporary.

F. N. Jewett of Chicago, before adjournment, reverted to Mr. Lee's paper on ice manufacture, which he praised highly. He pointed out that artificial ice is better than natural ice and usually commands a higher price. Adjournment for the day was then taken.

Prime Movers, Distribution, Lamps.

"Gas Producer Engines" was the subject of the first paper of Friday, prepared and read by Prof. G. W. Bissell, professor of mechanical engineering in Iowa State College at Ames. The speaker first alluded to tests of producer gas engines at the St. Louis Exposition and said the favorable results of these tests were significant. The engine of large size is still in the experimental stage; that is, for use in places where expert attendance cannot be secured. A given producer may be better adapted for handling a wide variety of coals than a given boiler unit. More recent tests confirm in a general way the advantages of the gas producer. The purifier has now been discarded, and coal carrying as high as four per cent. of sulphur has been discharged directly into the engine cylinder. The economizer as an economizer has been discarded, and other modifications in the direction of simplicity made. Professor Bissell described some tests of his own of last year on a hard-coal producer gas engine driving a dynamo. On a 14-hour test, with a load factor of 18 per cent., the cost per kilowatt-hour at the switchboard for fuel worked out at 1.2 cents. It is difficult to predict the immediate field of the producer gas engine. As the price of fuel increases, its field will enlarge. The cost of a producer gas engine is from 40 to 60 per cent. more than that of a corresponding steam engine. There is no reason why the gas engine cannot be used for general electric-light and power work. It is merely a matter of training the station force to be in sympathy with the gas engine. One thing to be borne in mind is that the water to run a gas-engine plant may be eight times as much as that needed to run a corresponding non-condensing steam-engine plant.

To a questioner Professor Bissell said that it was perhaps true that the vertical gas engine is difficult to oil. In the horizontal engine it is possible to obtain a pretty good distribution of oil in the cylinder. Large engines, as for blast-furnace gas, are usually horizontal, and European practice in general favors the horizontal engine.

The next paper was entitled "The Proper Selection of Steam Engines" and was read by Harry E. Chase of Des Moines. With plant running only at night, with no steam-heating load and boiler pressures of 90 to 100 pounds, medium, short-stroke Corliss-type engines should be selected. In the average small plant the slow-speed engine has no place. In large plants the case is different. Mr. Chase gave some interesting figures of the characteristics of electric-light plants in 62 towns in Iowa with which he is familiar. (It may be explained that he was formerly Hartford steam-boiler inspector for Iowa.) These towns might average from 3,000 to 3,500 in population. They contain 64 central stations, of which 46 are owned by private companies or individuals and 18 by municipalities. Six have hot-water and eight direct steam district heating. Thirty use simple Corliss engines, four compound condensing Corliss, six compound condensing high-speed, and 32 simple high-speed engines. The aggregate horsepower is slightly in favor of the Corliss type, while in number of units the high-speed engine has some advantage. Local conditions must govern to a large extent in the selection of an engine for an electric-light plant. The slow-speed, detachable-gear engine will run longer with little attention than the high-speed type, but yet at the end of that period it will be found that both engines will have cost about the same, in time and money, for overhauling. In other words, while the slow-speed will run longer with but little attention than its rival, it will necessitate more attention when it is overhauled.

Mr. Carson said that at Iowa City they have a high-speed engine (20 by 21 inch) to carry the load in case of failure of the waterpower. It has carried a load of 250 horsepower, running condensing, at a consumption of 30 pounds of water per horsepower-hour. In another station there is a Corliss engine having cylinder dimensions of 14 by 13 inches. The plant is operated on a 24-hour schedule. It was decided that the engine was too large to be operated economically all the time, and an engine of half the size was added. Operating the plant thereafter, with perhaps an increase of load of 10 per cent., the large engine was in service from 5 to 10:30 p. m., in winter, and the smaller one for the remainder of the 24 hours. The saving in coal was 40 per cent. by this arrangement, or a saving of $1,700. The small Corliss engine and its dynamo cost $2,500, so that two-thirds of the cost of the additional unit was saved the first year. Personally, Mr. Carson favors Corliss engines, where the conditions are suitable.

Mr. Burt of Waterloo knew of one four-valve Corliss engine a few years ago that used 125 pounds of steam per kilowatt-hour. His company has a 25-horsepower steam-turbine exciter unit that arouses his admiration. It consumes 32 pounds of steam per horsepower-hour on full load and 60 pounds on half load. But the back pressure cannot be allowed to go very high.

President Zahm told of running a 350-horsepower Corliss engine constantly in his town (Mason City) for six weeks, owing to an accident to a smaller unit. During that time the cost of current at the board was 50 per cent. more than usual, owing to the fact that the big engine was only half-loaded for part of the day.

Prof. A. H. Ford of Iowa State University at Iowa City read the next paper, "Electric Distribution Systems," which was illustrated by two diagrams. This paper is given elsewhere in this issue. The discussion touched on 230-volt and high-efficiency lamps, and, as to wattage, Professor Spinney explained that for the 110 or 115-volt lamps the efficiency is about 3.1 watts per candle, while on 230 volts the efficiency falls to 3.5 watts, depending largely on the fragibility of the filament. Speaking of transformers, Mr. Burt said that his experience in practice was that single-phase transformers are more generally useful than two-phase or three-phase transformers.

Paul B. Sawyer of Des Moines pointed out that in distribution it is often wise to use larger wire than theoretical calculations would show to be permissible. A sleet storm might put the smaller wire out of business.

C. H. Davis of Chicago, taking the place of Mr. McMaster, read a brief paper on "Nernst Series Alternating Street-lighting System." He described and exhibited a Nernst series outfit of 50 candle-power for street-lighting service. It comprises a single-glower lamp, a supporting bracket and a small series transformer, the primary coil of which may be connected in series on any 6.6 or 7.5-ampere alternating, constant-current circuit, the latter being regulated in the usual manner from constant-current regulators at the station. These units may be inserted in an existing arc circuit to supplement scant illumination where needed. The glower is mounted vertically, and the heater is made in the form of a helix around the glower. The lamps are placed 15 feet above the street for best results and are spaced, say, 150 feet apart, staggered on the two sides of the street. The lamp is intended to compete with the Welsbach gas street lamp. The watt consumption of this unit, including the loss in auxiliary transformer, being approximately 115 watts, four of them take about the same energy as one standard alternating-current series arc. For street illumination, however, it is said, that four such units are more than the equivalent of one arc with its concentrated brilliancy. The ordinary standard alternating-current series 7.5-ampere tub transformer having a capacity of 50 arcs will operate 167 Nernst lamps of the type described. As one of the characteristics of the glower is to crystallize during its useful life, thus increasing in resistance and under ordinary conditions reducing the current flowing, advantage is taken of the raising voltage characteristic of the series transformer to maintain the energy practically constant in the glower circuit, giving little or no depreciation in light.

Mr. Burt said he had tried one of these lamps, and the glower lasted 14 days. He doubted if there was any simpler or better street illumination for a small town than the high-efficiency series incandescent system with enclosed fuses. Lightning may burn out the series transformers where they are used.

Getting New Business.

The concluding session of the convention was held on Friday afternoon. The first feature was the reading of a paper on "Modern Methods of Securing New Business," by Charles A. Parker of Detroit. The speaker said that good service must be assured before the station manager can go after business with any degree of assurance. The next step is advertising, mainly direct-by-mail advertising, and the third is solicitation. Of advertising itself, Mr. Parker said:

"You can, by advertising, so influence your public that, instead of using only two or three dollars' worth of electricity per capita in a year, they will

not be satisfied with less than seven, eight or nine dollars' worth.

"Advertising makes the people want electricity. 'Oh,' says someone, 'that's nonsense; the want it now. Everyone would prefer it, but they're afraid to pay the price.' Exactly, my friend; you have got to make them want it so they will pay the price. Now they just want it. Advertise, and you'll find they want it and won't be happy till they get it."

Mr. Burt said a reduction of expenses of five or 10 per cent. in the station is hailed as an important thing, but a new-business hustler can increase the business 20 to 40 per cent. perhaps. The Waterloo company made an appropriation of $5,000 for new business last year, put on three solicitors and added 1,500 gas stoves. New business should be gone after in a sharp, determined, business-like way. The speaker thought direct solicitation the most effective. Good trade literature frequently goes into the waste-basket with the bad.

Mr. Carson thought direct mail advertising has its field, particularly in the central-station business. Mr. Zahm heartily agreed with Mr. Carson. His company sends out circulars on various subjects with monthly bills. It has sold tantalum lamps in this manner.

Concluding Business and Election of Officers.

In executive session the association decided to co-operate with the Co-operative Electrical Development Association, as asked by Mr. Crouse. A committee for this purpose will be appointed by the executive committee.

Six new members were received—Fort Dodge Light and Power Company, Parkersburg Electric Light, Heat and Power Company, Oskaloosa Traction and Light Company, Emmetsburg Electric Light, Heat and Power Company, Citizens' Railway and Light Company of Muscatine, and Keokuk Electric Railway and Light Company.

On recommendation of the nominating committee, these officers were elected:

President—George S. Carson, Iowa City.
Vice-president—L. D. Mathes, Dubuque.
Secretary—W. N. Keiser, Des Moines.
Treasurer—W. A. Mall, Belle Plaine.
Executive committee—Mr. Carson, Mr. Mall, Mr. Mathes, Mr. Keiser, P. B. Sawyer of Des Moines, Gus Lungren of Cherokee and A. L. Dodd of Charles City.

Des Moines was chosen as the place of meeting in 1908.

Mr. George S. Carson of Iowa City, the new president, has been a prominent figure in the association for several years and has contributed much to its success. He was promoted from the vice-presidency. He is president and manager of the Iowa City Electric Light Company. He was born in Iowa City in 1862 and took a partial course in engineering at the Iowa State University. After engaging in mercantile business he became identified with the Iowa City Electric Light Company, taking the management in 1899 and becoming president of the company in 1905. He is also president of the Iowa City Gas Light Company and the Iowa Gas and Electric Company of Washington, Iowa.

Iowa Street and Interurban Railway Association.

Overlapping the convention of the Iowa Electrical Association, the fourth annual convention of the Iowa Street and Interurban Railway Association was held at the same place on April 19th and 20th. President F. J. Hanlon of Mason City was in the chair and Secretary L. D. Mathes of Dubuque performed the duties of his office. After a speech of welcome by Mayor Crockett, President Hanlon presented his annual address, in the course of which he said:

"The most important work this year has been concerning legislation which at one time threatened to overwhelm us, and I am proud to say that at every call a goodly number of our members were quick to respond and exert their influence in opposition to proposed legislation that would have been injurious to electric-railway interests. I cannot commend too highly both branches of the Legislature for their very evident desire not to embarrass the electric railways with hostile legislation when the harmful effects of proposed acts were explained. Among the most important work was the defeat of the running-board, Sunday closing and wire regulation bills, and the securing of a 10-cent minimum on the two-cent-fare bill.

"The work of your secretary in this connection is worthy of the highest praise, and to his watchful diligence and energy may be ascribed a goodly portion of our success. Not only in this matter but in all others he has been faithful, and I trust the members will in all instances show their appreciation of his efforts to protect your interests by prompt replies to all correspondence. He gets no salary and renders valuable service and needs encouragement instead of having to wait for 'the letter that never came.'"

Mr. Mathes presented his report, and then the first paper was read. It was that of H. W. Garner of Oskaloosa on "Amusements." The paper was read by Secretary Mathes. Incidentally, the author gave the following information: "The electric-railway interests of the state of Iowa are now represented by some 23 separate companies operating a total of over 500 miles of electric street and interurban track and serving an approximate population of 500,000. For convenience the companies are divided as follows: Companies serving population of 40,000 to 100,000, 6; companies serving 20,000 to 40,000, 6; companies serving 10,000 to 20,000, 7; companies serving less than 10,000, 4.' The paper was discussed by Mr. Hippee of Des Moines, Mr. Crafts of Clinton, Mr. Mathes and Mr. Cass of Cedar Rapids.

Use of Storage Batteries.

The first feature of the afternoon session of Friday was an address on "The Storage Battery in Railway Operation," by J. M. S. Waring of Chicago.

Batteries for this work were divided into two general classes, namely, regulating and peak batteries. Mr. Waring defined the former of these as batteries which were not required to carry sustained loads for long periods of time, but whose functions were alternately to charge and discharge for short intervals of time in response to the rapid fluctuations on the railway circuit, thus maintaining an approximately constant load on the generating equipment. Peak batteries were defined as those which were required to discharge continuously over an appreciable length of time. Illustrations given of the latter types of batteries included those in service on the elevated roads in Chicago, where the batteries were discharged during the morning and evening peaks at the time of heavy traffic.

It was stated that a few years ago the field of the battery in railway service was restricted to the direct-current power-house battery and the line battery. In recent years, however, this field has been broadened so as to include in addition to these types batteries for regulation in alternating-current plants. Cases were cited of the batteries installed on the Oneonta and Mohawk Valley Railroad Company, in which case the entire power generated is alternating current, while the load to be regulated is partly direct and partly alternating current, the former being the load caused by rotaries operating in the power house and the latter the load transmitted from the alternators to outlying sub-stations. In this situation the battery regulates the fluctuations of load on the alternators as well as on the rotaries in the power house.

The batteries in service on the Spokane and Inland Railroad were also referred to, in this case the batteries being installed in a phase-changing station, the supply line to this station being 60-cycle and the outgoing line to the railroad being 25-cycle, single phase. The battery regulates the fluctuations on the incoming circuit, thus maintaining a practically constant demand upon the supply circuit.

Other cases were referred to, such as an installation where both alternators and direct-current generators were installed in the same plant, the battery regulating the fluctuations of load on both alternators and the direct-current generators, thus maintaining a practically constant output from these machines.

In discussing line batteries, Mr. Waring referred to the line battery for purely regulating work and outlined the advantages of such a battery, such as the saving in copper to be effected and the elimination of a sub-station by means of a line battery. In the former case the saving in copper effected is due to the fact that with a battery it is only necessary to transmit the average load from the power house over the railway line, while without the battery sufficient copper must be installed to give satisfactory voltage conditions when transmitting the maximum demand over the line; in the latter case the battery, by eliminating a sub-station, also eliminates the attendance incident to this sub-station, a battery of this type requiring no attendant.

Line batteries for carrying a sustained peak at times of heavy load were also discussed, and in this connection the installations on the Chicago elevated roads were again referred to.

In cases where the railroad company is operating from its own waterpower the point was brought out that where this power is limited the batteries afford a means for utilizing it to the best advantage, supplying demands in excess of the waterpower and charging at times when the load is light and water plentiful. Where railroad companies are buying power on a maximum-demand basis the batteries by cutting off the peaks and fluctuations of load reduce the rate for power.

Exciter batteries were then described. These batteries, by being constantly floated on the exciter bus in the alternating-current plants, are always available in case of a breakdown to the station exciters.

Other Papers.

H. H. Polk of Des Moines read a paper entitled "Modern Train Dispatching on Interurban Railways." He placed the important factors in train operation in this order—safety, speed of trains and economical operation. In order to obtain these results it is necessary that trains be operated on train orders issued from a central office. The telephone is superior to the telegraph in transmitting train orders on interurban lines. Mr. Polk described the system in use on his road. It is a composite system, using both the telegraph and the telephone on one line.

"Freight Handling by Electric Lines" was the subject of P. P. Crafts of Clinton. The author's conclusions were summed up as follows: "Backed by our experience in the past and at the present, I believe we can feel assured that any average interurban, the investment in which is warranted by the prospective passenger business, has a successful freight business practically assured, which within a very few years will become an important factor in its earnings."

The concluding paper of the afternoon was on "The Steam Motor—Its Value in Interurban Service," by W. G. Wagenhals of St. Louis. The writer described "the largest self-propelled motor car which has been built in this or any other country." It is 82½ feet long and will seat 64 persons. The front truck has the driving wheels and the total weight is 178,560 pounds. The car has handled 22 loaded freight cars, and, running light, has shown a speed of 45 miles an hour. Crude oil is burned for fuel. A duplex steam engine is used and the boiler is of the marine type. The consumption of oil is about two gallons per mile run.

On Saturday Isaac B. Smith of Cedar Rapids read his paper on "Joint Operation of City and Interurban Cars over City Tracks." There was a general discussion, followed by the re-election of the old officers, as follows:

President—F. J. Hanlon, Mason City.
Vice-president—P. P. Crafts, Clinton.
Secretary and treasurer—L. D. Mathes, Dubuque.

Convention Notes.

The Fox Manufacturing Company of Milwaukee was an exhibitor.

The Federal Electric Company of Chicago showed a sample of its electric signs.

G. M. Huber of Chicago was on hand for the Atlas Railway Supply Company.

C. W. Wilkins was on hand talking carbons for the National Carbon Company of Cleveland.

Evans, Almirall & Co. were represented by Benjamin Kauffman, western manager at Chicago.

Allis-Chalmers Company was represented by Ervin Dryer, C. M. Howe and D. K. Chadbourne of the Chicago office.

The Helion lamp proudly displayed by "Texas" Boyd of the Columbia Incandescent Lamp Company created a sensation.

Jasper Blackburn appeared for the Everstick Anchor Company of St. Louis. He demonstrated his company's ingenious guy anchor.

The Illinois Electric Company of Chicago was represented by C. C. Dawson. Mr. Dawson was especially liberal in dispensing cigars.

J. E. O'Neill of the Chicago office had something to say about bare, weatherproof and magnet wire for the Standard Underground Cable Company.

The Kalamazoo Railway Supply Company of Kalamazoo, Mich., was represented by Fred N. Root, who showed the Root spring snow scraper.

The Monarch Electric and Wire Company of Chicago was represented by H. E. Mason. Mr. Mason was kept busy looking after wire and supply business.

On Friday afternoon a number of the "boys" got together and played a baseball game on the local club's grounds. The "Lamp Men" beat the "Supply Men," 9 to 7.

The "Dutch lunch" of Friday night was a big hit. It was given in the hotel, and with song and story, food, drink and cigars, was a pleasant feature of the convention.

The Electric Appliance Company of Chicago was represented by its Iowa salesman, J. K. Alline, who made a good display of Sangamo meters and American Electric renewable-element flatirons.

The Western Electric Company of Chicago exhibited railway supplies, motors, arc lamps and fans. It was represented by O. B. Duncan, H. E. Griffin, W. E. Myers, D. C. Gursh and M. R. Lash.

There is a fine interurban line connecting Davenport and Clinton, 36 miles apart, and many of the visitors, availing themselves of the courtesy of the company, took the pleasant ride which it affords.

The Buda Foundry and Manufacturing Company and the Paige Iron Works of Chicago were represented by E. S. Nethercut, chief engineer, and V. A. Swett, traveling representative. The company had an exhibit.

The National Brake and Electric Company of Milwaukee sent Bert Aikman and W. R. Crawford of the Chicago office to represent it. The exhibit included an independent motor-driven air compressor, an oil-pneumatic automatic governor, a self-lubricating engineer's valve and the new "National" emergency valve for use in operating trains of two or more cars, the whole constituting a

complete equipment of the company's latest air-brake apparatus.

Frank N. Jewett of Chicago was on hand for the Wagner Electric Manufacturing Company, accompanied by C. C. Warner. The company showed a portable lamp-testing volt-wattmeter in the booth of the Central Electric Company.

The Ohio Brass Company of Mansfield, Ohio, was represented by F. H. Jamieson, sales manager of the Chicago office, and A. L. Havens. It showed overhead material, rail bonds, porcelain high-tension insulators and Tomlinson's car couplers.

Through the kindness of Ritchie O. Taylor of the Omaha office of the American Telephone and Telegraph Company, arrangements were made whereby delegates had the free use of the long-distance telephone service to any part of Iowa.

The Fort Wayne Electric Works was represented by A. L. Pond of the Chicago office and F. S. Wiemeyer of Des Moines, Iowa representative. The exhibit consisted of standard type K meters, multiple alternating-current arc lamp, meter calibrator and small power motors.

The Central Electric Company of Chicago was represented by F. R. Bryant, general salesman, and F. P. Kennedy and A. L. Hancock, salesmen, who exhibited and gave dissertations on the merits of the Central's specialties—Okonite wire, Columbia lamps and D. & W. fuses.

W. R. Garton & Co. of Chicago were represented by W. R. Garton, president, and C. C. Ewing, traveling salesman. The company exhibited the Heany fireproof wire, Anderson overhead material, Massachusetts chemical products, Shaw lightning arresters and other specialties.

G. H. Atkin and J. M. S. Waring of Chicago, respectively district manager and district engineer of the Electric Storage Battery Company, attended the convention. Mr. Waring delivered an address on storage batteries in railway work at the street-railway convention on Friday afternoon.

The American Steel and Wire Company of Chicago sent George Long, George Quigley and Frank Conklin to the convention. The company exhibited its "double twin spindle drill" for installing bonds on the rail and showed many types of rail bonds and terminals as well as bare and insulated wire and cables.

The Benjamin Electric Manufacturing Company of Chicago was represented by H. E. Watson and W. L. Rogers. A general line of wireless clusters and outlet-box receptacles was shown. Special attention was given to the company's line of car lighting and right-of-way lighting specialties as well as the Arc-burst and new Anti-night fixtures.

The Electric Service Supplies Company (Porter & Berg department, Chicago) was represented by E. R. Mason and Tom Henkle, and had a prominent exhibit in which was shown a large number of its specialties and general lines of supplies. Demonstrations were made in front of the hotel with the company's "Roller" rail-bond tester.

The H. W. Johns-Manville Company displayed overhead line material, molded mica insulation, Noark enclosed fuses, fuse blocks and accessories, friction tape, trolley wheels, high-tension insulators, molded mica weatherproof sockets, and the Electrotherm, the substitute for the hot-water bottle. J. W. Hardy of Milwaukee was in attendance.

The Westinghouse Electric and Manufacturing Company exhibited a full line of its portable testing instruments, wattmeters, fan motors and protective apparatus. W. R. Pinckard, manager of the detail and supply department of the Chicago office; A. M. Miller and H. H. Coughlan, Iowa representatives; S. G. Peticolas, Nebraska representative, and E. B. True, instrument expert, were in charge of the exhibit.

The General Electric Company was represented by J. D. A. Cross, agent; F. W. Hilliard, meters; D. Ulke, railway supplies; E. L. Callahan, heating devices; F. M. Vogel, Lynn, Mass., and R. E. Keller, heating devices. The display included various heating devices, luminous radiators, coffee percolators, chafing-dishes, flatirons, etc.; also railway supplies and tungsten lamps in operation, the second public exhibition of this new lamp in the United States.

Announcement was recently made that the East Creek (N. Y.) Electric Light and Power Company has made tentative plans for the erection of a large power plant on East Canada Creek, near Ingham Mills, Herkimer, N. Y., and that a surveying corps has been located to make the necessary preliminary survey. Stanley Dean, a New York contractor, is in charge. When the power plant is built it will not be long before the energy of the East Canada Creek will drive the electric cars over the entire system of the Fonda, Johnstown and Gloversville Railroad, furnish power for many manufacturing industries in those fields and become a competitor for electric lighting.

Electric Distribution Systems.[1]

By Arthur H. Ford.

A problem frequently confronting the power-station engineer is the selection and design of a distributing system. Therefore, it has been thought that a discussion of the subject from the viewpoint of cost and operating characteristics would be a matter of interest.

Whenever electrical energy is transmitted from one place to another over a conducting system a portion of the energy is wasted, due to the resistance of the conductors and losses in any translating devices which may be used. In a two-wire circuit containing no translating devices this loss is $W' = I^2 r t$, where I is the current, r the resistance of the circuit and t the time during which the current flows. The energy transmitted over such a circuit is $W = E I t \cos \Theta$, where E is the receiver potential and $\cos \Theta$ its power factor. Expressing both of these in terms of power they become $P' = I^2 r$ and $P = E I \cos \Theta$, which are the power lost in the line and transmitted, respectively. The efficiency of the transmission is

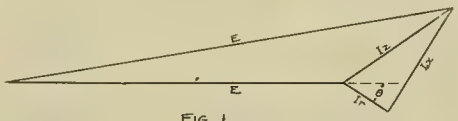


Fig. 1.

GRAPHIC REPRESENTATION OF DROP IN DISTRIBUTION.

$$\frac{E I \cos \Theta}{E I \cos \Theta + I^2 r}$$

A factor of equal importance with the efficiency is the regulation of the line, which is the ratio of the rise in the receiver potential from full load to no load, to the full-load potential. The general expression for the receiver potential is $E = \sqrt{E'^2 - I^2 (p x + q r)^2} - I (p r - q x)$, where E' is the generator potential, r the resistance and x the reactance of the line, and p the power factor ($\cos \Theta$) and q the reactance factor ($\sin \Theta$) of the receiver. The relation of the generator potential to the line drop and receiver potential, when the current is lagging, is shown graphically in Fig. 1. The reactance x is inductive and therefore positive for all practical cases. The inductance factor is positive for a leading current and negative for a lagging current.

When the load is non-inductive (consists of incandescent lamps, for example), the inductance factor is zero, the power factor unity and the effect of reactance negligible if the frequency is not greater than 60 cycles per second, the copper conductors not larger than No. 0 B. & S. gauge, spaced not more than 18 inches apart and the fall of potential due to resistance not more than 10 per cent. of the generator potential. A direct current may be considered as an alternating current with the frequency zero, in which case the inductance factor is zero, the line reactance zero and the power factor unity. In either of these cases the receiver potential is $E = E' - I r$, which expression will be sufficiently accurate for most moderate sized distributing systems.

Both the efficiency and the regulation can be improved, keeping the power transmitted the same, by reducing the current and increasing the potential in the same proportion. If the efficiency, regulation and power are kept constant, the cross-section of the conductor will vary inversely with the square of the potential when the distance is constant; or the distance to which power can be transmitted, with the same total weight of conductor, will vary directly with the potential. It is, therefore, advisable to use as high a potential as possible. Where transmission alone is considered the potential can be raised to about 60,000 volts.

It has been found by experience that where power is to be supplied in small amounts the limiting potential is about 2,300 volts with alternating currents and 550 volts with direct currents. Various considerations have determined these limits, among which are the safe potential for which air-brake switches mounted on a switchboard can be used, the safe potential for house wiring and the economical potential for incandescent lamps. The inability to change the potential at which power is transmitted by direct currents by the use of static transformers limits the line potential of direct-current systems to that which is safe for house wiring.

The efficiency and regulation can also be improved by decreasing the resistance of the line, by using larger conductors, which entails a larger investment, with the corresponding increase in the interest charge, which may equal the value of the energy saved. The distribution circuits from the average power station are loaded to their capacity for so short a time that the expenditure of a large amount of money to reduce the loss of energy is not usually a good investment. The reactance of the line is practically independent of the size of the conductor, increasing with the frequency and the distance of the conductors apart, so that the regulation cannot be improved indefinitely by increasing the size of the conductors.

The allowable variation of the receiver potential is determined by the character of the load, being not more than two per cent. with a load of incandescent lamps, if the service is to be satisfactory. A line regulation of 10 per cent. is the most that can be allowed for such service unless there is an attendant at the switchboard all the time and he is provided with means for determining the receiver potential, or unless each feeder is provided with an automatic potential regulator.

Where a line potential of 2,300 volts is used, and where the lines are loaded to their capacity for two hours a day, the cost of energy at the switchboard being two cents per kilowatt-hour and copper 25 cents, with interest at 5 per cent., the efficiency will be the determining factor for lines less than three miles long, and the regulation for lines of greater length.

The systems in use at present are the two and three-wire for direct currents and single phase alternating currents and three-wire and four-wire for two-phase and three-phase alternating currents. These systems may be designed from either of two viewpoints—the maximum potential which exists between any two conductors, or the minimum potential, which can be obtained from the system. The maximum allowable potential is determined by the insultation of the line, which presents no great difficulties if the potential is not over 5,000 volts. The minimum potential obtainable from the system is determined by the maximum potential for which receiving devices can be built, which is about 2,200 volts for small transformers and 230 volts for incandescent lamps. The conditions of economy demand, therefore, that the line potential shall approach as nearly as possible to 5,000 volts and still be able to get the lower potential required by the receiving devices. The line connections and relative weight of conductors for equal loss of power on the basis of equal maximum potentials and equal minimum potentials are shown in Fig. 2.

The relative weight of conductors for the same maximum potential is given merely to show the difference in the results obtained by the two methods of calculation, for the limitation of receiver potential always keeps the maximum potential below that for which it is possible to insulate the line, no matter which of these systems is chosen.

Single-phase Alternating and Direct-current Systems.

The great economy in conductors leads one to use the three-wire system instead of the two-wire system for low-potential circuits, except where a very small amount of power is to be transmitted, or the receiver potential is greater than 250 volts. The distance to which power can be transmitted with the same loss, receiver potential and weight of conductor is increased 63 per cent. by the use of a three-wire system, with the neutral of the same size as the outside conductors.

The increased distance to which power can be transmitted from a transformer with a three-wire secondary as compared with one having a two-wire secondary and the same receiver potential frequently makes it possible to connect all the customers in a couple of blocks, in a residence district, to one transformer, with a reduction in the transformer capacity to less than half what it would be if each customer were supplied with a separate transformer. This statement has been made so often that it may seem unnecessary to some; but it is not uncommon at the present day to see several small transformers placed within a couple of hundred feet. It is advisable to interconnect the secondary circuits of adjacent transformers so that they will aid each other when the maximum load does not come on both at the same time. When this is done the secondary of each transformer should be fused.

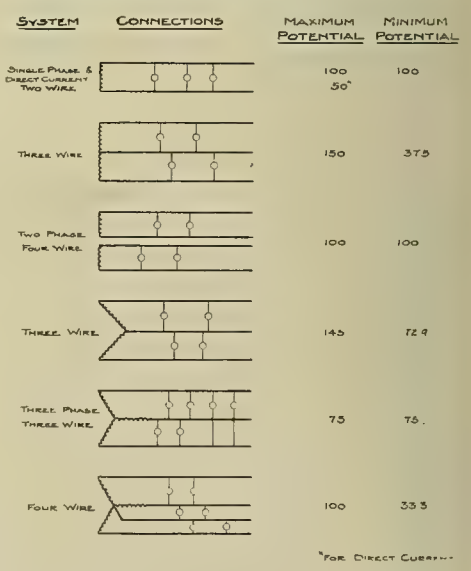


Fig. 2. Relative weight of copper for equal loss of power.

The same theoretical considerations would lead one to use the three-wire system on the primary circuits also; but it is not done on account of the extra complication which it would require at the power station, the same result being more easily accomplished by running the two-wire system at a higher potential. When the line potential is 2,300

[1] A paper read before the Iowa Electrical Association at Clinton, Iowa, on April 19, 1907. The author is professor of electrical engineering in the State University of Iowa.

volts the size of many of the conductors is determined not by electrical considerations, but by the strength of the wire, it not being advisably to use wire smaller than No. 8 B. & S. gauge.

The low potential at which direct-current circuits must be run limits their use to districts where the load is very much concentrated.

It is desirable that the load be equally divided between the two sides of the system at all times, for the regulation of each side is dependent on the load on the other. If the two sides be equally loaded and the load should be thrown off one side, the potential on the other side would fall an amount equal to the difference between the generator potential and the receiver potential when the load was equal on the two sides, and rise twice this amount on the side from which the load was removed. The load is usually kept balanced within 10 per cent., which is accomplished by wiring each customer's premises on the three-wire system and distributing the load as equally as possible.

Two-phase Systems.

The two-phase four-wire system may be regarded as two single-phase two-wire systems, as far as the lighting load is concerned, two-phase feeders being required only where it is desirable to operate polyphase motors. The lighting feeders are frequently run from the power station as entirely independent single-phase circuits. The circuits will be dependent upon each other to the same extent that they would if they were run from a single-phase system. This dependence of their regulation depends on the regulation of the generators.

The three-wire system requires much less weight of conductor, but this saving is at the expense of the regulation, which is dependent on the drop in the common conductor in much the same way that the regulation of a single-phase three-wire system is dependent on the drop in the neutral. The dependence is greater in this case, for the current in the common conductor is 1.41 times that in each of the outsides when the load is balanced, instead of being zero, as is the case in the single-phase system.

A considerable saving can be effected by running the three-wire feeders to the center of distribution and running single-phase feeders from there. The three-wire system also unbalances the mechanical load on the cross-arms unless a six-pin arm is used, each arm carrying two circuits of the same size, with the common conductor of the odd circuit mounted on the top of the pole.

No matter which two-phase system is used it is advisable to have the load balanced between the two phases at all times. This requires that care be used in connecting the customers' circuits so as to get customers of the same class balanced on the two phases.

Three-phase Systems.

The three-phase three-wire system requires practically the same weight of conductor as the two-phase three-wire system, and with a corresponding dependence of the regulation of the potential of each phase on the load on the other phases, the dependence being greater in this case. The problem of balancing the load is greater, as it must be balanced among three phases. It is not necessary to carry more than two conductors to places where there are no polyphase motors.

The three-phase four-wire system makes use of a neutral conductor which serves the same purpose as the neutral of the single-phase system and carries no current as long as the load is balanced among the phases. The line potential is 1.73 times that of the three-wire system, which accounts for the decrease in the weight of the conductors. It is the cheapest system to install of those given and is largely used in factories where the load consists principally of polyphase motors, for, by using 115-volt lamps and 200-volt motors, the advantages of a high motor potential can be obtained without the use of transformers for the lamp load. In some cases 230-volt lamps are used with 400-volt motors, for the saving in the cost of the conductor system more than makes up for the lower efficiency of the lamps. The same system may be used for the primary distribution circuits without introducing much more complication than the three-wire system requires.

As a motor load is very desirable it is necessary to discuss the various distribution systems with reference to their availability for a motor load. The direct-current motor is the only one which can be run satisfactorily as a variable-speed machine and therefore is an absolute essential for much motor work. The possibilities of developing a motor load of this kind are so great in many places as to determine the choice of a direct-current three-wire system at a great increase in the cost of the distribution system over that for an alternating-current system. Where such an expense is not warranted by the motor load alone, it may be by giving the possibility of installing storage batteries to act as insurance against shutdown and help the generators out on the peak load.

Where batteries are used it is advisable to put them at the subcenters of distribution and not at the power station. The use of the storage battery as a means for improving the regulation and reducing the cost of the distributing system has been much neglected except by the largest stations. Where the installation of a 230-volt three-wire system is not warranted a direct-current motor load may be obtained by the use of a 500-volt circuit for power purposes only. This requires the use of special machinery in the station and a special distributing system, so is not often resorted to. Where a motor load can be developed in a small district some distance from the power station it may be advisable to install a motor-generator set, if arrangements can be made for its care by some large power user on whose premises it is located.

Where alternating-current generators are used it is advisable to use polyphase machines on account of their greater output per unit cost and the possibility of running large motors from them. Self-starting single-phase motors are built as large as 25 horsepower; but they take such a large starting current that their starting has a very detrimental effect on the regulation of the line, so it is not advisable to use them in sizes larger than 10 horsepower. Induction motors are very satisfactory as long as variable speed is not required.

Two-phase distributing systems have an advantage over three-phase systems in that the load is required to be balanced between two phases instead of among three. This balancing does not have to be done very accurately if each phase of every feeder is provided with a potential regulator, so it is a point of no great moment. Three-phase motors require three service wires and three transformers, while two-phase motors require four service wires and two transformers. It is possible to run three-phase motors from two transformers, but it is not done except for very small motors, for it requires the installation of transformers of twice the capacity of each of the three transformers. The total transformer capacity will, therefore, be 1.33 times what it would where three transformers are used for each motor. There is practically no difference in the operation of two and three-phase motors.

The three-phase four-wire system requires the least weight of conductor and has the highest potential between conductors, which is somewhat of a disadvantage, for it is almost a necessity to work on the distributing system while it is alive. This system requires special generators and oil switches at the power station when the potential is 2,300 volts. The generators are special only as to the potential, which must be 4,000 volts, with an extra conductor connecting to the center of the Y-connected armature.

The writer is of the opinion that when the load is concentrated within approximately half a mile of the power station and where there is the possibility of a considerable variable-speed motor load being developed it is advisable to install a direct-current three-wire system with a potential of 115 volts on each side. By increasing the potential to 230 volts a great saving in conductors is accomplished, but this is offset by lower lamp efficiency and increased trouble with cut-outs, switches, etc., on the customers' premises.

When the load is scattered a polyphase system should be installed, two-phase four-wire for plants under 1,500-kilowatts capacity and three-phase four-wire for plants larger than this. The transformer potential is preferably 2,200 volts primary with a three-wire secondary having 110 volts on each side. The secondaries of all lighting transformers on each phase and feeder should be interconnected where it can be done without extending the circuit more than 200 feet. Separate transformers should be used for the motor load, although each motor may not be supplied with a separate set of transformers.

The Cost of Operation Per Dollar of Income.[1]

By L. B. Spinney.

For the purpose of estimating the average cost of operating an electric-light plant in Iowa forms were printed and distributed to various plants of the state with the request that they be filled out and returned. The values thus obtained were compared and averaged.

The form used separated the cost of operation into four general headings:

1. The cost of manufacture.
2. The cost of distribution.
3. Office expenses and management.
4. Miscellaneous expenses.

The cost of manufacture was itemized as follows: (a) Power-plant wages; (b) fuel, water, oil and waste; (c) repairs; (d) miscellaneous power-plant expenses.

The cost of distribution included: (a) Setting, removing and trimming arc lamps; (b) setting, removing and reading meters; (c) repairs to pole line and service, arc lamps, meters and transformers; (d) miscellaneous distribution operating expenses.

Under office expenses and management were included: (a) Salaries; (b) general office expenses.

Miscellaneous expense was made to include: (a) Interest; (b) taxes; (c) insurance; (d) advertising; (e) all other expenses.

This distribution of expenses differs somewhat from many of the accepted methods of classifying and distributing operating expense, and this fact is doubtless responsible, in some cases at least, for the incomplete data sent in. It was thought, however, that with the various expenses classified according to this schedule consistent returns could probably be obtained, since whatever the practice of any given plant operator might be with reference to the placing of various expense items, these could be readily transferred to the schedule as outlined. Nevertheless the returns were in some respects disappointing. This was true, for example, with reference to miscellaneous expenses, to which reference will be made later.

Of the 76 plant owners or operators who were asked for statistics 41 responded. The total number of forms returned was 31. The number which gave complete itemized reports was 10. In many cases the total cost under each of the four general headings only was given. In other cases the data given consisted only of total cost of operation and gross income, and in still others the total cost of operation in cents per dollar of gross income.

Various reasons were assigned for failure to furnish the statistics asked for or failure to itemize reports. In five cases the present owners had not been in possession of their plants long enough to be able to analyze their expense accounts. In five cases the plants were combined with central heating plants, gas plants, street-railway plants or mills and the operators were unable to distribute the operating expense. In two instances the records of the plant were not kept in such form as to enable the owner to itemize his cost of operation. One plant owner was too busy to be able to find the time necessary for filling out the form. Another thought the report would require too much time and sent his last annual balance sheet in lieu of a report. Another preferred not to itemize his operating expense account and sent in his gross income and total operating expense only. In one case it was explained that the men employed in the station were expected to make themselves generally useful outside as well as inside the plant. The plant owners therefore found it difficult to properly distribute their wages among the various accounts.

The general results of this statistical investigation are set forth in the following table, which gives the average value under each item together with the number of plants from which this average was taken and the maximum and minimum values of the corresponding items as shown by this number of plants.

Annual Operating Expense of Iowa Electric-light Plants.

	No. of Plants.	Cents per Dollar of Gross Income.		
		Av.	Max.	Min.
Cost of Manufacture:				
Power plant wages	21	17.7	36.9	4.46
Fuel, water, oil and waste	20	29.7	43.	15.
Repairs	16	2.76	10.7	.44
Miscellaneous power-plant expenses	14	2.37	12.3	.20
Total cost of manufacture	23	50.5	74.8	21.7
Cost of Distribution:				
Setting, removing and trimming arc lamps	10	1.06	2.	.13
Setting, removing and reading meters	9	1.5	1.64	.20
Repairs to pole line and service, arc lamps, meters and transformers	13	3.06	11.	.18
Miscellaneous distribution operating expenses	6	3.03	7.4	.55
Total cost of distribution	17	4.97	14.	.18
Office Expenses and Management:				
Salaries	16	7.1	15.1	.62
General office expenses	16	1.92	7.85	.21
Total office and management expenses	20	7.99	17.0	.55
Miscellaneous Expenses:				
Interest	16	7.66	19.4	.48
Taxes	21	1.95	5.6	.44
Insurance	13	1.07	2.5	.20
Advertising	11	1.65	2.49	.04
All other expenses	11	3.33	19.2	.50
Total miscellaneous expenses	21	10.7	46.2	2.20
Total cost of operation	31	70.3	89.	44.3

As exhibited by the table, the average total cost of manufacture of the electric current is 50.5 cents per dollar of gross income. The corresponding maximum and minimum values are 74.8 cents and 21.7 cents. The average total cost of distribution was 4.97 cents per dollar of gross income, the maximum and minimum values being 14 cents and 0.18 cent, respectively. The average total office and management expenses was 7.99 cents per dollar of gross income, the extreme values being 17 cents and 0.55 cent. The average total miscellaneous expense was 10.7 cents per dollar of gross income, the extreme values being 46.2 cents and 2.20 cents. The average total cost of operation for 31 plants was 70.3 cents per dollar of gross income. The largest value given for this item was 89 cents per dollar of gross income and the lowest figure was 44.3 cents.

It is probable that this figure of 70.3 cents per dollar of gross income is a fair average for the total cost of operation for the various plants of the state if the item of depreciation is not taken into account. Undoubtedly depreciation has been included in some of the values given in the different reports. This will be evident from a consideration of the wide range of values included under the fifth subhead of miscellaneous expenses. The average value for this item is 3.33 cents per dollar of gross income. The maximum value given is 19.2 cents. The minimum value is 0.5 cent. Since interest, taxes, insurance and advertising are separately itemized and the miscellaneous expenditures in connection with the cost of manufacture, the cost of distribution and office expenses and management are provided for elsewhere in the schedule, it is difficult to account for this wide range of values except by assuming that the values given under the head of "all other expenses" in some cases include depreciation, while in others they do not. In one

1. A report presented at the Clinton meeting of the Iowa Electrical Association on April 18, 1907. The author is professor of electrical engineering at Iowa State College, Ames, Iowa.

case it was explained that the large value under this heading included storeroom, legal expenses, rents, city royalty, etc. It was thought that in view of the wide variation in practice in estimating and accounting for depreciation it should not be considered in this investigation; but it now becomes evident that the topic "all other expenses" is so comprehensive as to lead to some confusion in this respect. However, the effect of this item upon the total result is not large, since, as shown by the table, the average value which appears under this heading is 3.33 cents per dollar of gross income, which is less than 5 per cent. of the average total cost of operation.

In spite of the wide range of values observed under the various headings it is believed that the averages obtained are valuable as showing, if only in an approximate way, what it costs to operate the average electric plant.

It is to be regretted that the number of completely itemized schedules returned was not larger, since, with a larger number of plants included in the investigation, greater significance would have attached to the general averages obtained.

New Printing-press and Machine-tool Controllers.

The Cutler-Hammer Manufacturing Company of Milwaukee has recently placed on the market a new line of printing-press and machine-tool controllers, illustrated on this page. These controllers are of the well-known Carpenter type and embody the distinctive features of this class of Cutler-Hammer apparatus. The essential difference between the new controllers and the older type is that the former provide for a greater number of field speeds than the latter.

At the time the first Carpenter printing-press and machine-tool controllers were placed on the market it was the accepted practice to obtain the major portion of speed variation by means of armature resistance, the increase in speed secured by means of field control seldom exceeding 15 per cent. Of late, however, variable-speed motors so designed as to permit of their speed being increased as much as 400 per cent. by field control have come into use, and the present line of controllers has been designed to meet this new condition in printing-press and machine-tool work.

Like the older type of apparatus, the new line of controllers is provided with an auxiliary breaking device equipped with a powerful magnetic blowout. In opening the circuit by moving the lever to the "off" position the break does not occur on the contacts, but on the auxiliary device located just below the contact segments. This prevents arcing on the contacts. The contact segments themselves are of hard-drawn copper and are separately renewable.

The controllers are equipped with cast-iron covers, shown in Fig. 1, which completely enclose all of the apparatus except the handle of the operating lever. The lever itself, instead of being cast in a straight bar, as in the older type of apparatus, is formed with a projecting arm carrying the contact shoe for the field speed points. This construction contributes to the compact arrangement of the controller. All contact parts are removable from the slate front without disturbing interior connection, and all terminals are labeled with brass tags, insuring proper wiring.

In this new line of controllers the speed regulation is effected by means of both armature and field resistance, the armature resistance being furnished separately, though it is possible to mount it with the front if desired. The field resistance is in all cases attached directly to the front of the controller, and provision is made for positively holding the lever on any desired contact.

Six distinct pieces of apparatus are comprised in this latest line of printing-press and machine-tool controllers—three non-reversible and three reversible. In each class the controller may be had with underload release only (Fig. 2); with underload and overload release, and with underload, overload and push-button release and dynamic brake (Fig. 3).

Fig. 1. Controller with Cover in Position.

Fig. 2. Non-reversible Controller with Underload Release Only.

Fig. 3. Reversible Controller with Underload, Overload and Push-button Release and Dynamic Brake.

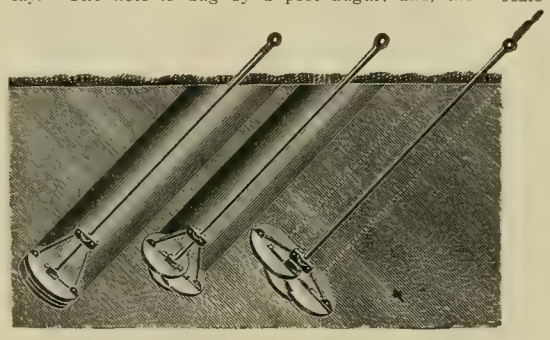
CUTLER-HAMMER PRINTING-PRESS AND MACHINE-TOOL CONTROLLERS.

The Everstick Guy Anchor.

Where the removal of earth to make a hole is necessary, the Everstick anchor, manufactured by the Everstick Anchor Company, 17 South Main Street, St. Louis, Mo., is said to be the quickest anchor installed. It is asserted by this company that anchors that are installed without the removal of earth will not hold so well as this anchor.

The Everstick anchors can be installed at any depth in less than a half minute after the hole is bored.

The anchor expands into solid and undisturbed earth at the bottom of the hole, as shown in the picture, and there is said to be no backward movement. There is no space under the anchor to hold water. The anchors are made of malleable iron and are coated with asphaltum, preventing rust and decay. The hole is dug by a post augur, and, the anchor being inserted, the projecting disks at the bottom are quickly forced out into the surrounding earth by mechanical means from the surface of the ground.



THE EVERSTICK ANCHOR.

Graphite Commutator Brushes.

The subject of graphite commutator brushes is an interesting one, for the reason that the conditions under which they are used are not uniform, and therefore we do not claim that graphite brushes will always be found satisfactory. Dixon's graphite brushes have a decided advantage, because their losses from friction on the commutator are less than with carbon brushes; in addition, the commutator is always automatically lubricated, whereas with carbon brushes there are conditions under which lubrication is necessary.

In comparison with many makes of brushes the graphite is soft; therefore the surface of the commutator should have a true and polished surface in order to insure uniform contact between the commutator and the brush. In some cases it has been found necessary to use a pressure of from four to five pounds per square inch in order to secure sparkless commutation for all loads.

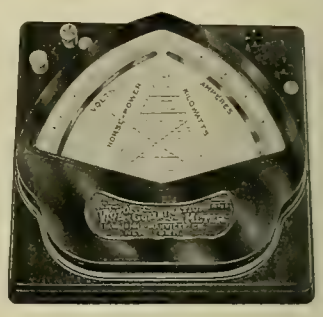
Our advice to those who desire to get best results is to be sure the commutator is smooth before putting on the brushes, as the success of any brush depends on a continuous contact from bar to bar of commutator. Intermittent contact will cause heating and sparking, and this will occur if there is a series of high spots from bar to bar. The tension on the brushes should be square, and as many men can hardly tell the difference between one pound and four pounds, we recommend the use of an ordinary spring balance. If the hook of the balance cannot be easily engaged in the brush holder, a stout string should be passed over and the hook caught in that, and the reading or pressure noted on the scale.—Graphite.

The longest telegraph line in the world is said to be that between London, England, and Teheran, Persia. This is 4,000 miles, 200 miles under the North Sea and the remainder through Europe and Asia. The system includes 10 automatic repeating stations.

New Portable Combination Meter.

The unique combination of a voltmeter, ammeter, wattmeter and horsepower meter in one instrument is accomplished in the Victor combination meter, manufactured by the H. W. Johns-Manville Company. This instrument was first placed on the market somewhat over a year ago, and a large number of inquiries and orders have been received. It was first designed for switchboard use in central stations, and the success of the instrument for this purpose has recently led to the placing on the market of a portable form for general electrical testing, an illustration of which appears herewith.

The Victor meter consists of two separate and complete instruments in a single case, the one giving readings in volts and the other in amperes. The third and fourth readings are obtained on a scale plotted at the center of the dial, giving the product, or power consumption, in watts or kilowatts and horsepower. These readings are taken at the points of intersection of the two indicators. The power scale is calibrated in "watts" or "kilowatts" on one side and "horsepower" on the other.



PORTABLE COMBINATION METER.

The convenience of having in one instrument a portable meter giving readings in volts, amperes, watts and horsepower is readily appreciated at a glance, as this meter is adapted for rapid testing in the laboratory, while for field work it is almost indispensable. It has been found especially suitable for taking readings on electric cars, electric elevators, etc.

If desired, multiple shunts and extra multipliers will be furnished in connection with the volt and ampere scales for additional readings, and a table containing the multiplying factor to be used with these various combinations when reading the central scale. The workmanship and materials used in the manufacture of the Victor meter are of the highest class. The calibrations are carefully and accurately made, and the instrument is reliable and permanent.

General Electric Company's Exhibit at Jamestown Exposition.

Although electricity plays an important part at the Jamestown Exposition (opening date April 26th), the management felt it advisable not to set aside a separate building for electrical exhibits. Two principal exhibit halls have been built. One of these—the Machinery and Transportation Building—includes the exhibits of electrical machinery, and it is in this building that the main sub-station and distributing switchboard of the exposition are located.

Inasmuch as the electrical apparatus in the sub-station as well as that used by the Exposition company about the grounds was furnished by the General Electric Company, its exhibit has been confined to illustrating various industrial and domestic applications of electricity. This exhibit is located adjacent to the sub-station and is filled with an interesting variety of devices, many operated by electric motors. One section has been fitted up as a model electric kitchen, with a spacious dining room adjoining, which will be used as reception quarters for guests.

One of the interesting features of this exhibit is the small refrigerating plant operated by an electric motor so arranged that the refrigerating liquid passes through an adjacent section of the railing, which, of course, is covered by a heavy white frost. Another unique application of the electric motor is seen in the Seth Thomas clock with 24-inch dials in full operation, regularly wound by an electric motor. An electrically operated floor surfacer and polisher is worthy of comment. A motor-driven washing machine attracts the housewife as much as the sewing machine operated by electricity. The electric cream separator is now quite generally used, and this company is furnishing the motors for driving an exhibition where cows are milked by electricity in another part of the grounds.

Up-to-date bakeries are now equipped with electricity for operating as well as lighting, and the electric dough-mixer shown by the General Electric Company has proved a most useful device. Two designs of electric hair-dryers are here exhibited, and the electric heating pad is also shown. The electrically operated circular saw and new form of electric bench drill, motor-driven lathe and a small

portable forge fitted with electric blower form an interesting part of the exhibit. There are also a number of small grinders, buffers and polishers for use of jewelers and in small shops. Several types of ventilating blowers are shown, and the exhibit of ordinary electric fans is very complete. In fact this promises to be one of the most useful parts of an exhibit located in the latitude of Norfolk.

In the electric kitchen is to be found an elaborate collection of the company's electric heating and cooking utensils. These will be in full operation during the exposition, and their convenience and durability will be amply demonstrated.

The dining room is attractively fitted up in Flemish oak, with dark red burlap wall covering, and contains a handsome mantel of Flemish design. Instead of the gas log, the luminous electric radiator has been installed in the fireplace. In the ceiling of the dining room a comprehensive showing is made of the company's incandescent units, including the Gem units of various sizes and the new tantalum lamps, all equipped with various forms of Holophane reflectors.

The main part of the exhibit is illuminated by enclosed arc lamps fitted with concentric diffusers. Edison incandescent lamps are used throughout for lighting the exposition buildings, and the General Electric Company exhibits this type of lamp as well as some of the other standard Edison lamps, with interesting information as to the annual production, etc., of these lamps.

As indicative of certain uses of the electric motor an Edison business phonograph with cylinder-shaving device is exhibited as well as a talking phonograph, all operated by small motors. The talking phonograph is used to explain the operation of the other phonograph and various devices in the exhibit. An electrically driven house pump is shown in operation and an electric renovator in the form of a carpet sweeper forms an unusually interesting application of the electric motor.

The General Electric Company will also furnish for use about the exposition grounds more than a score of powerful electric searchlights, and in the exhibit made by the Navy Bureau of Equipment is to be found a small Curtis steam turbine of the type and size used on board ship. Here, also, this company is exhibiting its new electric fireroom timing device.

Telephone News from the Northwest.

Governor Crawford of South Dakota has appointed W. E. Ege of Centerville, S. D., as a member of the State Telephone Commission.

Frank Bracelin, local manager at Grand Forks, N. D., for the Northwestern Telephone Exchange Company, has been made district manager at Crookston, Minn. A. E. Harfield of Northfield, Minn., succeeds Mr. Bracelin at Grand Forks.

G. W. Hooper will install a local telephone exchange at St. Hilaire, Minn.

R. F. Graeber and others have incorporated the Sheldahl Telephone Company. It is capitalized at $6,000 and will open an exchange at Sheldahl, Iowa.

The Bell telephone exchange and that of the Farmers' Telephone Company at Platteville, Wis., will be consolidated.

There is talk of organizing an Independent telephone company at West Point, Iowa.

The Mutual Telephone Company of Olds, Iowa, has been incorporated. It has a capital of $14,000. Everett Swans heads the board of directors. R.

Indiana Telephone Items.

The Russiaville Co-operative Telephone Company has filed amended articles of association and proposes to enlarge and improve its exchange. Albert Lindley is president.

The Steuben County Telephone Company has just completed a new switchboard in Angolia and will next build a line to Metz. The line between Jamestown and Freemont will be rebuilt as soon as satisfactory bids are secured on material.

The Forest Telephone Company of Forest, Clinton County, has organized to establish an entire new system.

The first quarterly meeting for the year of the Fifth District branch of the Indiana Telephone Association was held at Muncie on April 18th. Every company in the district was represented. The large attendance was due to the agitation now being had over the proposition of the Bell people to close their local exchanges in exchange for the toll-line business of the local Independent companies. While the question was discussed informally the matter was deferred until the state convention in May. Many of the delegates said they are now up to the necessity of increasing their plants and the purchase of new material and equipments to extend their lines. Not a single failure in the telephone business was reported in the entire district for last year. After delegates were selected for the state convention, A. J. Brown of Winchester and H. O. Miller of Fairmount were re-elected president and secretary, respectively.

An important conference of telephone men was held in Fort Wayne on the 19th inst., relating to the proposition alleged to have been made by W. P. Sylvan, general sub-licensee agent of the Central Union, and J. L. Putnan of South Bend, also representing the Central Union Telephone Company, to retire from the local-exchange business in favorable localities in exchange for a diversion of the long-distance business of the Independents. There were three districts represented at the meeting, and while the Third District voted by resolution to take favorable action on the proposition, the First and Second districts voted to postpone the matter, declaring it to be a question for the whole state to decide, rather than by individual districts. S.

Southeastern Telephone Developments.

A conference of Bell telephone officials in Spartanburg, S. C., recently is believed to precede the announcement of extensive improvements in that town. R. D. Blowers is the local manager for the Bell company.

In Shreveport, La., the Cumberland Telephone Company has petitioned the authorities for the right to raise residence telephones from $2 per month to $2.50 and party lines from $1.50 to $2 per month.

Manager E. C. Land of the Southern Bell Telephone Company at Salisbury and Spencer, N. C., has been transferred to Greensboro, N. C. Manager R. L. Boyd is transferred from Greensboro to Salisbury.

N. L. Walker of the Standard Electric Supply Company of Norfolk, Va., has closed a contract for furnishing material for the Johnston County Telephone Company at Smithfield, N. C.

The work of putting underground the wires of the Capital City Telephone Company at Raleigh, N. C., is progressing rapidly and is nearly completed in the business section of the city. Work on the new exchange building is all ready to start and will be located on Morgan Street, near the state capitol building. One of the most complete exchanges in the South will be installed during the early summer. A. Maupin of the Bell company will be in charge of the work.

The organization of the new Home Telephone Company of Nashville, Tenn., has been completed by the election of directors and officers. R. E. Cooper is president and W. C. Polk treasurer. The new company will be required to place its wires underground. The fixtures of the Home Telegraph Company have been transferred to the new company, which for two years has been fighting to gain a foothold in Nashville.

Representatives of an Independent telephone company, with headquarters at Knoxville, Tenn., are said to have made a thorough investigation of the field in Chattanooga and have determined to enter the field and compete with the Cumberland company in Chattanooga.

The State Board of Equalization of Alabama has raised the taxes of the telegraph and long-distance telephone companies and assessed them at a higher rate than they have ever paid before. The assessment of instruments was unchanged. The Independent telephone hearing was set for April 26th. L.

Lower Telephone Rates for Philadelphia.

It is announced that the Bell Telephone Company will reduce its local pay-station rate in Philadelphia to five cents a call, beginning May 1st.

Since November, 1904, the city has been divided into four pay-station zones, and 10 cents is charged for calls from one zone to another and five cents for a call to a telephone within the same zone as the calling station.

From May 1st the pay-station zones will disappear and all local calls will be a nickel. Considering the city's area, this reduction by the company gives Philadelphia exceptionally cheap pay-station service. Five cents will pay for a message from League Island to Torresdale, a distance of 20 miles.

GENERAL TELEPHONE NEWS.

The Bangor (Wis.) Telephone Company has increased its capital stock from $5,000 to $25,000.

The Farmers' Telephone Company of Sandwich, Ill., has been incorporated for $5,000 by J. S. Knights and others.

The new Edgewater exchange of the Chicago Telephone Company was put in service on the night of April 20th. After all preparations had been carefully made the new exchange of 4,000 telephones was cut over from the Lake View exchange in about one minute's time. One hundred cable workers, with their assistants, accomplished the rapid feat. Many officials of the company, accompanied by telephone men from a number of other cities, witnessed the "cut-over."

F. C. MacGougan, manager for the Pacific Telephone and Telegraph Company, announces that from $500,000 to $750,000 will be expended in Spokane, Wash., in the betterment of the service. The company has under consideration the erection of a new exchange building and one or two branch exchanges to be operated in connection with the present plant. Every telephone in Spokane will be exchanged, a new instrument of the latest model being installed in place of those now in use. When the improvements are completed 95 per cent. of the Bell telephone wires in Spokane will be in cables, either underground or overhead.

CORRESPONDENCE.

Continental Europe.

Paris, April 9.—A certain number of electric plants on the Continent are now being run on the co-operative system, and are under the control of an association whose members are thus provided with current for light and motors. Among such co-operative associations there is one which I may cite as an example. It is known as the "Electric" company, and it operates a central station located at Birsech, Switzerland. Current is furnished over a wide extent of country, covering twenty-eight localities in different cantons of Switzerland, and some of the lines run across the frontier into Alsace. As many as three hundred workmen have the looms in their home workshops operated by motors, and the current is also used in different kinds of industries and on the farm. In 1905 the association had 884 members and used 9,422 lamps and 400 motors, taking about 900 horsepower. As in the small industries of this kind the motors are not much above two horsepower, this means that a great number of motors are already in use.

The Belgian government has lately made a decision as regards the electric outfit which is to be installed in the new maritime buildings at Ostend. In order to secure the necessary current, an electric plant of some size will be erected, and this is now under way at the present time. Some of the railroad stations lying near the port will take their lighting current from this plant, and current is to be supplied to the maritime constructions for lighting, as well as for operating a number of large motors. According to present reports, the new central station is to be finished in 15 months and will be set running a few months later. It is to furnish current for the needs of the port for a period of 25 years and at the rate of 2½ cents per kilowatt-hour, allowing for a consumption of 600,000 kilowatts per annum.

A project for an electric railroad in Switzerland was adopted by the local authorities not long since. The road in question is to run over a part of the main route of Loeche-les-Bains, which is one of the health resorts of the region, and it is thought that the new line will go far toward promoting the influx of tourists to this point. It will give a good means of communication by the Gemmi Pass, seeing that this latter will come into prominence, owing to the opening up of the Loetschberg tunnel. The electric road will run along the border of the main route, and the bridge of the Dala will be enlarged to give room for it.

A mining and metallurgical exposition will be held at Berlin, Germany, during the month of December next, and will no doubt bring out many novel features connected with the electrical industries. Among them the use of electric motors in mining work, to which the German constructors have been giving some attention, will be illustrated by a number of exhibits.

It is stated that the Radio-telegraphic Company of Berlin has recently succeeded in making a direct connection by "wireless" between its large plant at Nauen and St. Petersburg. The distance in a straight line is about 900 miles. The company is thinking of extending operations as far as the north coast of Africa, where there is already a station at Derna, in Tripoli, and will also send messages to Asia Minor, working at first with the station which is now located at Patura.

The commune of Azmoos in the Saint Gall canton of Switzerland has decided upon the construction of a central electric plant, and it is estimated that it will cost $30,0000.

Hydraulic power is to be obtained from the Trollhättan Fall in Sweden, and the new plant which will soon be under construction at this point will be one of the largest in the country. The work is to be carried on by the Swedish government, and the new station will be erected forty miles from Gothenburg. A head of water of about 230 feet will be obtained, and it is estimated that with the average flow the plant can receive no less than 75,000 horsepower. Turbines of the Francis pattern, each giving 1,000 horsepower, are to be used here. A good part of the current will be used in the town of Gothenburg. It is also intended to run one or more electric railroads for transporting ore from the northern regions to Gothenburg, where it will be treated in the furnaces. Other electric railroads for passenger traffic are among the new projects which will no doubt be realized in the near future.

A. DE C.

Great Britain.

London, April 12.—Complaints have been heard recently of the want of combination among electrical manufacturers in Great Britain. A glaring example occurred two days ago. We have an electrical manufacturers' association and its membership is 59. A meeting was held to determine when the next official electrical exhibition should be held and 20 representatives were present. As a percentage it was not bad, but only 15 voted upon a motion to hold an exhibition in 1908. This motion was lost by one vote in favor of 1909, and presumably the whole association is to be bound by such a vote. The Manchester electrical engineering firms are keen in having an exhibition next year, and although they would like the co-operation of the Electrical Manufacturers' Association, as the

one body which pretends to represent the electrical industry, yet the indications are that the exhibition will be held willy nilly. But the embargo upon the members of the association not to exhibit anywhere without consent will interfere with the representative character of the exhibition, if held, and spoil the chance of a really good show either in 1908 or 1909. It will be best for both parties to come into line before a decision is reached.

The new proposed meter-testing regulations by the London County Council are being strongly opposed alike by the electric-supply companies and the borough councils owning electricity undertakings. An appeal has been made to the Board of Trade that until some degree of standardization is arrived at by the Engineering Standards committee, which is now considering the matter, special regulations of the character of those proposed by the London County Council should not be legalized.

A rather suspicious delay has been introduced in connection with the second reading of the three electric power bills dealing with London. Originally they were to have been read a second time on March 11th; it was then postponed until April 10th, and now April 25th has been fixed. Another delay will probably prevent any tangible result being arrived at for the third session. But this is, no doubt, what "progressive" members desire, in the hope that preference in some shape or form may be given to the scheme of the London County Council. At present the feeling of the new anti-socialist Council is to drop the bill altogether.

There has been a welcome revival on the part of several electrical manufacturing firms during 1906, to judge from the financial results now being put before the shareholders. Dividends of six and seven per cent. are being paid by such firms as Johnson & Phillips and Bruce, Peebles & Co.

A British manufacturers' patents protection association is being organized in London.

The report of the director of the National Physical Laboratory for the year 1906 bears further testimony to the generous support which is continually given to that institution by private individuals and firms. Thus it is seen that all the cable required for electrical building has been given by Mr. R. K. Gray of the Silvertown Cable Works and Messrs. Callender. A number of electrical manufacturing firms are also supplying goods at cost price. Work upon the ampere balance is practically completed, and a paper will shortly be published by Prof. W. E. Ayrton, F. R. S., Mr. T. Mather and Mr. Smith.

An extension of London's pioneer tube railway, the City and South London line, from its present terminus on the north to a point west, which will link up with several main-line termini, will be opened in a few weeks.

A new electrically driven motor car has made its appearance in London, although the principle of its construction is not new; i. e., the incorporation of the motor in the hub of the wheel. The axles, otherwise of the usual Mercedes I. section, are formed into hollow barrels at the ends, through which the cables are led to the commutators, which are mounted on the outer ends of these barrels. The inner ends of the axles form journals, on which the motor shells—formed as the driving-wheel hubs—rotate. Immediately inside these shells are the windings of the 16 fields of the motor, which, being mounted solid with the shell, revolve with it round the armature. The great point claimed for the system is that the low tangential speed of the fields—due to their being the rotating mass and not the armature—gives an enormous increase of power for a comparatively low consumption of current. Tests made with this car and with others have shown that 50 miles can be traversed upon one charge. G.

Dominion of Canada.

Ottawa, April 20.—A new telephone line is being constructed between Ottawa and Montreal. This will make six different services between these two points. The great increase in the local and long-distance business makes this step necessary. All are owned by the Bell Telephone Company of Canada.

The city of Ottawa and the Bell Telephone Company have come to terms, and the company has been given a five-year monopoly for the city. The city will receive $5,000 a year. The city reserves the right to empower a competing company to erect poles and string wires at any time during the last two years of the monopoly, so as to be ready for business at the expiry of the quinquennial period. The rates for telephones are $25 for residences and $45 for business.

The railway committee of the Dominion Senate has killed a bill to incorporate the International Canal and Power Company. The company proposed to construct a canal from Lake Superior to Edmonton. The members of the committee thought the intention of the promoters of the company was to get power rights.

The power and lighting committee of the Board of Works of the city of Hamilton, Ont., has recommended the City Council to apply to the Ontario Hydro-electric Commission for 3,000 horsepower. The commission will also be asked for an estimate of the cost of installing a municipal plant for the city. The aldermen figure out that they can pay for their plant in five years, and that their street lighting would not cost more than $50 a year per lamp, as compared to $85 a lamp now paid to the Cataract Company. It is estimated that the city will need 1,500 horsepower for civic purposes, and will require another 1,500 for private users. It was feared that if a greater amount than 3,000 horsepower was asked for, the Cataract Company would cut prices in order to put the city out of the power business.

The Erie-Ontario Power Development Company's bill has been passed by the Canadian parliament, but an amendment in the original charter was made empowering the company to commence its power canal eight miles east of the mouth of the Grand River, instead of, as in the original charter, at or near the Grand River.

The power policy of the Ontario government is face to face with its first great test. The Hydro-electric Commission has received official applications for contracts for 29,560 horsepower from only eight municipalities. It is understood that the government will act at once, and the contracts asked for will be given. The figures in these contracts will be a revelation of the government's confidence in the commission's estimates. In every case the prices voted upon by the people will be reduced, it is said, by from 10 to 15 per cent. For instance, last January the ratepayers of Toronto authorized the City Council to enter into a contract for power at $18.10 per horsepower per annum, delivered at the city limits, which is a large reduction on the present prices paid. It is anticipated that the contract which the city will secure, as the result of its present application for power, will be at least $2 less than the authorized price of $18.10. The Electrical Development Company may be afforded an opportunity to quote transmission figures to the government for a portion of the power required, but in any event a new government transmission line is to be expected. Toronto will probably provide her own distribution plant. This is estimated to cost $1,500,000. W.

Ohio.

Toledo, April 20.—Luminous and non-luminous electric radiators are among the new products for which there is a large demand this season. The demand for them has become so general that they are being specified by contractors and builders in putting up houses as a part of the equipment.

J. C. Carland & Co. of this city have started grading at Hamilton, Ohio, for the Cincinnati Northern Electric.

Contracts for 13 reinforced concrete bridges have been let in preparation for the reconstruction of the old Columbus and Lake Michigan road between Lima and Defiance, which is now a portion of the Indiana, Columbus and Eastern electric.

The extension of the Northern Ohio Traction and Light Company's line from Barberton to Wadsworth is practically completed.

The Toledo, Wabash and St. Louis proposition continues to be actively pushed, and C. D. Whitney, its president, states positively that it will eventually be built as a combination steam and electric road from Toledo to St. Louis.

The Springfield Traction and Power Company of Springfield, Ohio, has built its own repair shop at the car barns. Several lathes, drill presses and other necessary machinery have been installed to obviate the necessity of sending cars out of the city for repairs.

An effort is being made at Lima, Ohio, to erect a union interurban station and options have been taken on a centrally located piece of property to be used for this purpose.

Following a complaint from fire insurance people, E. Peabody of the Ohio Inspection Bureau made an inspection of the general electric wiring in Oxford, Ohio, last week. Some glaring defects were discovered and further investigations will be made.

The Cleveland Electric Company last week offered to sell its tracks and electric equipment on the Central Quincy line to Tom Johnson's company for $448,473. The offer has not been accepted.

An effort is being made at Newton Falls, near Warren, Ohio, to have the city buy the private lighting plant and operate it as a municipal plant.

Nicholson Bros. of Cincinnati have been awarded the contract for the erection of a three-story stone and pressed-brick telephone exchange building for the Cincinnati Bell Telephone Company. The building will be about 90 by 70 feet and cost $65,000 to $70,000.

The Findlay and Marion Railway and Light Company, with headquarters in the new Hayden Building, Columbus, is about ready to take bids on grading and excavating of the 46 miles of track work between Findlay and Marion.

Cleveland electricians are very much interested in the announcement of several large projects during the last week. The First National Bank will erect a $250,000 building. The Osborn Engineering Company is taking bids for a factory building for the National Carbon Company. The clubhouse for the Excelsior Club will cost $100,000 and there will also be some extensive electrical wiring in new residences, churches, etc.

The Dean Electrical Company of Elyria, Ohio, has plans for a five-story reinforced concrete factory building, 50 by 250, to be erected at Elyria. This building will probably cost $50,000 to $60,000. H. L. S.

New York.

New York City, April 20.—The Harway Improvement Company, which has steadily refused to give its consent to the new Coney Island subway line, has at last been induced to withdraw its opposition, thus avoiding the necessity of carrying the matter into court. As a result, Mr. Metz states that the route will be advertised within four weeks.

The Department of Bridges has begun the work of connecting the elevated railroads in Broadway, Williamsburg, with the Williamsburg Bridge. Within another month, just four years after the completion of the bridge, cars will be crossing the structure. The work on the Brooklyn side will cost $100,000.

On account of increased interest charges due to the sale of $4,500,000 four per cent. bonds to pay for the Atlantic Avenue improvement, changes in the line to Bay Ridge and Manhattan Beach and the electrification of lines in Brooklyn and Queens County, the income account of the Long Island Railroad for 1906, just published, shows a deficit of $28,358. President Peters does not, under the circumstances, consider this an unsatisfactory showing.

Plans are being prepared for electric service on the lines from Long Island City to Port Washington and to Whitestone Landing, and as soon as the tunnels under the East River are completed similar service will be given on the lines to Jamaica and Woodhaven Junction by way of the Glendale cut-off. Plans are being made for an enlarged terminal at Jamaica, where the change from steam to electric locomotives will be made.

The two biggest fire boats ever built in this country, and probably the first turbine fire boats ever put in commission, have just been launched at Newburg. The pumping capacity of each boat will be 10,000 gallons per minute.

When wireless messages are being transmitted via the wireless station at the navy yard (Brooklyn) the electric equipment is said to be almost paralyzed. The greatest difficulty is experienced with the arc lights. The electricians of the yard are not able to explain exactly how it occurs, and are experimenting with a view of overcoming the trouble.

Construction of a new trolley line along the south shore of Long Island has been actually commenced. The Cross Island Traction Company, composed of New York banking interests, headed by Joseph G. Robin, has absorbed the South Shore Traction Company, and it is understood that $1,500,000 is ready for the completion of the road. The new trolley line will begin at a point near the city line, close by Belmont Park, and will extend for 45 miles along the south shore to Brook Haven, with probable extension.

The Rapid Transit Commission has just forwarded to the mayor what will possibly be its last annual report. The contract for part of the construction of the subway loop connecting the Manhattan terminals of the East River bridges has just been awarded to the Degnon Contracting Company, and bids are now being asked for the building of the Seventh, Eighth and Lexington avenue lines. With regard to the other lines, the commission's report is not optimistic about speedy construction, because of the limitations of the financial resources of the city. The amount expended on the existing subway in 1906, under the head of regular work, was $2,883,389, and for extra work $1,415,886, bringing the total cost of the tunnel up to $38,782,276. The expenditures by the city on the subway extension to Brooklyn reached a total on January 1st last of $2,169,083.

After six months' effort, the Interborough Rapid Transit Company, which is to operate the East River tunnel, has begun work on the plant for ventilating the tunnel. The shaft from the surface of the tunnel will be 14 feet wide. The ventilating chamber will be built of concrete and will be 28 feet broad, 36 feet long and 10 feet deep. In it will be installed two electric blowers with seven-foot fan wheels. The air will be supplied through an intake up a sufficient distance to get good fresh air. The air will be blown through the tunnel through a nozzle on either side of the tube, and it will be possible to force in 95,000 cubic feet a minute, although it is not expected that that amount will be often required. D. E. P.

Southeastern States.

Charlotte, N. C., April 20.—The Retail Merchants' Association of Norfolk, Va., has appointed a committee to co-operate with those already at work in an effort to have the lines of the Norfolk and Portsmouth Traction Company extended to West Norfolk.

Already the electric power to be supplied by the Buckhorn Falls power plant, some distance from Fayetteville, N. C., has been contracted for on a liberal basis, and the transmission wires have been completed. Power will be available in a limited quantity at least by May 1st, according to present plans.

The Chattanooga and Tennessee Rivers Light and Power Company will begin at once the construction of conduits in Chattanooga. This is done to prevent a forfeiture of franchise, June 27th having been set as the limit within which work must begin. A

special act of Legislature was passed to make the life of the franchise 105 years, the legal limit previously being 21 years. The franchise was granted years ago.

The Tennessee Legislature at the recently adjourned session passed a bill authorizing the city of Nashville to issue $275,000 light bonds to extend the lighting plant.

President Warner of the North Georgia Electric Company denies the rumor that his company will consolidate with any other power concern in that section. The North Georgia company now has 4,000 horsepower at the city limits, and this will soon be available in the city of Atlanta. The wires of the company will be distributed through the city on the poles of the Atlanta Telegraph and Telephone Company, with which company the North Georgia will split profits, and will also furnish power at a less rate than that now in force, according to reports in advance.

A general movement of merchants on Baltimore Street, Baltimore, Md., has resulted in a determination to have extra illumination, the merchants to pay for the current for one year and the city to furnish the incandescent lamps. These will be stretched across the street from the poles of the United Railways Company.

J. C. Fisher and others have incorporated the Dillaboro and Sylva (N. C.) Electric Light Company; capital stock, $10,000.

The Raleigh (N. C.) Electric Railway has made an offer to the city to build several additional lines to the local street-railway system if the city will agree to extend the lighting contract with the company for a term of five years beyond the time when the contract expires.

The town of Henderson, Tenn., will hold an election on April 27th on the question of issuing $20,000 worth of bonds for purchasing the local electric-light plant.

The Georgia Railway and Electric Company has recently received a consignment of new cars for service on the Atlanta lines. L.

Indiana.

Indianapolis, April 20.—The Chicago, Indianapolis and Terre Haute Traction Company has incorporated; capital stock, $50,000. The purpose is to build an interurban line to connect Indianapolis, Lafayette, Terre Haute, Bainbridge, Rockwell, Sheffield, Williamsport and Gary. The directors are Daniel W. Bolen, Charles M. Kiler, F. M. Strong, R. F. Stewart and Simeon Loftin.

The survey for an extension of the Springfield and Fort Wayne Traction lines from Fort Wayne to Richmond has been completed. The road will connect the additional cities of Decatur, Portland, Winchester, Ridgeville, Fountain City and Richmond.

It is stated that only one interurban electric road has taken out a license and paid the fee of $1,000 to sell liquor on its dining cars, as required by a recently enacted law. Quite a number of steam lines have secured the license.

Suit has been filed in the Federal court at Indianapolis to test the two-cent-fare law. The suit is brought by a stockholder of the Louisville, New Albany and Corydon Railroad Company, who alleges that the road is now being operated on a 4 1-5-cent rate with no profits, and that a reduction to two cents will bankrupt the road. A restraining order is asked.

Probably the handsomest private electric car ever built is now being exhibited in Indianapolis. The car was built by the Cincinnati Car Company for W. Kelsey Schoepf, president of the Indiana, Columbus and Ohio Traction Company. It is finished in solid mahogany and has a combination parlor and dining room, library, kitchen, lavatory and observation platform, the latter enclosed in glass. The car is 60 feet long, eight feet eight inches wide, and 13 feet four inches high. The car weighs 40 tons. Buffet, china closet, extension tables, mahogany furniture, sleeping berths, etc., make up the interior, which compares favorably with the private cars of the steam roads.

The Vincennes, Washington and Eastern Traction Company has filed a mortgage with the recorder of Knox County for $1,250,000. The mortgage covers the right-of-way and the property of the company, to secure means to build an electric road from Vincennes to Cincinnati, Ohio.

The Evansville Electric Light Company has purchased additional land adjoining its plants. It is understood that additions and extensions will be made for a considerable increase in the capacity of the plant.

Papers have been filed with the secretary of state by the Northern Indiana Gas Company and the Michigan City Light and Power Company, increasing their capital stock. This step is preliminary to a merger or taking over by the former of the latter company. The new company when formed will make improvements on the plants so as to supply Michigan City and the surrounding community with light, heat and power.

The board of trustees of the Indiana State Soldiers' Home at Lafayette is asking for bids for the furnishing and installation of two 200-horsepower boilers, one 200-horsepower direct-connected engine, one 150-kilowatt dynamo, one three-ton-capacity cold-storage and ice plant and other electrical equipment. W. S. Haggard is president of the board.

The Hays Electric Manufacturing Company, manufacturer of automatic electric flashers for street and building signs, and other electrical devices, has established a plant in the Industrial Building, Indianapolis.

Charles R. Lane and others of Fort Wayne are reported to have secured a franchise to build, equip and operate a gas-electric-light plant in Danville to supply the city and community with light, heat and power. S. S.

Illinois.

Peoria, April 20.—The Peoria and Lincoln Traction Company has been incorporated, with office at Champaign; capital stock, $400,000. The incorporators are Charles Zilly, W. H. Burke, D. E. Bramble, C. A. Wright and George Mattis, all of Champaign. The line is a part of the Illinois Traction Company's system.

Interurban service by the Illinois Traction Company was opened between Peoria and Bloomington this afternoon, when the first car came over the bridge and made the loop through the city. Tomorrow morning regular service will be given, cars starting at 5 a. m. and continuing through the day at two-hour intervals. The new cars are built especially for the Peoria-Bloomington line and are equipped to operate on both single-phase and direct current.

The farmers along the proposed Lincoln-Mackinaw-Peoria line are taking great interest in the new line and are doing all they can to assist the company to secure the right-of-way at a reasonable rate. The Illinois Traction Company has agreed to construct switches and side tracks wherever 5,000 or more bushels of grain are to be loaded, and will supply coal to the farmers and supply portable stock chutes for the loading of cattle. The Interurban Company is making a great demand for the freight business. A tract of ground has been purchased at Carlinville for a two-story combination freight and passenger station.

The secretary of state has issued incorporation papers to the Carlyle and St. Louis Railway Company. It proposes to construct an electric railroad from Carlyle, Ill., to East St. Louis, Ill. This is an extension of the East St. Louis and Suburban system from Lebanon, Ill.

The new electric-light company that has been talked of in Springfield has secured signatures from property owners and will soon petition the council to grant permission to construct lines. In the downtown district the wires will be put underground. The plans for the new station are about completed and also the plan of the underground work. James L. Adams, Jr., has prepared the plans and specifications.

In a short time a complete telephone service will be in operation over the Illinois Central Railroad. The last stretch of 75 miles to New Orleans is now being finished. The wires are extra heavy, being No. 8 copper.

The Eagle Electric Works has been planning to connect its load to the Peoria Gas and Electric Company's lines here. When it attempted to secure the right-of-way along the road the farmers demanded so much that it abandoned the attempt. It has now secured the right-of-way along the railroad and will commence work at once.

The House committee on municipal corporations has taken favorable action on the public-service commission that the bill proposes to establish. The commission will fix the wages and working hours of utility corporations and fix annually the rates to be charged by such corporations. The bill fixes the maximum charge for street-car service, of gas (90 cents), electric light, telephones and water.

The Senate committee on railroads has postponed for a week the further consideration of the House bill requiring center aisles, closed and heated vestibules, etc., in order to give the interurban officials who were not present a chance to be heard on the bill. Judge Scheefer of Belleville, representing the East St. Louis and Suburban Railway Company, opposed the bill as "unreasonable and unnecessary." V. N.

Michigan.

Grand Rapids, April 20.—A bill affecting the suburban electric roads in all townships by taking from the highway commissioners the right to grant operation privileges in public highways will be introduced in the Legislature by Representative A. E. Woodruff of Wyandotte. The intention is to make operative once more the old law relating to the granting of suburban rights, thus vesting the power of granting franchises in the townships in the township board, composed of the supervisors, clerk and two senior justices. The bill is said to be in the interests of the roads as much as the people. The Norton bill, to compel interurbans to make a rate of 1½ cents a mile, will not be reported out of committee.

The Grand Rapids-Muskegon Power Company wants a 27-year franchise from the city of Grand Rapids. The proposed ordinance reserves the right to the city of fixing the districts in which the wires must be placed underground. It also provides that all high-tension wires carrying over 7,500 volts must be strung on a private right-of-way. The usual provisions regarding the erection of poles and the right of the city and other corporations to use them are also inserted.

Out of the $427,241.77 asked by the Detroit Public Lighting Commission, the committee of the Board of Estimates makes a cut of $183,831.46. The principal items in the cut are $63,432 for one 2,000-kilowatt unit, $21,000 for 400 alternating enclosed arc lights, $66,447.46 for conduits, and $24,943.61 for installing lights.

At the annual meeting of the Flint Light and Power Company officers were re-elected as follows: J. E. Derham of Philadelphia, president; D. D. Aitken, vice-president; A. G. Bishop, secretary-treasurer and general manager; F. A. Beard, superintendent.

The electric lights operated at Lapeer by the Frank J. Schlegel Electric Power and Light Company went out suddenly a few days ago. Stephen S. Yahner, superintendent of the plant, in a wood yard found a specially prepared iron wire, about three feet long, attached to two of the Schlegel wires. The insulation on the Schlegel wires had been cut down to the copper, and the iron wire laid across, the work of an expert. The iron had burned into the copper. L. W. B.

Texas.

Austin, April 19.—Negotiations between the city of Austin and the Consolidated Construction Company of New York for the re-construction and maintenance of the dam across the Colorado River and the installation of a hydro-electric plant are about concluded. The contract has already been signed by the City Council on the part of the city and will be ratified by the municipal water and light commission in order to make it binding. Under the terms of the contract the Consolidated Construction Company is to receive $2,600,000, to be paid in 40 annual installments, for the dam. The company guarantees the stability of the structure during this period. The dam will be located upon the site of the one which was destroyed by the great flood in 1900. Part of the wrecked masonry is still standing intact and it may be used in building the new dam. The dam is to be completed within two years. It will form a lake more than 30 miles long.

James L. Sanford, of Loraine, Ohio, representing the Buckeye Transit Company, is investigating the proposition of building an interurban electric railway between Beaumont and Port Arthur, a distance of 20 miles.

Satisfactory progress is being made with the construction of the electric street-railway system at Abilene by the Abilene Street Railway Company. The company has a capital stock of $100,000.

The route for the proposed interurban electric line which the Northern Texas Traction Company is to build from Fort Worth to Cleburne has been located by E. C. Macey, engineer for Stone & Webster of Boston. The line will be about 25 miles long.

The Galveston-Houston Electric Railway Company has filed its charter at Austin. It has a capital stock of $3,000,000, and is formed for the purpose of building an electric railway between Houston and Galveston, a distance of 51 miles. Its principal office is at Houston. It is a Stone & Webster enterprise, M. M. Phinney of Dallas, Texas, manager for that syndicate, being at the head of the company. All of the preliminary details for the construction of the line are completed. The last obstruction was removed when the Legislature a few days ago passed a law giving interurban companies the right of eminent domain. The route for the line has been located the entire distance between the two places. A branch line will be built to adjacent towns. Galveston Bay will be crossed upon a causeway, which the Legislature authorized the county of Galveston to build.

Governor T. M. Campbell has sent a special message to the Legislature, urging the enactment of a law requiring telegraph and telephone companies to make connection with competing lines. In response to the recommendation of the governor a bill on the subject has been introduced at the special session of the Legislature by Worth S. Ray, and the prospects are favorable for its passage. The bill does not seek to make telegraph companies connect with telephone companies, but telegraph with telegraph and telephone with telephone, so that a person may from any point in the state where there is a telephone, regardless of whether it is an Independent or Bell instrument or line, call up a person at any other point in the state, pay for the message at the point where the call is put in and talk at regular rates. Physical connections are required between telephone offices, but only relay service between telegraph offices. H.

Pacific Slope.

San Francisco, April 18.—Conditions have improved still further since the end of the rainy season with the local electrical interests, but a great deal is yet to be accomplished before the rehabilitation is complete and the supply of power becomes satisfactory. The switchboard was uninjured by the recent fire in the San Francisco Gas and Electric Company's station A. This enabled the company to recover the use of about 60 per cent. of the

plant's capacity by operating the generators in the least damaged section. It will, however, take considerable time to complete the repairs to the engines, generators and transformers in the south end of the station. An additional 5,000-kilowatt unit, consisting of Curtis steam turbine and a General Electric 11,000-volt generator, has been ordered.

The waterpower electric transmission plants of the Pacific Gas and Electric Company are operating again, but they cannot be depended upon for a great amount of surplus power for San Francisco in their present conditions. The floods washed out the upper dam, which gave an increased pressure at the Colgate station, and the washouts on the ditch system in Amador County caused a loss of a great quantity of storage water which was needed to run the Electra station through the coming summer. It is reported that the company will soon go ahead with the installation of the power plant at French Creek, upon which work was suspended about two years ago. The generators that had been manufactured for that station were diverted to other power houses on the system where there was more urgent need.

It is reported that M. V. Halsey & Co. of New York and San Francisco, who purchased R. M. Hotaling's $3,000,000 interest in the Pacific Gas and Electric Company and made an investment of about $5,500,000 in the consolidated light and power system in this city, have, since the recent final breaking off of negotiations for a merger giving the Western Power Company's interest the control of the situation, decided to increase their holdings to at least $10,000,000 and save the situation. At least $1,500,000 will have to be expended in further betterments necessitated by the fires and floods during the last 12 months. This will make these New York bankers more than ever the dominating and controlling factor in the Pacific Gas and Electric Company and its subsidiary corporations. The Electric company's bonds have advanced about four dollars in a week, which indicates confidence in the banking company's efforts to add stability to the big concern.

The City Electric Company is showing great activity in its preparations for inaugurating an independent light and power service before the close of the present year. Rapid progress has been made on the foundations for the power station at Beach and Mason streets, within two blocks of the waterfront. The first of the two Westinghouse-Parsons turbo-generators, of 2,500 kilowatts capacity each, has been shipped, and a third turbo-generator set with a capacity of 5,000 kilowatts has since been ordered, it is understood. Conduits have been laid in Market Street. Vitrified six-duct conduits, of home manufacture, are being laid on the west end of the new system, and 12-duct conduits will be laid farther downtown. Samuel Naphitaly, who resigned his position with the San Francisco Gas and Electric Company to become general manager of the City Electric Company, has gone East on business connected with the machinery purchases.

The third company to enter the local electric-lighting field, which is known as the Metropolitan Light and Power Company, still declares its intention of installing a local electric power plant with a steam-turbine equipment. A. M. Hunt is one of the staff of electrical engineers. The new concern amounts to a consolidation of interests of the Stanislaus Electric Power Company and the San Francisco Coke and Gas Company. The current, transmitted 165 miles by the Stanislaus company, will be distributed by the Metropolitan company.

Lighting rates may be quite reasonable when all of these concerns are in full working order, but by that time the city's needs will no doubt have grown to a point where all the power available will be in demand.

The United Railroads is getting better results on its local system with better weather conditions, more power and more cars. A shipment of 36 additional electric cars has arrived from St. Louis. The cable line on the Castro Street hill will be placed in operation again soon.

The San Juan Portland Cement Company has broken ground near San Juan, Cal., for its large cement mill, which will have a daily capacity of 4,200 barrels. A separate large power house will be erected, in which will be installed a modern oil-burning electric generating plant which is to supply all of the power for operating the mill. Electric lights for the plants will also be furnished from this source. The estimated cost of the power plant is $135,000.

The application of the Mono Power Company for a river water right has been approved by the secretary of the interior. The company has had a long fight against opposition of Los Angeles.

Los Angeles capitalists interested in the Home Telephone Company of San Francisco say that the actual consideration paid for the telephone franchise in San Francisco was the highest ever paid by any corporation for any purpose in any city in the world.

A great many electric wiring contracts for buildings in San Francisco are now tied up by the final walkout of Electrical Workers' Union No. 6. The completion of a number of reinforced concrete buildings has been retarded in this way. This union was expelled from the Building Trades Council.

A.

Mexico.

Mexico City, April 18.—A number of electric power projects are on foot in Northern and Western Mexico. It is stated that there are a number of waterfalls in the Sierra Madre range bordering the western coast which afford ideal sites for hydro-electric plants. The building of railroads through that region will lead to the early development of these power enterprises, it is said.

A. C. Nash, general manager of the company which has been organized to build a system of electric street railway in the city of Chihuahua, and to build interurban lines leading out of that city, has returned from the United States, where he closed contracts for the purchase of enough steel rails to lay 10 miles of track. He is now in the market for 30,000 cross-ties. Enrique Creel, Mexican ambassador to the United States, is at the head of the company. The same interests own the steam railroad which runs from Chihuahua to Santa Eulalia. This line will be changed to electricity and made a part of the general system.

The Parral Power and Reduction Company is preparing to construct an electric street-railway system in the city of Parral. R. B. Davis, formerly superintendent of construction and permanent way department of the Mexican Tramways Company of Mexico City, has just completed an estimate of the cost of the proposed system at Parral.

L. B. Speyer & Co. of Mexico City have signed a contract with Governor Tomas Anzar y Cano, of the state of Campeche, and the City Council of Campeche for the installation and operation of an electric light and power plant for Campeche. A subsidiary company will be organized to carry out the terms of the concession. L. B. Speyer & Co. are bankers and will finance the enterprise. The contract calls for furnishing 2,000 lights at $2 per month, and 60 arc lights and 200 lamps of 50 candlepower for the government at a price of $18,500 annually, making a total of $66,500 annually that is guaranteed, not counting any income that may be received on motor power and extra lights. Campeche is a city of much wealth. On account of its remote location the opportunity for an electric light and power plant there was a long time in being discovered.

The details for the merging of the properties of La Electra and the Compania Industrial de Guadalajara into a company to be known as the Compania de Tranvias, Fuerza y Luz de Guadalajara, in the city of Guadalajara, will soon be arranged. The new company will have a capital stock of $11,000,000. The company has planned some extensive enlargements and improvements. In addition to completing the equipment of the existing street-railway system with electric transit, important extensions of the lines will be made. The central power plant will be enlarged and transmission lines built to the cities of Aguas Calientes, 125 miles distant; Etzatlan, Hostotipaquillo and to Ameca.

The Compania Industrial de Orizaba is installing another hydro-electric plant on the Blanco River, near the city of Orizaba. This company owns and controls a number of large cotton mills in Orizaba, and the new plant is for the purpose of supplying power to operate these industries. The present plant of the company is of insufficient capacity to supply the demand for power.

The El Rey mines at Temascaltepec are to be provided with a complete electrical equipment.

The Sultepec Electric Light and Power Company is installing an electric power plant at Temascaltepec. It will furnish the mines of that district with electric power. It will build a transmission line to the town of Sultepec.

The Canadian syndicate has forfeited its option to purchase the electric lines of the Consolidated Street Railway Company of Torreon. The latter company has taken steps to extend the lines and to make important improvements. A new steel bridge will be built over the Nazas River. Additional equipment has also been ordered.

At a meeting of the shareholders of the Electric Power Transmission Company of the State of Hidalgo, recently held, it was decided to acquire two more waterfalls, to erect additional hydro-electric plants and to increase the capital stock of the company $759,600. The company paid a dividend of 16 per cent. on a capital of $5,000,000 in 1906. It operates in the city of Pachuca and adjacent territory.

W. D. H.

PERSONAL.

J. E. McElligott of Grantsburg, Wis., has been appointed superintendent of the Winnebago electric-light plant at Winnebago, Minn.

Charles F. Downton of the Westinghouse Electric and Manufacturing Company gave an illustrated lecture on the company's apprenticeship course before the Worcester (Mass.) Polytechnic Institute students at Worcester recently.

ELECTRIC LIGHTING.

An electric-light plant is being installed at Wortham, Tex.

An electric-lighting plant may be erected in Ashley, Mich.

The new Palestine (Texas) Electric Light Company's plant is nearing completion. The equipment comprises two Westinghouse-Parsons turbine alternators, each capable of generating 10,000 16-candlepower lights.

It is proposed to establish an electric-light plant at Sheffield, Ill.

The United Iron Works will install an electric-light plant at Iola, Kan.

T. H. Slover has been granted an electric-light franchise in Davis, I. T.

K. Krueger contemplates installing an electric-light plant in Westbrook, Minn.

The electric-light plant at Versailles, Ky., has been sold to Harry Reid of New York.

The Alexandria (La.) Lumber Company will put in an electric-light plant in its mill at Pineville, La.

It is proposed to erect a municipal electric-lighting plant at Pass Christian, Miss. W. A. Terrill can give particulars.

The Eaton (Ohio) Gas and Electric Company has been incorporated for $200,000 by Arthur Wyatt, W. W. Tait and others.

The City Council of Ballard, Wash., has under consideration plans to establish a municipal electric-lighting plant in that town.

The electric-light plant at Trenton, Ky., was destroyed by fire recently. The plant had only been in operation about four months.

The plant of the Alexandria (Ind.) Electric Light and Power Company will be sold at public auction on May 18th. It is valued at $50,000.

A light and power plant may be erected at Duncan Falls, Ohio, to cost $50,000. J. W. Winsforder of Duncan Falls is interested in the project.

The Idaho-Oregon Light and Power Company has been incorporated with a capital stock of $7,000,000 to generate and utilize electricity for light and power in Eastern Oregon and in Idaho.

The Dillsboro and Sylva Electric Light Company of Dillsboro, N. C., has been capitalized at $10,000 to erect an electric-lighting plant to furnish light for various towns and villages in Jackson County. S. W. Enlie and J. C. Fisher of Dillsboro are among the incorporators.

The city of Milwaukee, Wis., may enter into a contract with the Milwaukee Electric Railway and Light Company to pay $65 a year for every street lamp, for a period of five years, dating from December 10, 1905. Justice Ludwig decided some time ago that the city must pay over $140,000 for lighting since the expiration of the old contract.

The bursting of one of the large generators in the Thirty-eighth Street plant of the New York Edison Company on the night of April 20th caused a fire in the plant, and for half an hour Broadway, usually brilliantly lighted, was almost in complete darkness. Within half an hour emergency generators were in operation, and the street, theaters and cafes were again flooded with light.

The Chattanooga (Tenn.) Electric Company is preparing to make improvements, for which $140,000 will be expended. New machinery will be installed, including one 1,000-kilowatt generator, a 500-kilowatt generator, a steam turbine and four water-tube boilers of 410 horsepower, increasing the present capacity of plant about 2,000 horsepower. Byron T. Burt is general manager.

The plan of municipal ownership of a lighting plant by the borough of Rutherford, N. J., was repealed on April 19th at a public meeting called by Mayor Andrew H. Brinkerhoff. A committee of 15 was appointed a year ago to investigate the question. Nine members of the committee presented a majority report, with which the other six disagreed. The minority report agreed that it was inadvisable for the borough to install at the present time a municipal gas plant, but advocated the establishment of an electric plant.

The annual meeting of the shareholders of the Sao Paulo Tramway, Light and Power Company of Brazil was held in Toronto a few days ago. The financial statement for the year ended December 31, 1906, showed that the gross earnings were $2,018,703 and the net earnings $1,368,162. After a dividend of 8 per cent. on the stock there is a surplus of $408,310. The directors announce that they have decided to construct a reservoir at Santo Amaro capable of storing 195,000,000 cubic meters of water, which, it is expected, will be ready in the next rainy season. They have also decided to place in position the south generator and turbine at Parnabyba. The capital stock is increased from $7,500,000 to $8,500,000.

ELECTRIC RAILWAYS.

The Carlyle (Ill.) and St. Louis (Mo.) Railway Company has been incorporated to construct an electric railway between Carlyle and East St. Louis, Ill.

A syndicate which controls the electric railways in Central Maine has let contracts for the building of electric railways between Lewiston and Mechanic Falls, Lewiston and Gardiner, and Augusta and

Waterville. The cost will be $800,000. Gore Bros. of Boston have obtained the contracts.

Supervisors are considering the matter of installing an electric-light plant in Peoria, Ill., at the county farm.

The New Orleans Railway and Light Company has issued $5,000,000 in bonds. Extensive improvements will be made in the system.

Calvin Manning of Ottumwa, Iowa, is interested in the construction of a street railway in Albia, Iowa. A franchise has been granted.

The franchise granting the Messaba Traction Company to construct an electric line is being considered by the council of Eveleth, Minn.

The Granite Street Railway Company may extend a line to the stone quarries from St. Cloud, Minn., for freighting purposes and also a line from Sauk Rapids to the paper mill. The latter would cost about $20,000.

The suit begun by Jos. L. Kiichli of Minneapolis against A. F. White of New York to secure the return of 3,000 shares of stock in the Minnesota Power and Trolley Company has been transferred to the Federal court.

E. G. Buckland, vice-president of the New York, New Haven and Hartford Railroad Company, says that the adoption of electrical equipment on the company's entire New England system will depend on the success of electric power on the main line between New York city and Stamford, Conn., which will probably be put in operation about June 1st.

The preliminary steps toward the construction by the McKinley syndicate of an electric railway from Chicago to Peoria, Ill., were taken a few days ago, when a license was taken out at Springfield, Ill., to incorporate the Chicago, Ottawa and Peoria Railway Company. The capital stock is nominally $500,000. It is proposed to construct the line from Chicago to Peoria and from Ottawa through the counties of La Salle and Bureau to Princeton.

An electric railway from Terre Haute, Ind., to Quincy, Ill., and St. Louis, Mo., has been licensed to incorporate by the secretary of the state of Illinois. The road is the St. Louis, Terre Haute and Quincy Traction Company, capitalized at $25,000. It is to be constructed from a point in Illinois opposite Terre Haute, Ind., to Venice and Quincy, Ill. The incorporators and directors are Edward Yates, Pittsfield; Peter Chase, Decatur, Ill.; H. T. Willson, H. C. Simons, Virden, Ill., and E. E. Barclay, Springfield, Ill.

It is reported that the ministry of state railways at Vienna, Austria, will introduce electricity on an extensive scale on all the state railways covering the western half of Austria and extending south to Trieste. A special engineering commission has been appointed, it is said, to investigate the waterpower available along the railroads, after which the details of equipping the individual line will be worked out. The Southern Railway, the largest in Austria, is engaged in a similar investigation. Austria is especially rich in rivers and mountain streams capable of supplying unlimited power.

POWER TRANSMISSION.

The Warrior River Power and Electric Company has been incorporated at Birmingham, Ala., with a capital stoock of $100,000 by M. C. McGannon of Nashville, Tenn., and others. The company proposes to harness the Warrior River and to build an electric railway from Birmingham to Huntsville, Ala.

A mortgage has been filed by the Beatrice Gas and Power Company of Beatrice, Neb., to the Superior Savings and Trust Company at Cleveland, Ohio, amounting to $100,000. Contracts provide that $40,000 of the total sum realized from the sale of the bonds shall be used for enlarging the plant in Beatrice.

The statement is made that $4,500,000 will shortly be expended in the development of waterpowers in Georgia. Most of the development will be on the Upper Savannah River and on the Flint River. In Middle and North Georgia there are said to be a great many rapids and falls capable of development without interference with navigation.

The Claremont (N. H.) Power Company has been capitalized at $700,000 by W. L. Mauran of Providence, R. I., Hiram R. Breckwith of Claremont, and others. The company, it is said, will be the holding company in the development of the waterpower at the Cavendish (Vt.) gorge falls of the Black River, having a working merger with the Black River Water Power Company.

RADIO-TELEGRAPHY.

A movement is said to be on foot to establish a radio-telegraph station of the Pacific Wireless Telegraph Company at Burlington, Iowa. C. W. Motz, representing the company, was in that city a few days ago making inquiries as to the prospects for the establishment of a station there. It is said to be the intention of the company eventually to reach New Orleans.

The American Wireless Telegraph Company is said to be contemplating the erection of a station at Coffeyville, Kan.

It is said that a Lloyds' wireless-telegraph station is to be erected at Peterhead, England, on the south point of Keith Inch. The position of the station will be distinctly advantageous for shipping.

The Royal Mail steamship Tagus arrived at Southampton a few days ago, the first passenger vessel sent to England equipped with the De Forest wireless apparatus since the establishment of the new De Forest station at Hartland Point. The company reports that the Tagus got into wireless communication with the Hartland Point station when 600 miles at sea and that messages were received and sent until the vessel reached Southampton.

PUBLICATIONS.

Bulletin No. 42 of the H. T. Paiste Company, Philadelphia, Pa., the April number of "Paistery," describes and illustrates different styles of panel boxes manufactured by the company.

New Cutler-Hammer apparatus in the way of printing-press and machine-tool controllers is described in bulletins 81½, 82½, 83½, 84½, 85½ and 86½, issued by the Cutler-Hammer Manufacturing Company of Milwaukee.

The C. W. Hunt Company, New York city, has issued catalogue No. 072, engineers' edition, which describes and illustrates "Hunt" coal-handling machinery for power stations, boiler rooms, coaling stations and coal yards, gas companies, shipping docks, factories, etc.

C. A. Vedder, of Galveston, Texas, is sending out a booklet treating of Percival reinforced concrete steel ties for railroad construction. The Percival ties, on account of their construction, are rotproof, rustproof, fireproof, waterproof and insectproof. The booklet says they can be manufactured by common laborers along the line of any railroad.

The Western Electric Company, Chicago, is sending out a folder which is intended to show the necessity for using ventilating fans in manufacturing establishments. The company carries a complete line of ventilating and exhaust fans in large as well as small sizes. Its 72-inch fan will supply 67,000 cubic feet of fresh air every minute. The fans are especially suitable for mines, malt-houses, laundries, chemical factories, etc.

The Beardslee Chandelier Manufacturing Company of Chicago recently issued a small catalogue (No. 12), in which are illustrated fixtures in electric, combination and gas that are carried in stock ready for immediate shipment, thus enabling customers to secure any fixtures shown in the catalogue at once, without having to wait until they are manufactured or finished. The catalogue is sent free to dealers upon application.

"How the Telephone Helps the Farmer" is the subject of an interesting booklet, No. 112, issued by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. A large percentage of the company's business is done with the farmers and people residing in rural districts, who organize telephone companies among themselves. In the booklet the company attempts to answer most of the inquiries relating to telephone matters received from these districts in a number of short stories descriptive of the telephone. Much information is given, together with a description of the apparatus, illustrations of the Stromberg-Carlson factory, village-exchange switchboards, model constitution and by-laws, and diagrams showing how to install telephone lines, etc.

The General Electric Company of Schenectady, N. Y., has issued Bulletins Nos. 4393C, 4495 and 4496. In Bulletin 4393C small moderate-speed engine-driven revolving-field alternators are described. An illustration is given of a 105-kilowatt alternator with direct-connected exciter. The machines can be furnished with or without direct-connected exciters. These alternators will carry continuously their full-rated capacity of two or three-phase non-inductive load, the temperature of no part of the machine exceeding 40° C. above that of the surrounding air. Bulletin 4495, which is very neatly gotten up, is devoted to a description of General Electric fan motors for 1907, which are said to be models of simplicity in electrical and mechanical design. Nine different styles and sizes are described of the alternating-current type and seven of the direct-current type. Two electric pumping installations, regarded as typical of the most recent practice in this work, are described in bulletin 4496. They are taken as representative of a number of installations for which the General Electric Company has supplied motors. The first description relates to a 25,000,000-gallon municipal electric pumping plant at Buffalo, N. Y., and the second to a 172,000-gallon pumping plant recently completed for the village of Scotia, N. Y.

SOCIETIES AND SCHOOLS.

The section of the Engineering Societies Building in New York city devoted to club purposes will be formally dedicated next month.

Candidates for degrees at Lehigh University, South Bethlehem, Pa., in June, number 123. They are distributed as follows: Master of science, 2; bachelor of arts, 9; civil engineer, 46; mechanical engineer, 30; engineer of mines, 18; metallurgical engineer, 2; electrometallurgist, 2; electrical engineer, 12; bachelor of science in chemistry, 2. The theses to be presented by the electrical candidates cover many interesting subjects and represent a wide range of research.

The proceedings of the American Street and Interurban Railway Engineering Association for 1906 contain a complete report of the fourth annual convention held at the State Fair Grounds, Columbus, Ohio, in October, 1906, in which are included a number of technical papers. Eighteen pages are devoted to the answering of questions of the 1906 Question Box. H. H. Adams, superintendent of shops of the United Railways and Electric Company, Baltimore, Md., is president, and S. W. Mower, general manager South-Western Traction Company, London, Ont., is secretary-treasurer of the association.

TELEGRAPH.

According to a newspaper paragraph, the desert of Sahara will soon be traversed by a telegraph line. All the details of the scheme are said to have been worked out, and it is but a matter of a few months before the project will be in operation. The work is being done by the French government, which proposes to connect all its possessions in Northern Africa by wire. The poles will be of metal and will be placed 100 meters apart, supporting the wire at a distance from the ground sufficient to permit of the passage of a man on camelback.

MISCELLANEOUS.

The Illinois Senate on April 18th killed the bill intended to create a board of examiners to determine who may engage in the business of master electrician and to guarantee against loss, damage or injury through want of skill or through failure to use suitable or proper materials.

It is generally believed that the velocity with which electricity is propagated is nearly identical with the velocity of light. The identity may be perfect, but experiments have as yet failed to prove it so. In a recent communication to the French Academy of Sciences one scientist has shown, it is reported, that the mean velocity of electricity is 188,185 miles a second. This is about one per cent. greater than the velocity of light, which is 186,300 miles a second.

The United States Circuit Court of Appeals has affirmed the lower court's decree dismissing the Thomson-Houston Electric Company's bill seeking an injunction restraining an alleged infringement on an electric meter patent by Isaac McLean of Boston. The plaintiff's patent is No. 448,894. The defense contended that the invention had been previously patented in Great Britain and that the United States patent expired with the British patent on July 8, 1904. The complainant alleged certain changes in the invention, but the court held that changes in detail which do not affect the essence of the invention as covered by the patents could not avail.

It is said that the tallest chimney in the world will be built for the Boston and Montana Consolidated Copper and Silver Mining Company at Great Falls, Mont. It will rise 506 feet above the top of the foundation and will have an internal diameter at the top of 50 feet. The size of the chimney has been proportioned for leading off 4,000,000 cubic feet of gases a minute. The chimney is designed so that an additional 60 feet may be added at any time if necessary. It will be constructed to withstand a gale of 125 miles an hour. Four electric elevators will be employed in scaffolding the structure. Electric power developed from the Missouri River will be used in operating a brick plant to be built especially for the purpose of manufacturing the required material. The chimney will cost $200,000, exclusive of the foundation.

Isaac W. Anderson of Spokane, president, announces that among the plans for the immediate future of the Northwestern Corporation, a $5,000,000 concern, recently incorporated, controlling the lighting and power of nearly a score of cities in Washington, Oregon and Idaho, are the construction of a large power plant in Oregon, the building of a great railroad in the Willamette Valley, traction lines in the city of Eugene, Ore., and interurban lines in that vicinity, and the extension of traction lines in Walla Walla, Wash. The directors in the new company are: Isaac W. Anderson, Robert E. Allen, R. F. Brackett, Thomas Michelson, A. K. Dice, S. A. Scott, Otto B. Frank, Robert Breese, Nicholas Lawson and Cary M. Rader. The bulk of the stock is owned by Rhodes, Sinkler & Butcher of Philadelphia.

TRADE NEWS.

The Electric Service Company of Omaha, Neb., has been incorporated with a capital stock of $50,000.

The Seattle (Wash.) Electric Heating and Manufacturing Company has been incorporated for $300,000 by A. E. Ransom, Harry M. Frost and others.

The Novelty Incandescent Lamp Company advises that the product of its refilled factory will hereafter be known as the "X-L" refilled incandescent lamp.

On and after May 1st the New York offices of Robert W. Hunt & Co. will be moved from 66 Broadway to the new West Street building, No. 90 West Street, New York city.

The Minneapolis Steel and Machinery Company of Minneapolis, Minn., has opened a branch office at 262 Commerce Street, Dallas, Texas, under the management of Mr. J. P. Greenwood. The large demand for Twin City Corliss engines and Muenzel producer-gas engines in this territory made it necessary for the company to open an office in Texas so as to take care of the increasing business.

The Franklin Electric Manufacturing Company of Hartford, Conn., maker of the "Femco" incandescent lamps, has opened branch offices and stockrooms at 602 Fisher Building, Chicago, and 1414 Chestnut Street, St. Louis, where a complete line of standard, Reflector, miniature, Gem and tantalum lamps will be carried. The Chicago office is in charge of Charles N. Thorpe, while A. S. Doxsee will be the St. Louis manager.

The Blake Signal and Manufacturing Company, 246 Summer Street, Boston, Mass., has established the following agencies for its Blake tube flux: George F. Schoen, 108 South Forsyth Street, Atlanta, Ga.; Syles R. Fralick, 269 South Canal Street, Chicago; Wesco Supply Company, St. Louis; Brooks-Follis Electric Corporation, 212 First Street, San Francisco, and the Norton System Telephone Company, Toronto, Canada.

Trade of the United States with its American neighbors constitutes practically one-fourth of its foreign commerce. Figures covering two-thirds of the current fiscal year have just been issued by the Bureau of Statistics of the Department of Commerce and Labor. They show that out of a total commerce of $2,222,000,000 for this fractional part of the year, trade with America exclusive of the United States aggregated $536,000,000, almost evenly divided between imports and exports, the latter exceeding the former by only $16,000,000 in a total of over $500,000,000. These figures, it is proper to state, do not include the movements of merchandise between the United States and Porto Rico, now a customs district of the United States. In the trade with North America exports exceed imports by $67,000,000 in a total of $374,000,000 of commerce with that section; in the trade with South America imports exceed exports by $51,000,000 in a total commerce of $162,000,000 with that grand division.

BUSINESS.

The Navy Department has awarded the contract for four two-ton electric hoists and one four-ton electric hoist, all for the Washington Navy Yard, to the Yale & Towne Manufacturing Company of New York city, at its bid of $2,008. The contract for one electrical wagon, for the use of the same navy yard, and having a carrying capacity of 2,500 pounds, has been awarded to the Philadelphia General Supply Company of Washington, D. C., for $2,230.

The demand for the Baby gasoline torch manufactured by the Zeidler Lamp and Brass Company, Lomira, Wis., has materially increased, and in order to facilitate the production the company has found it necessary to devote all its time to the manufacturing of the torch, while the Marion Company, 123 Liberty Street, New York city, will handle the entire output. The company is at present erecting a new spacious factory at Lomira. Edwin C. Zeidler will have complete charge of manufacturing. A request to the manufacturer or distributor will bring prompt reply.

The April stock-list of Wickes Brothers, machinery manufacturers and dealers, Saginaw, Mich., contains specifications of the boilers, engines, dynamos, motors and machinery manufactured by the concern. Wickes Brothers operate plants at Saginaw, Mich., Jersey City, N. J., Boston, Mass., Pittsburg, Pa., and have stores in New York city and Pittsburg.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, E. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. Judge Joseph D. Bedle was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers.

The steam-turbine shops, erecting and testing floors at the West Allis works of the Allis-Chalmers Company present a busy appearance these days, caused by the increase in orders for Allis-Chalmers steam turbines since the first of the year. During the month of March more contracts for turbo-generator units were taken than for any similar period since the building of turbines was begun by the big Milwaukee company, and the orders so far received for the current month bid fair to double the March sales. As a result of this increased volume of business, every effort is being made to insure prompt delivery, erection and acceptance of the turbines at the hands of the purchaser. The facilities and organization available for this service have been developed to a high state of efficiency.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 16, 1907.

850,127. Electrolytic Apparatus. Anson G. Betts, Troy, N. Y. Application filed May 11, 1904.

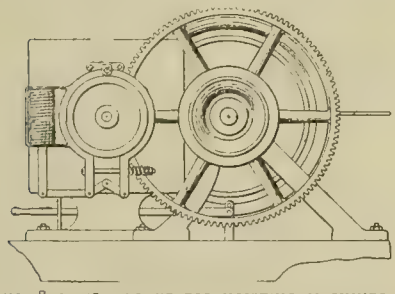
In an electrolytic tank are anode compartments containing a liquid in which is dissolved an oxidizable ingredient, insoluble anodes immersed therein, cathode compartments separated from the anode compartments by a suitable electrolytic diaphragm, containing a solution in which is immersed a cathode and means for imparting to the anodes motion through the anolyte.

850,129. Portable Electric Measuring Instrument. Henri Bourgeois, Damprichard, France. Application filed July 31, 1905.

The instrument comprises an outer casing, means secured therein for indicating electrical measurements, means to actuate the measurement-indicating means, contact pins connected by current-conducting wires with the actuating means, one of the pins being located within a stem secured to the casing, a ring pivotally secured to the stem and means adjustably carried by the ring for normally covering the outer portion of the pin.

850,152. Brake for Hoisting Machines. Guy C. Grable, Minneapolis, Minn., assignor to W. L. McBride, Minneapolis, Minn. Application filed June 1, 1905.

Combined with a shaft and its pulley are an electric motor located to one side of the pulley shaft and having its shaft parallel with and geared to the pulley shaft, a solenoid in circuit with the motor and a brake device arranged to be released when the circuit is closed through the motor and solenoid. (See cut.)



NO 850,152 —BRAKE FOR HOISTING MACHINES.

850,165. Electric-motor Starting Device. David R. Knapp, Philadelphia, and Howard E. Cade, Pencoyd, Pa. Application filed December 7, 1906.

In combination with an electric motor and starting resistance are leads connected to the positive and negative side of the electric motor, the leads forming a variable voltage circuit, electromagnets each with variable weight-cores, the electromagnets being energized by the variable voltage distribution circuit and an electromagnet having its windings in series with the electric motor, the core of the electromagnet carrying the means to open the variable voltage distribution circuit upon a predetermined movement of the core.

850,166. Electrical Condenser and Method of Making the Same. Robert C. Lanphier, Springfield, Ill., assignor to the Sangamo Electric Company, Springfield, Ill. Application filed December 13, 1905.

The condenser consists of thin strips of conducting material separated by strips of paper and having between the strips of paper and the conducting material thin layers of sulphur introduced therein by immersing the condenser in a bath of sulphur heated to a point at which the sulphur becomes a thin liquid.

850,173. Electric Transportation System. William C. McMurray, Wellsville, Ohio. Application filed November 20, 1905.

In a system of the character indicated are a series of posts, outgoing and return circuits supported on opposite sides of the posts, each of the circuits comprising two wires, one of which is arranged above the other, and means for forming a station and for transferring cars from one circuit to the other, comprising curved tracks arranged between the outgoing and the return circuits and switches connecting the curved tracks with both of the circuits.

850,174. Metering Panel-board. Arthur C. McWilliams, Chicago, Ill. Application filed April 19, 1906.

In the panel-board described are combined with the board removable conductor, bus-bars and parallel bars, meter terminals and load terminals, one side of each being connected to the proper bus-bar, the remaining side of one kind of terminal being attached to parallel bars and the remaining side of the other kind of terminals being attachable to the removable conductor, the last-mentioned terminals being arranged in a row parallel to the parallel bars, the parallel bars being also attachable to the removable conductor.

850,203. Electric Motor. Ralph E. Barker, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 12, 1906.

Combined with an electric motor are an impedance in series with the motor, a manually operated switch arranged to cut variable portions of the impedance out of circuit, and means for automatically short-circuiting the impedance at starting.

850,205. Automatic Device for Induction Motors. Sven R. Bergman, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 20, 1906.

In combination with a single-phase induction motor are a phase-splitting starting device, a switch adapted to break the circuit of the device, and a magnet winding adapted to open the switch and connected in shunt to a portion of the motor winding of different phase from the portion connected across the source, this switch being arranged to return automatically to closed position, when the magnet winding is de-energized.

850,211. Automatic Motor Cut-out. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 18, 1906.

In a motor-control system are a number of groups of motors, an automatic cut-out device associated with each motor for opening the circuit thereof, an electroresponsive device in shunt to each of the cut-out devices, and means controlled by each of the electroresponsive devices for cutting out corresponding motors from the groups upon the operation of one of the cut-out devices.

850,217. System of Distribution. Budd Frankenfield, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed March 17, 1906.

In a system of distribution are a main source of current supply, feeder conductors, a dynamo electric-machine unit comprising two main armature windings, one or more shunt field windings therefor, and an auxiliary compounding generator having an armature winding and one or more field windings for creating a magnetic field which varies with load conditions.

850,218. System of Distribution. Budd Frankenfield, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed March 31, 1906.

In a multiple-voltage system of distribution are a number of main and compensating conductors, a balancer adapted to be connected thereto, and a number of main and compensating switches interlocked so that the opening of the former controls the opening of the latter and the latter cannot be closed without the former being closed.

850,226. Ventilating Fan. Lewis L. Holladay, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 14, 1903.

A pivotally supported ventilating fan driven by an electric motor comprises an electrically pivoted screen supported in proximity to the blast-impelling member of the fan.

850,231. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed April 24, 1906.

Combined are a feed circuit, a source of current therefor, a working circuit associated with the feed circuit and deriving its energy solely from the feed circuit, a transmitting device connected in parallel with the feed circuit and including a converter, the primary of which is connected to the feed circuit and the secondary of which is connected to the working circuit, means associated with the primary normally to prevent flow of the current therethrough, and means to shunt the means in accordance with the characters to be transmitted.

850,237. Brush Holder. John P. Mallett and Thomas E. Drohan, Madison, Wis., assignors to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed May 10, 1901.

The device comprises a movable metallic brush-carrying frame and a non-metallic protecting device carried by the frame in position to engage the commutator to prevent the frame from coming into contact with the commutator.

850,258. Circuit-detecting Device. Louis M. Schmidt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 8, 1904.

In a current-detecting device are a laminated U-shaped core having its inner sides diverging from the base of the U to accommodate conductors of different sizes, a handle attached to the base of the core, a winding carried by the core at the base of the U and an electroresponsive device connected in series with the winding.

850,270. Vapor Electric Apparatus. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1904.

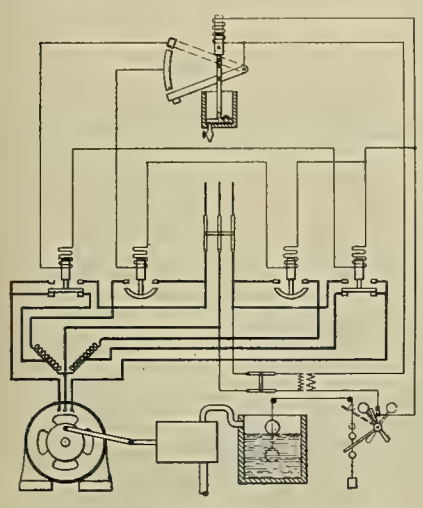
Combined with a vapor electric device are an armature associated with the device and a magnetic device having a time element, the magnetic device being in operative relation with the armature.

850,276. Dynamo-electric Machine. Karl Sulzberger, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed April 3, 1906.

In a dynamo-electric machine of the commutator type are a field structure with a compensating and commutating winding, the commutating portions of the winding for the several poles being connected in a group and the remaining portions of the winding being connected in another group, the groups being connected in series, and two adjustable resistances shunting the groups, respectively.

850,277. System of Motor Control. Clifford R. Tatem, Buffalo, N. Y., assignor to Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed March 31, 1906.

Combined are an induction motor, a supply circuit, a transformer, a number of magnetic switches, a master controller for the magnetic switches, the master controller in one position causing the magnetic switches to connect the motor to the supply circuit through the transformer and in another position causing the magnetic switches to connect the motor directly to the supply circuit. (See cut.)



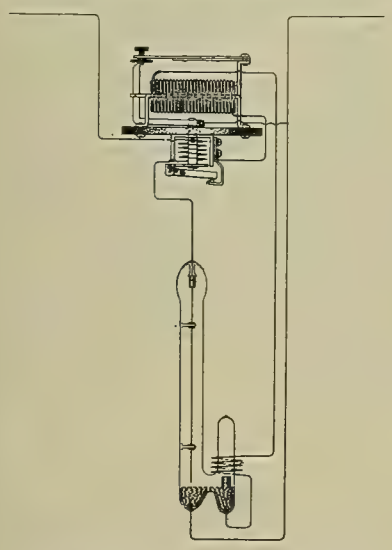
NO. 580,277.—SYSTEM OF MOTOR CONTROL.

850,278. System of Distribution. Lewis L. Tatum, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed March 31, 1906.

In a multiple-voltage system of distribution are a number of conductors, a balancer comprising a number of compound-wound dynamo-electric machines and means comprising one or more automatically operated switches for opening the circuit of either one of the series field windings when the loads become unbalanced.

850,279. Cut-out for Vapor Electric Apparatus. Tycho Van Aller, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

Combined are a vapor electric device, a circuit for producing a starting arc in the device, and means for automatically interrupting the starting arc after an interval in case the device fails to start. (See cut.)



NO. 850,279.—CUT-OUT FOR VAPOR ELECTRIC APPARATUS.

850,287. Combined Fire and Burglar Alarm. Alexander M. Bennett, Ellsworth, Mich., assignor of one-half to Charles Bennett, Ellsworth, Mich. Application filed April 18, 1906.

The device comprises a pair of contact-arms having their ends bifurcated, an energized circuit, the terminals of which are extended to form loops seated in the bifurcated ends of the contact-arms, strips interposed between the loops and the adjacent faces of the arms, an alarm included in the circuit, and a circuit-breaker interposed between the contact-arms and movable to inoperative position to sound the alarm.

850,305. Duplexing Telegraph Line. Isidor Kitsee, Philadelphia, Pa. Application filed August 9, 1906.

In duplex telegraphy are combined with the line a receiving instrument having a single winding, an induction coil having its secondary connected to the receiving instrument, its primary including a key and a source of current, and means for adjusting the mutual induction between the primary and secondary windings.

850,311. Annunciator. James L. McQuarrie, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 2, 1905.

In an electric annunciator are combined with an electromagnet and its armature an electric circuit including a signal device, a pair of springs controlling the circuit, one of the springs being adapted to be moved to close the circuit when the magnet is excited, and thereupon to lock the armature in closed position until manually released.

850,329. Electric and Pneumatic Governor. Harry W. Young, Philadelphia, Pa., assignor to John E. Reyburn, Philadelphia, Pa. Application filed January 22, 1906.

In the governor described are a diaphragm actuated by fluid pressure, a cylinder, a piston in the cylinder actuated in one direction by fluid pressure and in the opposite direction by gravity, fixed and movable carbons and electrical conductors therefor, and means operative by the diaphragm to release the piston and carbons for action by gravity to form the electrical circuit and by fluid pressure to break the circuit.

850,334. Automatic Cut-out for Fuse Box. Swan C. Anderson, Oak Park, and Charles H. Frenberg, Chicago, Ill. Application filed October 18, 1906.

In the device patented are combined with trunk-wire binding posts, fuse binding posts hinged thereon and adapted to lie in alignment therewith intermediate the same, a fuse connecting the last-named posts and means adapted to swing the posts oppositely when the fuse blows.

850,344. Telephone-exchange System. Edward E. Clement, Washington, D. C. Application filed March 20, 1905.

In a telephone exchange system are a subscriber's station having selective devices and a central switchboard divided into distinct parts, together with trunk lines normally extending unbroken to all the parts, and means whereby the subscriber may set a signal therethrough on any division of the switchboard.

850,349. Circuit for Coin Collectors. Henry M. Crane, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

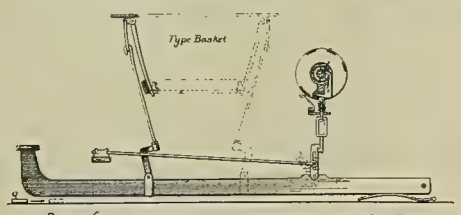
Combined with a signaling circuit, including an indicating device, are normally open contacts in the circuit adapted to be closed by a coin to actuate the indicating device, an electromagnetically operated test-signaling device adapted to be connected to the circuit, a resistance in the circuit rendering the signaling device inoperative, and a short circuit of the resistance having normally closed contacts adapted to be opened by a coin.

850,352. Circuit for Coin Collectors. Hiram D. Currier, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

A signaling circuit including an indicating device, comprises normally open contacts in the circuit adapted to be closed by a coin to actuate the indicating device, an electromagnetically operated test-signaling device adapted to be connected to the circuit, a resistance in the circuit normally rendering the signaling device inoperative, and a normally open short circuit of the resistance having coin-controlled contacts.

850,364. Keyboard Telegraph Transmitter. George M. Goddard, Rutland, Vt., assignor of one-half to George C. Thrall, Rutland, Vt. Application filed April 30, 1906.

A telegraphic transmitter comprises a continuously rotating shaft having its surface formed by longitudinal flutings into continuous longitudinal teeth along its length, commutating disks axially hung upon the shaft and recessed centrally and clutch devices for coupling the shaft to the disks arranged in the central recess of the disks. (See cut.)



NO. 850,364.—KEYBOARD TELEGRAPH TRANSMITTER.

850,365. Alarm Fuse. William E. Harkness, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 24, 1906.

An alarm fuse comprises an integrally formed metal body portion, spring tongue and terminal, an insulated terminal carried by the body portion and a fuse wire electrically connecting the tongue and insulated terminal and maintaining the tongue under tension.

850,376. Process of Producing Light Metals by Electrolysis. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. Application filed May 4, 1905.

The process of producing light metals from their salts consists in electrolyzing the fused salts in the presence of a soluble anode of heavy metal beneath and a cathode above, thereby forming a salt of the heavy metal overlying the anode, and dividing the electrolyte by a diaphragm between such salt and the cathode whereby to prevent circulation and confine such salt to the lower part of the cell to prevent its reaching the cathode.

850,392. Process of Oxidizing Atmospheric Nitrogen. Albert Neuburger, Berlin, Germany. Application filed December 24, 1904.

The process consists in subjecting air to the action of an electric arc employing a maximum energy of 120 watts.

850,402. Relay. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed March 31, 1906.

In the relay are combined with a magnet an armature, a pole-piece forming a seat therefor, the armature and pole-pieces each having a knife-edge bearing against the other, and the pole-piece being inclined upwardly from the seating point of the armature.

850,433. Telephone Apparatus. Koby Kohn, New York, N. Y., assignor of one-half to Louis A. Ksensky, Denver, Colo. Application filed October 24, 1903.

Combined are a series of telephone receivers each independently connected to the main-line wires by an open electric circuit, a generator adjacent to each receiver, and means operated by each generator for closing its receiver circuit and preventing the closure of all the other receiver circuits.

850,434. Telephone Apparatus. Koby Kohn, New York, N. Y., assignor of one-half to Louis A. Ksensky, Denver, Colo. Application filed February 11, 1904.

Combined with the main-line wires are a telephone receiver connected thereto by an open electric circuit, a magnet and armature for closing the circuit, a bell, a second magnet connected to one of the line wires, an armature for the magnet, the magnets and bell being normally out of circuit with each other, a pivoted arm carrying circuit-closing devices, the arm being normally biased to move in one direction and restrained from such movement by the armature of the second magnet, means for sending a current through the second magnet to attract its armature and release the arm to close circuits for connecting the magnets and bell in series.

850,443. Motor-controller. Adolph Pedersen, Cleveland, Ohio, assignor to the Van Dorn-Elliott Electric Company, Cleveland, Ohio. Application filed August 16, 1905.

In a motor controller are combined two switches, manually operable means for actuating one of the switches, the switch having a movement independent of the actuating means, electrically controlled means tending to operate the other switch to its "off" position, and means for actuating the latter switch to its "on" position.

850,470. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 16, 1902.

Combined with a trunk line extending between different switchboards and having switch sockets at one end are a signal associated therewith, the sockets being normally disconnected from the trunk line, a cut-off relay permanently connected with one of the talking contacts of the switch sockets, and means when a connection is established with one of the sockets to actuate the cut-off relay to render the signal inoperative and to connect the sockets with the line.

850,475. Electric Motor and Controller for the Same. John H. Hertner, Cleveland, Ohio, assignor of one-half to De Witt Cookingham, Cleveland, Ohio. Application filed May 28, 1906.

In an electric motor, the field of which is controlled by a series winding, are a shunt winding arranged to act upon the field, and means whereby current through the shunt winding may be passed in either direction or cut out at will while the direction of the current through the series winding remains constant.

850,484. Reinforcing Telephones. Charles Newman, Elizabeth, N. J. Application filed June 15, 1906.

In a telephone relay are a vibratory member having an armature thereon, a magnet in a telephone circuit acting on the armature, a repeating circuit, means whereby the resistance thereof is varied by the movements of the armature, and a continuously moving phonographic substance in contact with the member.

850,506. Electric Switch. Christian J. Toerring, Philadelphia, Pa. Application filed November 24, 1905.

The switch comprises a fixed member connected to one circuit terminal and a movable member or pivoted switch-arm connected to the other circuit terminal, in combination with a swinging scape lever connected to the switch-arm near its pivot, a rocking latch controlling the scape lever and itself connected to operating push-buttons, and a spring tensioned by the movement of the latch and operating through the scape lever to throw the switch-arm when the scape lever is released by the latch.

850,509. Device for Lighting Gas Lamps. Harold K. Wilson, New Bedford, Mass. Application filed March 13, 1906.

In the device described are a switch comprising a pair of spaced spring contact members, a stationary contact member and a rotatable key between the spring members for establishing initial electrical connection therebetween and for moving one of the members of the pair to engage the stationary contact.

850,511. Train Signaling System. James S. Anderson, Ames, Neb. Application filed May 29, 1906.

Combined with a number of coupled cars are a normally open circuit extending throughout the length of the connected cars, a circuit closer carried by each car and automatically operable on the separation of any car from coupled position, and means automatically operated in the manual uncoupling of the cars to prevent operation of the circuit-closer.

850,521. Illuminated Sign. Charles L. Carter, Marion, Ind. Application filed November 20, 1906.

The sign comprises a casing having the front composing a lettered illuminatory sign hinged to the casing, and the back board also hinged to the casing, each capable of being swung open on its hinges, and an individual light and reflector for each letter removably supported in the casing.

850,558. Attachment for Telephones. Mortimer H. Black, Pittsburg, Pa. Application filed March 6, 1907.

Combined with the transmitter and receiver of a telephone are a yoke pivotally supported by the transmitter and a rod adjustably supported by the yoke.

850,570. Headlight for Vehicles. Frederick G. Frankenberg, Chicago, Ill. Application filed September 18, 1905.

Combined with a vehicle furnishing a source of power are a jointed stand supported on the vehicle and manually adjustable to different positions, a dynamo supported

in the stem, a shaft for conveying power from the source to the dynamo, and a joint in the shaft corresponding to the joint in the stem.

850,604. Switch-operating Device. Elton J. Rice, Spokane, Wash., assignor to the Rice Electric Switch Company, Spokane, Wash. Application filed January 25, 1907.

The device comprises a pair of arms pivoted to a railway car, magnets carried by the arms, a crank shaft, links connecting the arms to the cranks whereby the magnets may be swung from one side of the rail to the other.

850,618. Elevator Signaling Apparatus. John D. Bowne, New York, N. Y., assignor to the Slawson-Graham Company, New York, N. Y. Application filed June 30, 1906.

In a signaling apparatus are combined a movable signal-controller, comprising separately-operative portions, controller-operating means for actuating a portion of the signal-controller, controller-operating means for actuating the remaining portion of the signal-controller, thereby completing the operation of the signal-controller, and resetting devices constructed and arranged to reset the signal-controller.

850,625. Apparatus for Threading or Laying Electric Conductors in Conduits or Pipes. Thomas J. Cope, Philadelphia, Pa. Application filed June 11, 1906.

The apparatus described comprises a member of a traveler provided with a shoe adapted to engage the wall of a conduit, the member and shoe being pivotally mounted and of such construction and arrangement as to conform to and press against and interlock with the angles of a conduit of angular shape.

850,630. Alternating-current Motor-controlling Apparatus. William N. Dickinson, Jr., Brooklyn, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed July 20, 1905.

Combined with a polyphase motor, are motor-controlling means, radially arranged circuit-closing levers, means for normally holding levers in open position, electromagnets for operating the holding means to trip the levers to closed position, multiphase circuits and connections for the reversing-switches, single-phase circuits and connections for the electromagnets, and an arc shaped cam for restoring the levers to normal position.

850,664. Dynamo-electric Machine. Campbell Macmillan, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 25, 1906.

An alternating-current unipolar machine comprises a revolving armature, stationary coils provided with brushes engaging the armature so as to form therewith a closed secondary winding, and a primary winding arranged to induce current in the secondary winding, at least one of the windings including conductors extending circumferentially with respect to the armature so as to produce a flux perpendicular to the surface of the armature between the brushes.

850,671. Electric Tower for Displaying Carriage Numbers. John H. McDaniel, St. Louis, Mo. Application filed May 8, 1906.

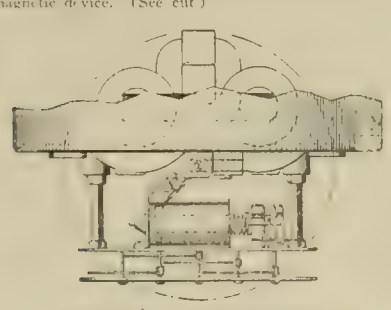
The device comprises a vertical tower provided with number-opening adjacent the top thereof, a horizontal platform movable through the tower, a light on the platform, means for raising and lowering the platform, and a number-box provided with transparent digits and designed to be mounted upon the platform surrounding the light.

850,681. Fire and Temperature Alarm or Indicator. George L. Smith, Aberdeen, Scotland. Application filed July 23, 1906.

The device comprises two electrical contacts, an electrical conductor, having its ends respectively electrically connected to the contacts, an electric battery, and an alarm device located in the electric circuit.

850,687. Meter. William Stanley, Great Barrington, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 10, 1904.

In a meter are combined shunt-energizing coils and series-energizing coils, a body adapted to be rotated thereby continuously in the same direction, a registering-train, an independent electromagnetic device in series with the shunt-coils and operating the train, and means co-operating with the body for periodically short-circuiting the electromagnetic device. (See cut.)



NO. 850,687.—ELECTRIC METER.

850,691. Electrical Indicator. Jesse Summers and John J. Berry, Indianapolis, Ind., assignors to the Indianapolis Watchman Clock Company, Indianapolis, Ind. Application filed April 5, 1906.

Combined with an electrical indicator are a grounded receiving-station with a number of independent indicators, a series of call-stations, each of which is grounded, a pair of lines connecting the receiving and call stations in series, means at the receiving station connected with each line for controlling the operation of an indicator, and means at the call-station for grounding the lines one or both at a time for a certain number of times and in a certain order.

850,694. Automatic Stop for Electric Hoisting Apparatus. Herbert S. Valentine, Stamford, Conn., assignor to the Yale & Towne Manufacturing Company, Stamford, Conn. Application filed January 10, 1907.

In combination with a motor-controller are a screw rotating with the motor, means for manually operating the controller, a sleeve, means actuated by the screw for rotating the sleeve under certain conditions, and gearing connecting the sleeve and controller-shaft.

850,714. Transformer. Claxton E. Allen and Sven R. Bergman, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed April 24, 1906.

Combined are a winding, and a core portion surrounded thereby comprising a central layer of relatively wide laminæ, two layers of relatively narrow laminæ parallel to and placed one at each side of the central layer, and at opposite edges thereof, and two other layers of laminæ transverse to those of the central layer placed one at each side of the central layer, the thickness of each of the other layers being equal to the difference in width between one of the relatively wide laminæ and one of the relatively narrow laminæ.

850,733. Block System. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 20, 1905.

In a block system are two receptacles, staves in each receptacle, an electrically controlled locking mechanism for each receptacle and a circuit arranged to be closed upon the withdrawal of a staff from either receptacle and when closed to energize the locking mechanism of the other receptacle.

850,738. Electrically Operated Valve. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 13, 1901.

Combined are a conduit of magnetic material, a valve for opening and closing the conduit, a spool of non-magnetic material independent of the conduit and having an integral portion extending between the end of the conduit and the valve forming a seat for the latter, and a magnet winding on the spool for actuating the valve.

850,755. Prepayment Mechanism. John E. Hubbell, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 30, 1904.

In an electric prepayment device are a switch, credit-purchasing means, a manually actuated means for moving the credit-purchasing means on the insertion of a coin, value-canceling means for returning the credit-purchasing means to its original position, and means controlled by the position of the credit-purchasing means for operatively connecting the manually actuated means and the switch.

850,766. Electric Signal. Emile Lionais and William T. Sutton, Montreal, Quebec, Canada. Application filed May 5, 1904.

Combined are a relay provided with a magnet and with an armature, an electric bell provided with a magnet and with an armature, a battery common to the relay and to the bell, and mechanism controllable by movements of the armature of the relay for the purpose of energizing and de-energizing the magnet of the bell.

850,788. Secondary-battery Plate and Method of Making Same. Louis N. J. Roselle, Paris, France. Application filed February 13, 1905.

The method described of manufacturing plates for secondary batteries consists in casting a core of active material, and casting about the core a grid provided with ramifications, the grid being provided between the ramifications with a comparatively thin film of metal, allowing the entire mass to cool, and finally removing the thin film of metal.

850,790. Railway Safety Apparatus. George E. Ryan, New York, N. Y. Application filed September 28, 1906.

In the apparatus described are track devices adapted to be disposed at intervals along the roadway, a number of contact devices, circuits connecting the contact devices with track devices and affording means for setting a track device in advance of the train and a track device in the rear of the train, and affording means for releasing the track devices in succession in the rear of the train, a second set of contact devices and circuits connecting the same with the contact devices and affording means for releasing the contact devices in advance of the train.

850,796. Trolley Stand and Pole. George Q. Seaman, New York, N. Y., assignor of one-half to Thomas O'Connor, Brooklyn, N. Y. Application filed March 26, 1906.

Details are described.

850,797. Conduit Traveler. Lewis D. Shaffer, Paint Borough, Pa. Application filed November 25, 1905.

The machine for wiring conduits comprises a front and a rear traveler, a connecting-bar projecting from the front traveler through the rear traveler, the travelers being provided with spring-arms arranged in pairs on opposite sides of the connecting-bar.

850,798. Line Carrier. Lewis D. Shaffer, Paint Borough, Pa. Application filed November 25, 1905.

In a line-carrier is a traveler provided with a line-guide and in the rear thereof with a detent portion for engaging a supporting-line to prevent any backward movement of the carrier.

850,823. Anode for Electroplating Cells. George M. Elliott, Belvidere, Ill., assignor to Zucker & Levett & Loeb Company, New York, N. Y. Application filed May 7, 1906.

An anode for electroplating-cells, comprises a series of slightly tapering teeth or columns, a severable transverse bar connecting the teeth at one end, all of the parts being integral and composed of a pure metal to be deposited on the cathode or article to be plated.

850,836. Cut-out Block for Connecting Fuse in Circuit. Harry H. Hornsby, Chicago, Ill., and Edward W. Anger, Jr., Adrian, Mich. Application filed December 10, 1903.

Combined with a suitable base are terminal supports mounted upon the base, each of the terminal supports being provided with a differently shaped aperture so that a conducting-wire which exactly fits an aperture in one support will not fit the aperture in the other support, and a protective device of definite current capacity provided with terminals formed exactly to fit the apertures in the terminal supports.

850,837. Selective Call Apparatus. John A. Hulit, Topeka, Kan. Application filed July 13, 1905.

In combination are an electromagnet and a main propelling-lever, a ratchet and push and holding pawls therefor, a gravity-operated main balance-bar, and a gravity-operated auxiliary balance-bar actuating the main balance-bar in one direction whereby the main balance-bar moves slowly by the force of gravity in both directions.

850,858. Emergency Telegraph. Murray C. Tunison, Los Angeles, Cal., assignor of one-half to Charles W. Harrison, Los Angeles, Cal. Application filed July 27, 1905.

The device comprises a conductor consisting of a sheet-metal case turned at the sides and bottom to form grooves, tubes at either side of the case, an insulating-tube inside of one of the tubes, a metallic tube inside of the insulating-tube, spring-contacts within the metallic tube, a wire coil connected with the contacts, a character-plate, and a stylus with a wire for grounding and a needle adapted to engage operatively the character plate.

850,863. Transformer. William J. Wooldridge, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 8, 1906.

In a core-type transformer are a core comprising wound portions, and unwound portions connecting the wound portions, and a winding on each wound portion comprising turns of conducting material connected in series, the turns adjacent the unwound portions of the core being connected in series with and between other turns more remote from the unwound portion.

850,867. Battery of Electrolytic Cells. Robert H. F. Finlay, Belfast, Ireland. Application filed February 12, 1907.

In an electrolytic cell are a cathode having projections on the opposite faces thereof, a laterally-extending rim around the cathode, the outer surfaces of the projections being arranged within the planes of the lateral faces of the rim, and diaphragms arranged against the lateral faces of the rim, the intermediate spaces between the diaphragms and the faces of the cathode constituting cathode-chambers.

850,870. Electrical Switch. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 9, 1904.

In an electrical switch, combined with a base, are a shelf integral therewith, circuit-changing springs mounted on the shelf, an operating member, a stationary pivot on the base therefor, a pressure device normally maintaining the operating member in engagement with the pivot and an arm integral with the operating member adapted to engage the shelf to limit the movement thereof.

850,872. Motor-controller. Adolph Pedersen, Cleveland, Ohio, assignor to the Van Dorn-Eliott Electric Company, Cleveland, Ohio. Original application filed September 19, 1904. Divided and this application filed August 16, 1905.

Combined with an electric circuit and a motor therein are a motor-controller comprising a movable contact member adapted normally to occupy its "off" position, a manually-operable member adapted to move the contact member to its "on" position, and retain the member in the position, the manually operable member being rendered inoperative to retain the contact member in the "on" position when the magnetic flux of such motor reaches a predetermined quantity.

850,886. Telephone Attachment. Delzon G. Hobby, Albion, N. Y., assignor of one-half to Fred L. Ferris, Albion, N. Y. Application filed May 14, 1906.

Combined with a telephone comprising a receiver, and a receiver-hook for controlling the circuit of the telephone, are a bracket, a forwardly-extending arm pivoted thereon, a toggle-link connection between the bracket and the arm for supporting the latter in its operative and inoperative positions, and means operated by the arm for actuating the receiver-hook.

850,887. Adjusting Clocks and Watches to Changes in Temperature. Samuel Kahan, New York, N. Y. Application filed July 31, 1906.

The device comprises an oscillating member, means for rigidly supporting one end thereof, a thermostatic coil in engagement with the oscillating member adjacent to its point of support and adapted to maintain constant its operating length to compensate for variations in temperature, and means adjacent to the coil for preventing movement thereof other than that caused by changes in temperature.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on April 22, 1907:

425,990. Electric Machine for Covering Wire, etc. F. E. Davis, Boston, and J. Scott, Jr., Plymouth, Mass.
425,991. Electric Motor. F. E. Davis, Boston, and J. Scott, Jr., Plymouth, Mass.
425,995. Electric Fan. P. Diehl, Elizabeth, N. J.
425,999. Process of Manufacturing Electrodes for Secondary Batteries. L. Epstein, Berlin, Germany.
426,009. Bell and Engine Indicator for Pilot Houses of Steam Vessels. W. E. Hadlock, Wenham, Mass.
426,049. Electric Switch. J. P. Norton, Detroit, Mich.
426,102. Electric-railway Contact. F. O. Blackwell, New
426,108, 426,109 and 426,110. Safety Device for Dynamos. E. P. Clark, New York, N. Y.
426,127. System of Electrical Distribution. C. J. Kintner, New York, N. Y.
426,134. Electric-signaling Apparatus for Hotels. J. J. Miller, Cleveland, Ohio.
426,153. Converter. E. Wagemann, Little Rock, Ark. York, N. Y.
426,222. Electric-railway Signal. G. A. Tower, Richmond, Va.
426,247. Electro-magnetic Instrument. P. B. Delany, South Orange, N. J.
426,469. Electric-railway System. L. Gutmann, Fort Wayne, Ind.
426,307. Electric-annunciator Call. William S. Paca, Baltimore, Md.
426,348. Dynamo-electric Machine. M. J. Wightman and E. Thomson, Lynn, Mass.
426,379. Electric-railway Car. J. C. Henry, Kansas City, Mo.
426,380. Electric Motor and Dynamo. J. C. Henry, New York, N. Y.
426,381. Electric Gas-lighter. C. H. Hinds, New York, N. Y.
426,382. Electric Railway. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Peoria Power House of the Illinois Traction Company.

The power house of the Illinois Traction Company which has just been completed at Peoria, Ill., is one of three owned by the company, the other two being located at Riverton and Danville, respectively. The building housing the Peoria plant, shown in Figs. 1 and 5 of the accompanying pictures, is oblong in shape, with a central wing through which the main line of track passes at an elevation of 20 feet. Fig. 5 shows the river side of the power house and illustrates the viaduct over the railroad track and leading to the bridge shown in Fig. 6. Two generating units of 2,000 kilowatts each are installed in the plant, and provision is made so that they can be tied in to work in connection with the power equipment at Riverton and Danville. The two units are shown in Figs. 2 and 3. The company is now operating over 300 miles of track and 75 miles more is in course of construction.

Coal will be taken to the power house in the company's own cars and dumped from the elevation shown in Fig. 1 to the ground level, whence it will be hoisted by a clam-shell bucket to the conveyors, which carry it to the hoppers or storage bins directly over the central passage between the boilers. The coal-handling machinery was installed by the Case Manufacturing Company. A crusher for crushing coal to a given size will be installed. The traction company has purchased ground in East Peoria, where it will mine its own coal and haul it over its own line to the power house. One of the large electric locomotives recently purchased will be used for hauling the coal. There will be no handling of coal except by machinery from the time of leaving the coal mine until it is finally consumed.

There are two batteries of Stirling water-tube boilers. Each battery of four boilers is designed to take care of one generating unit. The boilers are equipped with Green automatic stokers, a five-horsepower motor driving the stoker for four boilers. Water for the boilers is secured from 17 driven wells, which are equipped with strainers. The water is of a low temperature.

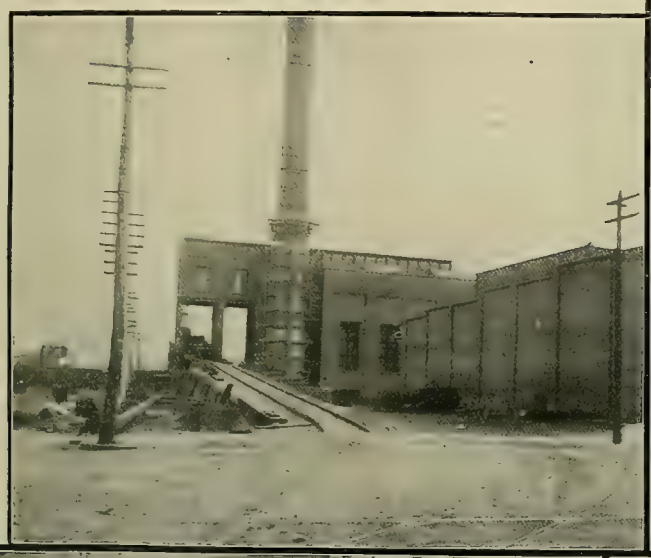
Two concrete stacks, one on each side of the central portion of the wing, will provide the necessary draft. They are each 11 feet in diameter and 200 feet high. They are shown, not quite finished, in Figs. 1 and 5.

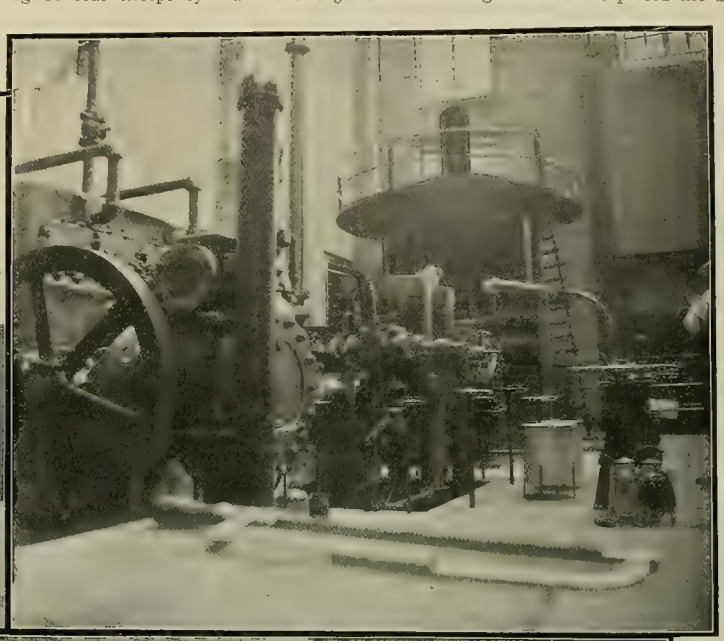
Ashes are dropped into hoppers, from which they are conveyed to a pit where the clam-shell bucket can hoist them to the cars to be hauled away. There are several chutes so placed that coal can be delivered by wagon should the occasion arise.

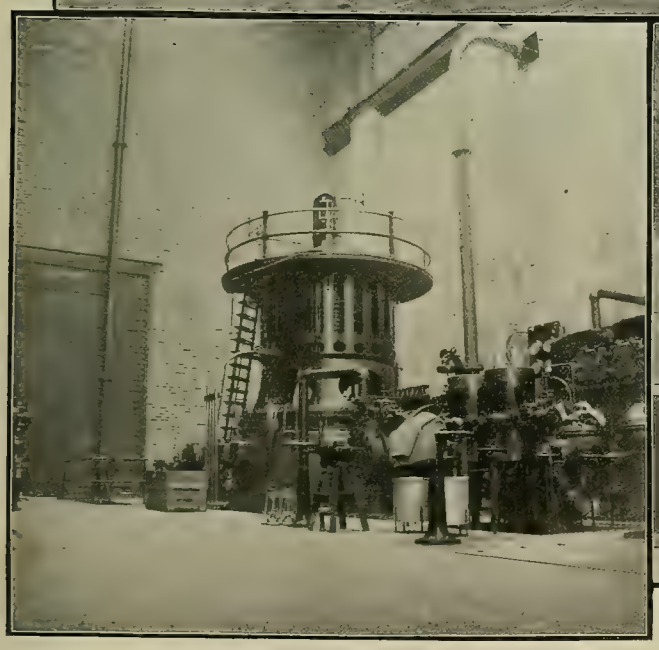
The generator room is separated from the boiler room by a 16-inch brick wall. The two turbo-generators are placed in separate corners of the room next to the boiler room and generate 25-cycle current at 2,300 volts. These units are shown in Figs. 2 and 3. Between the generators are placed the air pumps, boiler-feed pumps and vertical wet pumps for condenser to heater, each of which can take care of one unit.

Each generating unit is of 2,000 kilowatts capacity. The turbines are of the Curtis type and with the generators were supplied by the General Electric Company. A 75-kilowatt exciter driven by a 100-horsepower General Electric motor and a Curtis turbo-generating set of 70 kilowatts capacity, running at 2,400 revolutions per minute, furnish the current to excite the alternators. The former is shown in Fig. 4.

The switchboard is placed in a corner of the turbine room and is also shown in Fig. 4. It is equipped with all necessary instruments. From the alternators the current is taken to the transformers, which step-up the voltage to 33,000 volts. The transformer room is directly back of the switch-







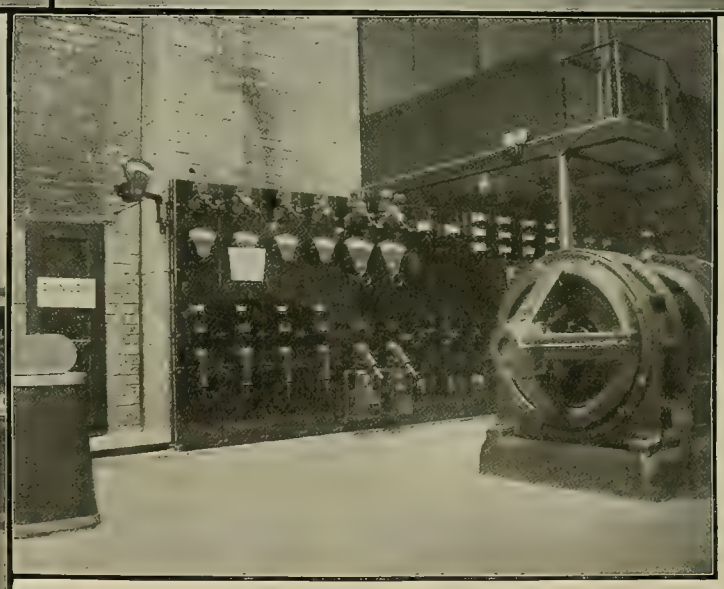


Fig. 1. Exterior View, Showing Incline Leading to the River Bridge. One of the Concrete Stacks is shown.
Fig. 3. Another 2,000-kilowatt Generator.

Fig. 2. One of the 2,000-kilowatt Turbo-generators. Auxiliary Apparatus in the Foreground.

Fig. 4. View Showing the Switchboard and One of the Motor-driven Exciter sets. Superintendent's Office is shown over the Switchboard. Door at Left leads to the Transformer Room.

PEORIA POWER HOUSE OF THE ILLINOIS TRACTION COMPANY.

board and contains six 750-kilowatt Westinghouse oil-cooled transformers with water coils through which cold water can be pumped to keep down the temperature of the oil. Besides these there are six 250-kilowatt transformers for the rotary converters which will take care of the local car lines. In a separate room above the transformer room are located the high-tension oil switches, which are electrically operated from the switchboard.

In another corner of the generator room are two 750-kilowatt 500-volt General Electric generators direct connected to 340-volt alternating-current three-phase motors. These units receive current from a second transformer whose primary is connected to the 33,000-volt bus-bars. They are installed to take care of the city lines, which are operated by 500-volt direct current. The intention is to dismantle the old power house, at present in use, which runs non-condensing, and use the room for car barns or depots to accommodate the interurban traffic.

The superintendent's office, partially shown in Fig. 4, is elevated above the switchboard and the upper part of the partition is entirely of glass, giving a clear view of the whole room. The turbine room is spanned by a Whiting electric crane of 50,000 pounds capacity and is capable of handling any part of the machinery in the room. It was used in erecting the present machinery.

All power-house wiring is in conduits or in lead-covered cable laid in an iron trough. The high-tension lines are of No. 2 copper, and, after supplying the transformer stations on the Peoria-Bloomington line, will terminate at Decatur.

The lines from the Riverton power house will also be extended to Decatur, and by this arrangement the power houses may be tied together.

The Peoria-Bloomington and Decatur-Bloomington, other lines now building north of Springfield, will be operated by single-phase current. In all the company will have 125 miles of track equipped for single-phase operation, the apparatus for which is being furnished by the General Electric Company. Four-motor 75-horsepower single-phase equipments with multiple-unit train control will be used. The motors will be the GE A-605 compensated type, designed to operate on both high-tension alternating current and 600-volt direct current.

The change from alternating to direct-current operation, as described in a recent paper by H. C. Hoagland, electrical and mechanical engineer of the company, is accomplished, where necessary, at a dead section in the trolley wire. At the instant the car enters this dead section whichever main switch is closed will open automatically, owing to the fact that the circuit energizing its retaining coil is broken. The car can run over this dead section at full speed and all the motorman has to do to obtain the proper connections is to throw the commutating switch and close the main alternating or direct-current switch, as the case may be, which can be done in the fraction of a minute.

The alternating-current passenger cars for the system are of the standard interurban type, 51 feet 6 inches long over all, having a seating capacity of 58 passengers, and weigh, loaded and completely equipped, about 40 tons. They are geared to a speed of approximately 50 miles per hour on level tangent track. Several electric locomotives weighing about 60 tons, for freight service, equipped with single-phase motors, are also in operation.

The first transmission line and two sub-stations are on the Peoria, Bloomington and Champaign line. In the sub-stations the pressure will be stepped down from 33,000 to 3,300 volts, which will be used on the trolley. It is the intention to connect the Springfield and Northeastern line from Springfield to Mackinaw to this line; also the Chicago, Bloomington and Decatur line, from Bloomington to Decatur, and balance the three phases of the transmission line by feeding one of these roads from each phase. The transmission line will be connected through an automatic oil switch to bus-bars in a sub-station at Decatur. The line from the present Riverton power house will also be connected in the same way, and the two power houses will be operated in multiple. From these bus-bars a line will be run to Champaign along the St. Louis, Decatur and Champaign Railway and at Champaign the 15,000-volt transmission line—which now furnishes power to the Danville, Urbana and Champaign Railway—will be connected through three 400-kilowatt step-down transformers, making the transmission line from Peoria to Georgetown about 175 miles long.

The Peoria power plant was designed and built under the supervision of John A. Radford of Chicago. The power house was commenced in January, 1906, when the company secured the ground, and on March 16th the contract was awarded for the building. In a few days over a year current was being generated and used to operate the city lines, which are owned by the same company. The line to Bloomington was opened to travel on April 21, 1907.

Fig. 5. River Side of Power House, Showing Viaduct over Railroad Tracks.

Fig. 6. Bridge over the Illinois River, Completed April 20, 1907.

POWER HOUSE AND BRIDGE OF ILLINOIS TRACTION COMPANY AT PEORIA.

Five-cent Theaters in the South.

Southern cities, among others, are at present suffering from an epidemic of "theatoriums," which is assuming such proportions as to attract the attention of underwriters and electricians. These "electric theaters," as they are sometimes called, are exhibitions of moving pictures held in small halls remodeled from stores and fitted up cheaply to accommodate audiences at five cents a head.

The fact that they all have different attractions, which are frequently changed, has given rise to a new fad in Southern society which takes the place of slumming in the larger cities, and which consists in getting up a party and going the entire rounds. In consequence of this fad there are 15 or 20 of these places in Atlanta, more in Birmingham, a dozen or more in Macon, and the more conservative Southern cities boast at least eight or 10.

For the purpose of the exhibition they must all be completely darkened during the performance, and are consequently lighted more or less thoroughly by electricity, the wires being run over the thin board partitions which line the room, and which are papered to keep out the daylight, as the performances are continuous. The authorities of Atlanta have taken up the question of making all electric theaters pay the regular theater license, which will probably put most of them out of business.

Double Meeting of the Institute in New York.

On the evening of April 26th the American Institute of Electrical Engineers held two meetings in New York city at the same time in the Engineering Societies Building. The meeting held on the fifth floor was called to order by President Sheldon. Announcement was made by Secretary Ralph W. Pope that at the meeting of the board of directors held in the afternoon 154 associates were elected. Mr. Pope further stated that the board of examiners was passing upon 270 applications received in one month.

Gano S. Dunn of Ampere, N. J. (to whom Dr. Sheldon turned over the chair), introduced Mr. D. MacFarlan Moore, chief engineer and general manager of the Moore Electrical Company of Newark, N. J., who presented a paper on "Light from Gaseous Conductors Within Glass Tubes—the Moore Light." The room was lighted with the Moore tube light, and during the reading of the paper a number of demonstrations of the Moore light and the ordinary incandescent light were given. Among those who took part in the discussion which followed were Chairman Dunn, Prof. C. P. Steinmetz, Percy H. Thomas and Dr. C. H. Sharp. Mr. Moore was called upon to close the discussion.

In the auditorium on the third floor of the building, where the other meeting was held, a paper was read by Mr. Sergius P. Grace, chief engineer of the Central District and Printing Telegraph Company of Pittsburg, on "The Telephone Wire Plant." This meeting was presided over by Mr. J. J. Carty, chief engineer, New York Telephone Company, who also led the discussion. Others who spoke included H. V. Hayes, chief engineer of the American Telephone and Telegraph Company, G. M. Yorke, assistant engineer of the same company, F. L. Gilman, telephone engineer, Western Electric Company, and K. B. Miller, consulting engineer, of Chicago. Both meetings were well attended. The first part of a condensation of Mr. Moore's paper appears elsewhere in this issue.

A Fire Engine That Gives Shocks.

An unusual experience, probably due to static electricity, is reported from Chattanooga, Tenn. It is said by the firemen of that city that the new La France fire engine which was installed in December last has taken to generating electricity, when, after operating, the steam is allowed to "blow off." One of the firemen says that he has received several electric shocks when the engine was "blown off," and the agent for the fire-engine company has been notified to make an examination and explain the mystery. The engine is mounted on rubber tires. The fire insurance interests as well as the fire department of Chattanooga are much interested in the matter.

Light from Gaseous Conductors within Glass Tubes—The Moore Light.[1]

By D. McFarlan Moore.

Part I.

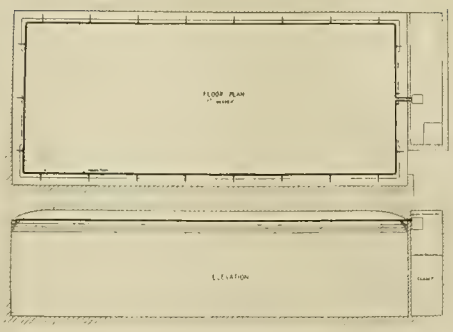
All energy consists of vibratory or wave motion and can be conveniently classified under six general heads—mechanical motion, sound, heat, electricity, light, chemism. The term "light" should be used not as the name of an effect on the eye but to designate one of the great divisions of all energy. Each division always contains a percentage of all the other divisions, and the less this percentage the purer is the division sought after. The less heat, etc., light contains the more efficient we call it. Science should know how efficiently to change or convert any one of these divisions into any other one. For example, we do not know how efficiently to change electricity into mechanical motion, namely, by the use of an electric motor, but we are ignorant concerning many of the other 29 combinations, which indicates that there remains plenty of scientific work to be done by future generations. Since all energy is really the same thing, we should become proficient in magnifying or suppressing at will any particular division or divisions, corresponding with rate of vibrations which we have settled upon and named, because they affect in a distinctive manner the different organs of our bodies.

Some years have passed since I first realized that there then existed no form of artificial light that could truthfully be said to imitate daylight. Believing unalterably that such a light was to be the next logical step of great importance in artificial illumination, I commenced an investigation that still continues. To duplicate daylight closely three premises were soon determined upon which have never been abandoned: (a) Large light source, the practical solution being a long glass tube emitting light. (b) Use electricity flowing through a gaseous conductor, not a solid conductor. (c) Perfect imitation of color values. Immediately on beginning investigation on these premises the gaseous conductor became the factor of greatest importance. The life of the first lamps or tubes constructed was extremely short. Up to date four methods have been developed and used and thousands of experiments have been made concerning the replenishing of the gas and thereby overcoming this vital difficulty of the gaseous conductor becoming non-conducting, due to the peculiar chemical reaction that must occur when electricity passes from a solid conductor to a gaseous conductor. These methods are as follows: (1) By obtaining a cycle of events through catalytic action; the intensity of light possible was found to be very low. (2) Obtaining a cycle by evaporation and condensation; probably mercury is the only element that can ever be used in this way in glass tubes. (3) By resupplying the necessary gases automatically by the action of heat on suitable substances. (4) By automatically feeding gas to the tube when needed, which is the method used at the present time.

Inventing intricate theories for explaining vacuum-tube phenomena was easy compared with furnishing a merchant a practical tube light to sell his goods under. For some years past there has existed a great mass of theoretical literature on gaseous conduction, etc., but practically none that deals with watts and hefners under commercial conditions. The old "pith-ball" phenomena of elementary physics is still a good working hypothesis for explaining the passage of electricity through gases, especially at less than atmospheric pressures. It is apparent that movements of the almost infinitely small "pith-balls" or ions is regulated largely by the potential and degree of vacuum. A collision of two moving bodies results in heat. The general law of all light sources applies also to the vacuum-tube light, namely, the higher the temperature the greater the efficiency. The absolute temperature of the individual particles of matter within the tube after collision is greater than that of any other temperature on earth. But the quantity of heat of each of these ultra incandescent, though infinitesimal bodies, is so small that there results that which at first would seem paradoxical, namely, the "coldest" source of light. In this expression we crudely refer to the external temperature of the entire tube. Some gases are easily ionized and conduct well, yet give practically no light, which may indicate that their chemical constituency and therefore their emissivity is not suitable for light production.

The subject of improved artificial lighting methods is one of the greatest economic problems of the day. The Moore light has passed the experimental stage. It is a result of 12 years of experimenting, but its advance from year to year has always been steady. It contains no make-and-break apparatus whatever. For many years all scientists have agreed that a vacuum-tube light would be right theoretically; commercial men who have had their electric-lighting bills reduced now know of its practical value.

The illumination of this assembly room (Fig. 1) at the present moment by a so-called Moore vacuum tube greatly facilitates making clear not only its mechanical construction but also its many other salient advantages and characteristics. The electrical energy is obtained from the alternating-current street mains. The light emanates with absolute uniformity from the entire area of a single, continuous glass tube 1.75 inches in diameter in the form of a large rectangle 62 feet by 25 feet, supported on a cove designed to conceal the incandescent lamps. The glass tube is 13 inches from the ceiling and 16 feet from the floor, as shown by Fig. 2. It is supported by plain brass rings 1⅞ inches in diameter attached to small porcelain insulators inserted in the ends of brass fixture tubing, which of course contains no wires. The two ends of this continuous tube at the center of the rear side of the rectangle approach within such a short distance of each other that the gap is scarcely discernible from the floor. They then extend horizontally through the wall and into a rigid steel terminal box located on the wall of the closet at the rear of the hall. This terminal box contains all the necessary electrical apparatus and corresponds in form and size with that shown in Fig. 3. It is fed by 60-cycle alternating current at 220 volts. Besides the two carbon electrodes of the tube the terminal box contains a step-up transformer and a small specially designed valve with its solenoid, which represents an entirely new departure in vacuum-tube lighting and also one that is vital to its success. The electrical circuits from this apparatus are extremely simple and are shown in Fig. 4.



FIGS. 1 AND 2. PLAN AND ELEVATION OF MOORE TUBE LIGHTING IN ASSEMBLY ROOM.

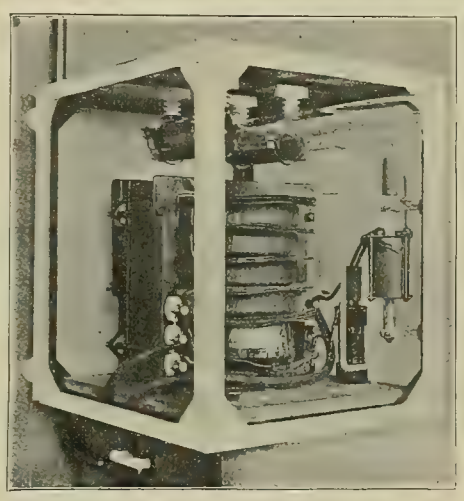


FIG. 3. INTERIOR OF MOORE TERMINAL BOX.

There is no distributed or high-potential wiring. The high-potential terminals of the transformer within the terminal box are only two or three inches in length and are attached directly to the electrodes within the box. All the high-potential wires, therefore, always remain within the box, which has a wire seal placed upon it. A hand can be placed on each of the glass tubes near where they emerge from the two holes in the side of the box, but the glass tubes insulate the gaseous conductor within them so well that no shock can be felt.

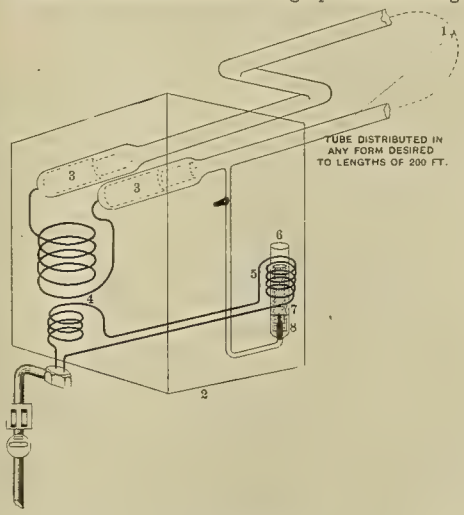


FIG. 4. DIAGRAM SHOWING ESSENTIAL FEATURES OF MOORE LIGHT.

Since the feeder valve (Fig. 5) operated by the solenoid just mentioned is an essential feature of this system, a description of its operation will be interesting. Any vacuum tube when commercially luminous will, in a few minutes, seriously alter the degree of its vacuum unless special provision be made to replenish its gaseous conductor. Due to the flow of current, a portion of the residual gas within the tube is absorbed; that is, changed to a solid form, and thereby the degree of vacuum in the tube becomes higher. This higher degree of vacuum so increases the resistance of the tube that at first the light simply becomes unsteady, but rapidly changes to a condition of violent spasmodic flickering, which soon entirely ceases and the tube gives no light whatever. The light has actually died for want of air. This simple fact was not recognized for many years by prominent investigators in this line of phenomena. The problem, therefore, was to devise thoroughly practical means for replenishing the gaseous conductor of a vacuum tube. This is the function of the feeder valve, which permits air or other gas to enter the tube only when it is needed and in such a manner that it is entirely automatic.

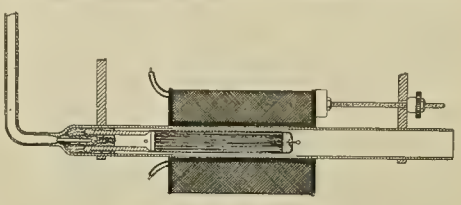


FIG. 5. FEEDER VALVE.

A piece of ⅞-inch glass tubing is supported vertically, its bottom end being contracted into a ⅜-inch glass tube which extends to the main lighting tube. At the point of contraction at the bottom of the ⅞-inch tube there is sealed by means of cement a ¼-inch carbon plug, the porosity of which is not great enough to allow mercury to percolate through it, but which will permit gases easily to pass, due to the high vacuum of the lighting tube connected to the lower end of the plug, and approximately atmospheric pressure above it. This carbon plug is normally completely covered with what would correspond to about a thimbleful of mercury, which simply seals the pores of the carbon plug, and therefore has nothing whatever to do with the conducting properties of the gas in the main tube which produces the light. Partly immersed in the mercury and concentric with the carbon plug is another smaller and movable glass tube, the upper end of which is filled with soft iron wire, which acts as the core of a small solenoid connected in series with the transformer. The action of the solenoid is to lift the concentric glass tube partly out of the mercury, the surface of which falls and thereby causes the minute tip of the conical shaped carbon plug to be slightly exposed for a second or two, and an extremely small quantity of air or other gas filters through it and then finds its way into the vacuum tube proper. In normal operation most of the tubes expose this carbon tip for about one second every minute. Therefore this system, broadly speaking, consists in continuously burning air electrically.

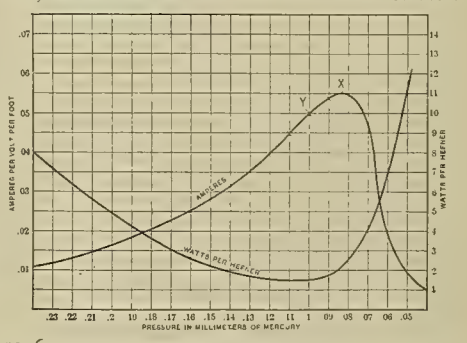


FIG. 6. RELATION BETWEEN CONDUCTIVITY AND VACUUM IN MOORE LIGHT.

Fig. 6 will explain the theory of this action still more clearly. This curve shows the relation between conductivity and degree of vacuum. Of course there must be a critical degree of vacuum at which the conductivity is a maximum; this point corresponds to (X). By means of the adjusting screw at the top of the solenoid the degree of vacuum is kept normally at a lower vacuum corresponding with (Y); therefore as the electricity uses up the gaseous conductor the vacuum of course becomes higher, the conductivity better, and a

1. A condensation of a paper presented at a meeting of the American Institute of Electrical Engineers, New York, April 26, 1907. The author is chief engineer and general manager of the Moore Electrical Company, Newark, N. J.

greater current flows through the solenoid, causing it to lift the displacer and expose the carbon tip above the surface of the mercury. In viewing its action one is vividly reminded of a mud-turtle taking a breath of air on a millpond. As others have expressed it, this apparatus actually breathes. Immediately upon the air being admitted the vacuum falls, its resistance increases, and the current through it decreases, as does also the current from the mains; therefore, the feeder magnet weakens and the displacer falls, thereby shutting off the air or gas inlet. This cycle is repeated about once a minute throughout the life of the tube, which is indefinitely long. Of course when the tube is not in service there is no leakage of air or other gas through the mercury covering the plug.

Tests of illumination measurements in hefner feet made in the lobby of a theater (Fig. 7) showed that the mean illumination (average hefner-feet of 16 stations) was 3.12 hefner-feet from the Moore tube and 1.09 from the incandescent system; the watts used per square foot, using the Moore tube, was 1.46, and 2.82 for the incandescent system; the illuminating efficiency $\left(\frac{\text{mean hefner-foot}}{\text{watts}}\right)$ was 2.15 for the Moore tube and 0.39 for the incandescents.

The tube system has 5.1 times the illuminating efficiency of the incandescent-lamp system under the same local conditions. The useful illumination has been increased 450 per cent., yet the current consumption is reduced 45 per cent. Although there are many factors which it is necessary not to lose sight of in determining the true value of any form of illuminant, nevertheless the *sine qua non* is the matter of efficiency. Does this apparatus produce

FIG. 7. LOBBY OF A THEATER LIGHTED BY MOORE TUBES.

more light for a given expenditure of energy than the other forms of illuminants with which it must naturally compete, is a question of vital importance. A new and excellent type of portable illuminometer recently developed by Mr. Marshall was used to make these illumination measurements in the theater. At all stations it was placed 32 inches from the floor, although the floor of the lobby slopes toward the entrance end.

The tube is not provided with a reflector of any kind and therefore the ceiling was much brighter than when the incandescent lamps were used, most of which were located directly on the ceiling. The walls and ceiling are covered with a buff-colored paint. The tube operated directly from the street mains, 220 volts, 60 cycles, single-phase. If this tube had been longer its efficiency would have been still better, and by equipping it with a simple white reflecting enamel on the exterior of its upper half it would have had the benefit of a reflecting surface like most other forms of light in normal operation. Measurements of tubes so equipped show an efficiency corresponding to less than one watt per hefner, and therefore approaching the theoretical limit for a light of such a commercially good spectrum.

Comparative illumination tests were made in a department store between tube "B" when fed with pure nitrogen and therefore giving a yellow light, and nine arc lamps provided with 15-inch white opalescent reflector shades formerly used to illuminate the same area. The tests showed that the mean illumination (average hefner-feet of 22 stations) was 2.6 hefner-feet from the Moore tube and 1.16 from the arc-lamp system; the watts consumed per square foot, using the Moore tube, was 0.93 and 1.2 with the arc lamps; the illuminating efficiency $\left(\frac{\text{mean hefner-foot} \times \text{area}}{\text{watts}}\right)$ was 2.79 and 0.967 with the Moore tube and arc-lamp system, respectively.

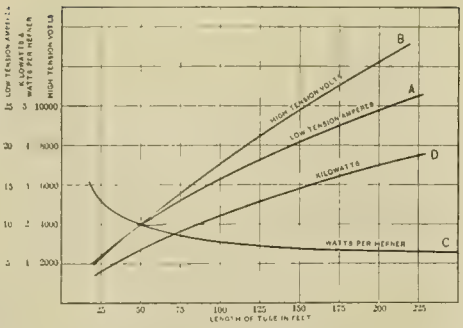


FIG. 8. CURVES OF TUBE PERFORMANCE.

The tube system with yellow light has 2.9 times the illuminating efficiency of the enclosed arc-lamp system under the same local conditions.

The efficiency of this tube in terms of watts per hefner instead of watts per hefner-foot was determined by direct photometric measurement instead of by illuminometer measurements. An accurately constructed photometer placed upon this tube showed it to be operating at 12 hefners per foot, which is equivalent to 2,388 total hefners and an efficiency of 14 watts per hefner power from the street mains. This figure is obtained by simply dividing the total watts delivered to the tube from the city service mains by the total number of hefners. This Bunsen photometer consists of a black wooden box five inches square and exactly three feet between light sources. The tube passes through one end of this box transversely, while at the other end is located a certified standard amyl acetate lamp. If the losses of the terminal box are deducted the actual efficiency of this tube, simply as a light source—which is the manner in which practically all other light sources are usually rated—reaches the remarkably high figure of 1.3 watts per hefner. When a Moore tube is diffusing its yellow light, one seems at least to be able to see far better than when it is producing the same hefner power of white light. The useful illumination has been increased 220 per cent., yet the current consumption is reduced 22 per cent.; this amounts to a saving of 10 cents per kilowatt-hour. At 65 hours per week this means $338 per year on this one tube. On the four tubes for the entire basement it means a saving of $1,350 per year.

On account of the remarkable color qualities of the white Moore light a request was made to change two of these yellow tubes over the china department in the store to a white color, and comparative illumination tests were made between tube "C," 211 feet long, when fed with pure carbon dioxide gas, and therefore giving a white light, and the 10 six-ampere 60-cycle arc lamps provided with 12-inch spherical opalescent globes. The tests showed that the mean illumination (average hefner-feet of 16 stations) was 1.12 hefner-feet with the Moore tube and 0.65 with the arc lamps; the watts used per square foot with the Moore tube was 1.34, and 1.17 with the arc lamps; the illuminating efficiency $\left(\frac{\text{mean-hefner-foot} \times \text{area}}{\text{watts}}\right)$ was 0.83, and 0.55 with the Moore tube and arc-lamp system, respectively.

The white tube is 1.5 times more efficient than the enclosed arcs. The delicately colored chinaware exhibited under exact daylight conditions shows that the general illumination is a marked improvement over that furnished by the arc lamps. The fact should be emphasized that the arc lamps hung much lower than the tube and produced a bad effect. The arc proper of the arc lamps was 28 per cent. nearer the plane of measurement than the tube. With the tube there located it would also show an economy over the arc lamps of about 78 per cent.

Although the above tests indicate that this system is now the most efficient light source known, nevertheless not only theory but experiments already made show that greater advances in efficiency are yet to be made. The best gaseous conductors particularly adapted for selective radiation must be determined upon. For example, nitrogen has about 20 times the efficiency of hydrogen. A gaseous conductor must also be selected that not only has proper color values but must maintain high efficiency over wide ranges of intensity. For example, mercury vapor (to say nothing of its color) is very

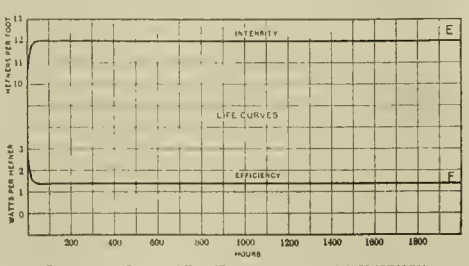


FIG. 9. CURVES OF INTENSITY AND EFFICIENCY.

inefficient in the long-tube system. It is only efficient at intensities which should be considered too high and which is also the reason why the mercury tube is so sensitive to temperature changes.

Moore tubes are now used in lengths varying from 40 to 220 feet. The watts per hefner for 40 feet is 2.5, and for 220 feet, 1.4, on the basis of a yellow light. Therefore when tubes are operating at 12 hefners per foot, which is the average intensity now used, tubes from 40 to 70 feet use a two-kilowatt transformer; from 80 to 125 feet use a 2.75-kilowatt transformer; from 130 to 180 feet use a 3.5-kilowatt transformer, and tubes from 190 to 220 feet use a 4.5-kilowatt transformer. In order to insure steady light the power-factors of the circuits supplying these transformers average at present 65 per cent. This is obtained either by using a shell-type transformer of special design with a leakage reactance of about 65 per cent., depending on the size of the transformer required, or there can be used a standard type of core transformer, operated in series with a special type of adjustable inductance consisting of two composing coils on the center leg of an iron core of the shell-type formation. Feeder-valve solenoids of four sizes have been found sufficient and are usually connected in series with the low-tension circuit of the trans-

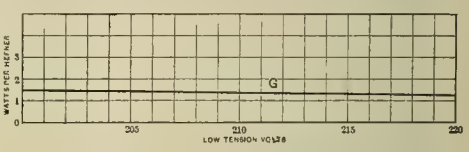


FIG. 10. EFFICIENCY AND VOLTAGE.

former and inductance, although they are sometimes operated by the high-tension circuit.

Although the average power factor is now about 65 per cent., there is no theoretical reason why all these tubes should not operate at a considerably higher power factor. In fact, a very recent improvement in the valve which has entirely eliminated capillary attraction has made it practical to adjust tubes to a power factor as high as 84 per cent., which is a decided improvement over some of the first tests published, and makes the tube far better than either the alternating-current motor or the arc lamp in these respects. Since all of the electrical factors of the entire system are based on the conductivity of the gas column, it is possible to vary the power factor over a wide range simply by changing the degree of vacuum by regulating the amount of gas fed to the tube.

The following curves show the relations existing between the salient factors that have to do with the tube performances: Curve A (Fig. 8) shows how the amperes of the low-tension side of the transformer at 220 volts vary with the length of the tube. Curve B indicates that the actual voltage on the tube terminals for 40 feet is 3,146, and for 220 feet, 12,441 at 12 hefners per foot. Curve C shows that since the no-load transformer losses and also the electrode losses become a larger percentage of the total watts as the tubes are shorter, the watts per hefner grow less—that is, the longer the tube the

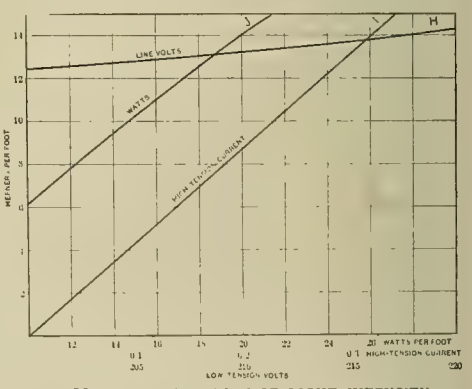


FIG. 11. CHARACTERISTICS OF LIGHT INTENSITY.

better the efficiency. Curve D shows that doubling the length of a tube does not double the kilowatts required. Curve E (Fig. 9) indicates that since these tubes soon become seasoned and use up all foreign gases, their intensity remains perfectly constant for an indefinitely long period of time. Curve F demonstrates that the efficiency also remains constant. Curve G (Fig. 10) indicates that the efficiency does not vary over a wide range of supply voltage.

Curve H (Fig. 11) proves that the light intensity is directly proportional to the voltage, not as the square or the cube of the voltage as is the case with incandescent lamps. This is an advantage of great practical importance. Curve I demonstrates that the light intensity is nearly proportional to the watts. Curve J shows that the light intensity is proportional to the tube amperes, and that a tube radiating 13 hefners per foot of yellow light requires three-tenths of one ampere.

[To be concluded.]

The Recent Italian High-tension Experiments.

By Frank C. Perkins.

Some experiments of unusual importance were recently made by Messrs. Pirelli, the Italian electrical engineers, with pressures ranging from 160,000 volts to 320,000 volts.

In these experiments a 200-horsepower transformer was utilized, arranged as shown in the accompanying diagram, Fig. 1. The primary was wound for 160 volts and fed directly from the city service main. There are two similar groups of coils in the secondary (S), arranged to be connected in parallel or in series, and thereby obtaining potentials of 160,000 volts or 320,000 volts, as desired.

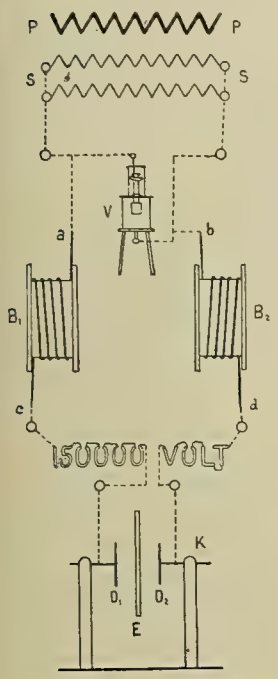


FIG. 1. CONNECTIONS FOR ITALIAN HIGH-TENSION EXPERIMENTS.

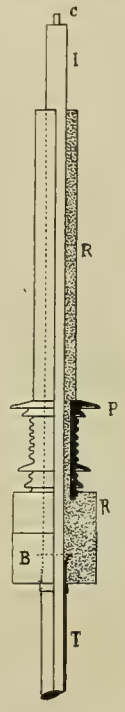


FIG. 2. HIGH-TENSION CABLE ARRANGED FOR BREAKDOWN TEST.

A potential of 200,000 volts was measured directly by means of an electric static voltmeter (V), connected as shown in Fig. 1, while for higher potentials the voltmeter was connected to one of the terminals of the transformer as well as to the middle point of it, thereby measuring half of the total voltage at the terminals of the secondary.

The Italian engineers arranged two drums (B_1) and (B_2), each of which was wound with a length of high-tension cable of 120 meters. A section of this cable, full size, is given in Fig. 4. Various layers of different dielectrics are used for insulation, partly vulcanized rubber and partly paper, the whole sheathed in lead.

To one of the terminals of the secondary of the transformer, which was connected in parallel, as noted in Fig. 1, one of the ends of each of these two coils (a) (b) was connected, while the other two ends (c) and (d) were connected to a number of vacuum tubes in series, forming the words, "150,000 volt."

In series with the vacuum tubes a small condenser was connected, formed by a disk of ebonite (E) separating two movable copper disks (D_1) and (D_2), the distance betwen the armatures being regulated from 15 to 20 centimeters in order to adjust the current in the tubes and obtain good brilliancy. As the impressed voltage was too high for the tubes, the condenser became necessary, and the cables formed a part of an electric line working at a pressure of 150,000 volts steadily.

A number of pieces of this cable about 20 feet in length were tested to the point of breakdown, the ends being especially prepared to obviate surface discharges, as shown in the accompanying drawing, Fig. 2. By means of a suitable resistance put in the primary the tension could be gradually increased until a pressure of from 200,000 to 210,000 volts was applied between the lead sheathing and the conductor, when the cable broke down. The diameter of the conductor was 18 millimeters and the total diameter was 48 millimeters over the insulation, making a thickness of 15 millimeters for the dielectric, the experiment showing a very high rigidity. Referring to Fig. 2, (C) is the conductor, (I) and (R) insulation and covering, and (P) a porcelain insulator. The insulation (R) is a resinous material, the lead covering (T) of the cable entering the lower block of this insulating material at (B). This special precaution in the insulation in the end of the cable was necessary in order to obviate surface discharges in these high-tension experiments. The conductor is absolutely cylindrical, the copper strands being sheathed with lead.

Fig. 5 shows a section of the cable tested by Messrs. Pirelli which was recently laid across Lake Garda. This cable was laid for the transmission of power at a pressure of 13,000 volts from Ponalle to Rovereto, about 6,000 kilowatts being employed, three-phase currents being utilized. The section (Fig. 5) is full size, the stranded conductor being 75 square millimeters, sheathed in lead tubing, this being insulated by a number of layers of vulcanized india rubber to a thickness of 5.5 millimeters, outside of which is a coating of gutta-percha of 1.2 millimeters, to exclude any water. There is an outer covering provided with an armor of 18 steel wires, each having a diameter of three millimeters. Each of these steel wires was wrapped with tarred hemp in order to avoid the effect of self-induction.

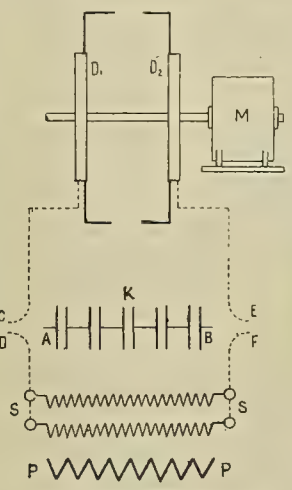


FIG. 3. CONNECTIONS FOR ROTARY SPARK-JET EXPERIMENT.

FIG. 4. FULL-SIZE SECTION OF CABLE WORKED AT 150,000 VOLTS.

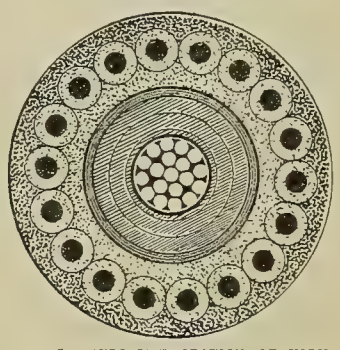


FIG. 5. FULL-SIZE SECTION OF HIGH-TENSION SUB-AQUEOUS CABLE.

This cable was tested between the conductor and sheathing up to 100,000 volts, and it is stated that fierce sparks were noted between the conductor and the sheathing running along the surface of the dielectric, but it is maintained that the cable withstood the pressure satisfactorily, although it was not possible, on account of this sparking, to increase the voltage above that amount.

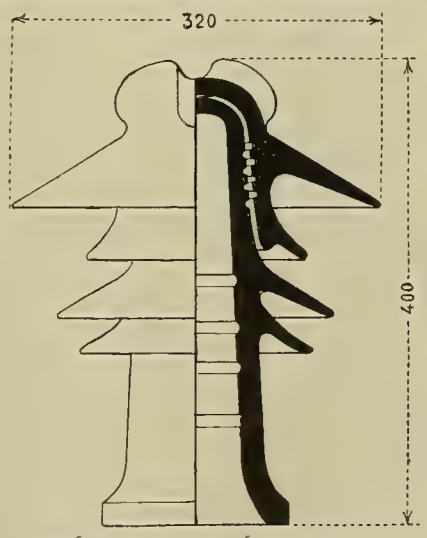


FIG. 6. INSULATOR FOR 60,000-VOLT LINE.

The accompanying drawing (Fig. 6) shows the large porcelain insulators, made by Richard Dinori, which carried the aerial two-wire line for these experiments, designed for lines of 60,000 volts and tested up to 2½ times this pressure. This insulator, it will be noted, is 400 millimeters high and 320 millimeters in diameter. The wires were spaced 1.6 meters apart and consisted of copper strand of different diameters in order to show the difference of brush discharge with varying thicknesses of conductor.

It is stated that the smallest wire showed a brush discharge at 50,000 volts, this conductor having a cross-section of 20 square millimeters, while the largest wire showed a brush discharge only when the pressure reached 100,000 volts, the diameter of this conductor being 100 square millimeters. When the pressure was increased to 150,000 volts and up to 280,000 volts there was a bright brush discharge and a considerable hiss on the line. Sparks could be obtained from any insulated metallic mass on account of the electrostatic field being so intense, and vacuum glass tubes were lit up spontaneously. The experiment was stopped at 290,000 volts on account of the burning of the wooden supports, due to an arc from one of the insulators.

Fig. 3 is a diagram showing the electrical connection of the rotary spark-jet experiment made by Messrs. Pirelli, which is of great interest. The two ebonite disks (D_1) and (D_2) were of 25 centimeters radius and placed 250 millimeters apart on the shaft of a three-phase motor (M). The tension of the transformer secondary (S) was lowered to about 90,000 volts and arranged to charge a battery of condensers.

The disks above referred to were arranged with two bronze rings on the outer edge, to which were screwed two iron wires, the ends of which were 10 centimeters apart and 50 centimeters from the shaft of the motor, which operated at a speed of 1,200 revolutions per minute. These rings were connected to the condensers, and the speed of the spark jet was 60 meters per second, with the motor operating at the above rate of speed.

It is stated that there was a brilliant circle of sparks observed which appeared to turn opposite to that of the motor rotation and quite as slowly, the speed being the slip of the motor.

These high-tension experiments were most interesting and instructive, and the construction of the high-tension voltmeter is of more than passing interest. This 200,000-volt electrostatic instrument was designed to measure the attractive force exerted by the lower fixed plate, which was connected to one of the transformer terminals (S), Fig. 1, on a movable plate connected to the other terminal, paraffine oil being employed for filling the apparatus. The lower plate is 280 millimeters from the upper plate, the latter measuring 50 millimeters in diameter. Mr. Gona, the engineer, says that the attractive force exerted on the upper plate is 23 grammes with a tension of 200,000 volts, and this electrostatic attraction is considerable when it is noted that the small plate has an area of only 20 square centimeters.

Firemen Object to Electric Signs.

Objection is made in Atlanta, Ga., to electric signs in front of stores and other buildings. Insurance men say the fire department officials object to the use of these signs because they imagine that there is an increased electrical hazard, and also because of the possibilities of the explosion of bulbs when, in case of fire, the firemen have to climb over and around the signs. The insurance men assert that there is little danger from the electrical hazard if the wiring is properly installed, but they recognize the possible interference of large, cumbersome signs with the work of the fire department.

Electric Train Tests at 100 Miles an Hour.

On the New York, New Haven and Hartford Railroad a speed of 100 miles an hour was attained, according to report, by an electric train in tests conducted several days last week. The motors of that train were of the single-phase type. The overhead contact system was used and the officers of the road declare that the experiments have shown it to be superior to the third-rail system. It is also asserted that the tests prove that passenger trains can be run at 100 miles an hour with perfect safety.

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DATES AHEAD.

Southwestern Electrical and Gas Association (annual convention), San Antonio, Texas, May 14th to 16th.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Institute of Electrical Engineers (special high-tension meeting), Chicago, May 24th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), The Willard Hotel, Washington, D. C., June 4th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

BELL AND INDEPENDENT telephone interests seem to exhibit an increasing tendency to "get together." From all parts of the country we receive reports that in rural localities where the Independents are strong the Bell people offer to retire from the field in return for the long-distance business. Possibly this has become a settled line of policy with the older company. The Independents seem to be in doubt how to treat this offer, and the situation is the subject of earnest discussion.

FROM Muncie, Ind., comes the news that the city has disposed of the last of the machinery of the municipal electric street-lighting plant. When the building and ground are sold all existing evidence that Muncie was ever in the electric-lighting business will be wiped out, except for a reminder in the shape of $10,000 worth of unredeemed bonds that will continue to draw interest for seven years more. The experiment proved a failure, and the city now has a contract with a private company to light the streets. Muncie is only one of many municipalities that have discovered after trial that municipal ownership is much more alluring in prospect than satisfactory under actual long-continued operating conditions.

GASOLINE storage for automobile purposes in crowded city centers brings grave dangers in its train. A recent troublesome fire in the "Loop" district in Chicago is a case in point. Several firemen were required in this instance to keep the flames from approaching a 100-gallon tank of gasoline which was located in an alleyway. On one side of this alley there is a theater building and immediately adjoining it is a large hotel, while in the closely built neighborhood are many buildings liable to be badly damaged by an explosion of such a tank. The imminent danger was averted by the efforts of the firemen; but it is hardly necessary to point out that with electric automobiles, now rapidly increasing in number, the necessity of using or storing gasoline, with its highly explosive fumes, is entirely obviated.

THE X-RAY was undoubtedly the cause of the death of Wolfram C. Fuchs, the expert skiagrapher, who died at his home in Chicago last week. After the discovery in 1895 of the peculiar qualities of the radiation to which Roentgen gave the name X-ray (intended to be temporary but which still sticks), Mr. Fuchs was among the first to investigate and apply the newly observed phenomenon. He soon became an expert operator, and, backed by members of the medical profession, he opened a laboratory in Chicago which achieved a wide reputation in professional circles. He continued in this occupation for nine or ten years.

At first the serious effects of long-continued and unrestricted application of the X-ray were not known, and, like a number of other operators, Mr. Fuchs was doomed to demonstrate these effects in his own person. He received several severe X-ray "burns," and in time these were the cause of cancer, from which he died, despite repeated amputations and the best medical attention.

Mr. Fuchs was in the prime of life, and although his work was not without its commercial side, he died, in a way, a martyr to science. As the result of the work and experience of Mr. Fuchs and of men like him, the fact that the X-ray may have a malign as well as a beneficial influence is now generally recognized, and measures are taken to protect operator as well as patient. The Roentgen radiation has, of course, amply demonstrated its great usefulness; but it is a powerful agent when extensively employed, and it is to be used with caution and only on the advice of a physician or expert of sound judgment who is familiar with its characteristics.

NEW BREMEN, OHIO, a village with a population of 1,500, has an electric-light company which, under the management of Mr. F. H. Plaice, has a remarkable record of success. We take much pleasure in laying before the readers of the Western Electrician, in this week's "Selling Electricity" department, an article written by Mr. Plaice, at our request, in which he gives a most interesting account of his methods. This article is an inspiration and shows what can be done in a small country town that many people would suppose could not support a plant at all. But Mr. Plaice does not rely on the village alone—not he. The motto of his company is: "We intend to light every building and turn every wheel within a radius of ten miles." That's the spirit that has built up the business until the earnings have reached about $8.50 a year for every man, woman and child in the town in which the plant is located. If that ratio of earnings to population could be applied to the average central-station company, the increase would be simply tremendous. It shows the latent possibilities of the business of supplying electric light, heat and power.

Mr. Plaice shows an indomitable spirit that is in every way admirable. "In our new plans the lighting item will become secondary and the power item first." Think of that from a town of 1,500! And listen to this, speaking of air heaters, "We cannot at present hope to compete with natural gas at 25 cents a thousand. We will, however, keep posted, and when the time comes, we shall certainly take hold of the heating business." There is an air of calm confidence about this that is irresistible. A little thing like 25-cent natural gas in competition doesn't disturb this man in the least.

Mr. Plaice has the spirit that wins. May his stimulating example be followed more largely in the electric-current-supply business! We urge every central-station manager to read his article. Every electrical man who does so, we are persuaded, will join us in hearty congratulations to the author.

PRECIOUS STONES and semi-precious stones are used in electric meters to an extent unsuspected by persons who are not familiar with that branch of the industry. The fact was brought out recently when a large electrical manufacturing company entered a protest against the duty levied by the collector of customs in Boston on an importation of diamonds intended for bearings in electric meters. The question arose as to the correct classification of the stones. The diamonds in question average 16 to the carat, are brown in color, and each has one surface cut and polished. They were classified and duty assessed at the rate of 10 per centum ad valorem under the provisions of paragraph 545 of the present tariff act. It was conceded by the importers that the diamonds had been advanced in value by a process of cutting; therefore, unless they could be more specifically provided for by some other paragraph of the tariff, they should be held to be dutiable.

The hearing in the case took place at Boston, but was later transferred to New York, in order to enable the government to procure evidence to support its contention that the diamonds were dutiable and not entitled to free entry, as asserted by the importers. An exhaustive examination was held, and prominent importers and cutters of diamonds appeared and testified, and from such testimony it appeared that at the date of the passage of the present tariff act, and immediately prior thereto, the diamonds in question, which are used largely for industrial purposes, were known in the trade as "bort." There was some testimony to the effect that, by reason of the continuous advance in the price of all grades of diamonds during the last ten years, the better qualities of bort, capable of being cut into the form of rose diamonds, would now be excluded from the trade designation of "bort." The preponderance of the evidence, however, showed that at the present time the articles in the condition in which imported would not be known as rose diamonds.

It was not material, in the opinion of the Board of General Appraisers, to consider present conditions. For tariff purposes the only question should be how the merchandise was commercially known in 1897, and it was found that it was then known as, and was in fact, bort. On the other hand, precious stones cut and faceted and intended for jewelry purposes or suitable to be set in jewelry, even if made of bort, would not be known at the present time as bort; nor would they have been known so in 1897. Following previous decisions the protest was sustained and the collector's decision reversed.

The proceeding throws an interesting side-light on the diverse aspects of the electrical industry.

The Electrical Fire Hazard.

At a meeting of the Insurance Library Association of Boston, on April 26th, an address on the "Effect of Electrical Development on the Fire Hazard" was given by Mr. F. H. Wentworth, engineer in charge of the Boston office of the Underwriters' Laboratories. Mr. Wentworth pointed out the attitude of the insurance companies in respect to domestic and industrial installations of electricity and said that this form of power will continue to be in its infancy from the insurance viewpoint until consumers understand the principal hazards incident to its use. Like any other form of energy used for light, heat or power, it must be handled intelligently in order that it may not follow the tendency of all energy to transform itself into heat with consequent possible loss by fire. Considering the application of electricity the user's ignorance must be taken as the principal factor.

The application of electricity to the operation of factories and mills where large investments are made in such apparatus—the consequence being that trained supervision is paid for—is likely to be of more service in reducing hazards than are domestic applications, where the wiring is left at the mercy of people absolutely ignorant of its functions, even though electricity replaces the hazard of gas or kerosene. In a general way the mill hazard is in inverse ratio to the size of the equipment. A large equipment of from 25 to 100 motors generally requires a man competent to oversee and maintain it, but a small equipment of but a few motors is usually left to shift for itself, and the funny things which the untrained man will do to the motor and its control, when in his opinion, they are out of order, should be given grave consideration. The laboratories are gradually weeding out poor fittings of all kinds, and this is a help to the layman as well as to the expert engineer.

It is noteworthy that those industries which have utilized electric power for the greatest length of time are seeming to show the fewest proportionate fire losses from electricity. Thus, electricity has superseded other forms of power pretty generally with all the small job printers throughout the country, and no other power is considered in the operation of large printing establishments on account of the ease of electrical manipulation. The up-to-date pressman in all the larger establishments of this character is as familiar with the functions of his motor and its control as he is with his press, and this is a most encouraging sign from the insurance viewpoint.

Mr. Wentworth concluded with a discussion of the objections to electrical installations improperly supervised in flour mills and small grain elevators, especially in connection with bleachers, driers, and other adjuncts of the grain business. It is most important that the elements of hazard in such mills be reduced and that intelligent supervision be accorded the apparatus in service.

Technical and Trade Journals Discussed by Experts.

"Patrons' night" was observed at a dinner given by the Chicago Trade Press Association and the Space Club—a society of advertising solicitors—at the Great Northern Hotel, Chicago, on April 29th. Mr. W. H. Taylor, president of the former organization, sat at the head of the table, with Mr. J. C. McQuiston of Pittsburg, manager of the Westinghouse Companies Publishing Department, on his right, and Mr. L. A. Greene, president of the Space Club, on his left. About ninety gentlemen attended the dinner. The speeches related principally to the science of advertising, as exemplified by the technical and trade press, and they were of a high order, demonstrating the honesty of purpose and discriminating study now devoted to this important subject.

After the opening address by Mr. Taylor, Mr. Greene was the first speaker. He gave a brief history of the Space Club and was followed by Mr. M. C. Robbins, who, taking the text, "A cause is no stronger than its representative," made a plea for the conduct of the advertising business on a high plane. Mr. McQuiston was next introduced, and he delivered a sensible, well-considered address. In the course of it he said:

"We regard advertising as a written form of salesmanship. We aim to show that the various classes of work which we touch can be done better by electricity than by any other means. In our extensive and varied business almost all methods of advertising must be followed. We are represented in about 100 technical and trade journals. The dodger system has no merit at all, it seems to me. Received at a time when the business man has many demands on his time, practically all of this material goes in the waste basket." Mr. McQuiston said that the advertising in a trade or technical paper should be divorced entirely from the editorial policy. He advocated a standard size for all technical journals and closed with a tribute to the solicitor. "I have learned a great deal about advertising from the sellers of space," he said.

R. C. Jacobsen of Hide and Leather made a humorous speech, yet abounding in shrewdness. He was followed by Hugh M. Wilson of the Railway Age, whose remarks were direct-to-the-point and well reasoned. "The daily paper is a romance," said he; "the popular magazine is a more highly organized romance; but the technical journal is a text-book. The technical journal dispenses information—facts not romance. Its circulation is distinguished by quality rather than quantity."

The speakers were extended a vote of thanks, and there is a likelihood that the joint meeting of the two societies will become an annual affair.

First Convention of Oklahoma Electric Light, Railway and Gas Association.

The first annual convention of the Oklahoma Electric Light, Railway and Gas Association was held in the Chamber of Commerce, Oklahoma City, on April 22d and 23d, and was attended by 75 members. The convention was called to order by President F. H. Tidnam of Oklahoma City.

Mayor Scales delivered an address of welcome to the members attending the first electrical convention held in the new state. Galen Crow of Guthrie responded to the mayor's address, and J. C. Walton welcomed the delegates on behalf of the local members. After roll-call and the presentation of new candidates for membership President Tidnam delivered an address.

Galen Crow, manager of the Guthrie Light and Power Company, read a paper on "Heating and Cooking with Electricity." Mr. Crow called attention to the rapid advance made in this direction within the last few years. He referred to the improved method of heating glue pots, soldering irons and other implements used in manufacturing. Electrical cooking apparatus was also mentioned.

"Interurban Railways" was the subject of a paper read by J. H. Merrill, general superintendent of the Choctaw Railway and Lighting Company of South McAlester. He told of the early history of interurban railways and dwelt upon the development along this line. Mr. Merrill warned members starting new lines to beware of cheap rates, which would overload the equipment and would not result in fair profits when the cost of maintenance and new equipment is considered. He also warned the members not to attempt such service as would be unprofitable to them; that a four-hour service was often as paying as the hourly service and did not require a large outlay of money.

After the adjournment for luncheon W. J. Dibbens of the Guthrie Gas, Light, Fuel and Improvement Company spoke on the subject of "Gas Lighting." President F. H. Tidnam's subject was "New Business, and How to Show the Prospective Customer that You Can Benefit Him." "Car Painting and Other Uses of Paint" was the subject of the paper read by J. Cliff Leavitt of Oklahoma City. Mr. Leavitt advised as to the kind of paints, the use and the durability of certain qualities.

The question box consumed the remainder of the first day's session. At four o'clock the members took a trolley ride around the city. On account of rain a parade which was scheduled to take place was called off. A rejuvenation of the Sons of Jove was held in the evening at Eagle Hall, Main Street and Broadway, when 50 members were initiated into the mysteries of the order.

At the session of the 23d Errett L. Callahan of Chicago read a paper on "Increasing the Central-station Day Load." Mr. Callahan urged the working up of interest in heating and cooking by electricity as a means of bringing about such an increase.

"The State University and Oklahoma Industries" was the subject of Prof. C. M. Jansky of Norman, Okla. He was followed by J. C. Walton of Oklahoma City, whose subject was "Co-operation." After the discussion of the answers in the question box the regular business was taken up and committees were appointed.

The election of officers for the ensuing year resulted as follows: President, F. H. Tidnam; first vice-president, Ed Reynolds; second vice-president, J. H. Merrill; third vice-president, Fred Bedford; secretary, Galen Crow; treasurer, W. J. Dibbens. On the executive committee H. C. Stetmund of Chandler and C. F. Mercer of Geary were chosen for two-year terms, Clarence Klein of Tulsa and J. E. Turner of Elk City being chosen to fill one-year terms. The finance committee is composed of C. W. Ford of Oklahoma City, R. Wonderlich of Sulphur Springs and W. W. Ballington of Okmulgee. The advisory committeemen are H. H. Stephens of Elreno, J. J. Patterson of Ada and E. M. Cooper of Wilburton.

In an attractive booth, where a large electric range was installed, eatables cooked by electricity were served during the convention. Some exhibits were shown in the Chamber of Commerce by various electrical companies. Other firms had their displays at the hotels about town, there being little space in the hall. A list of some of the firms represented includes the H. W. Johns-Manville Company, New York; the Electric Traction Company, St. Louis; the Standard Underground Cable Company, Pittsburg, Pa.; the Electric Service Supplies Company, and the Commercial Electrical Supply Company, St. Louis.

After the close of the convention the members were entertained at Delmar Garden. It is probable that at Oklahoma City will be located in the near future a large jobbing house for electrical supplies as a result of the convention. W. H. Nolker, secretary of the Commercial Electrical Supply Company of St. Louis, who attended the convention, said that he was favorably impressed with the city and was considering the advisability of locating a jobbing house there.

Electrical Exports for March.

Electrical exports from the United States for the month of March, 1907, amounted to a total value of $1,510,824, compared with $1,295,365 for March, 1906. Both classes of goods—electrical appliances (including telephone and telegraph apparatus) and electrical machinery—show an increase. Following are the figures: Electrical appliances—March, 1906, $590,328; March, 1907, $590,999. Electrical machinery—March, 1906, $705,037; March, 1907, $919,825. British North America was the largest purchaser of electrical appliances during March, 1907, while the United Kingdom took the lead last year. In electrical machinery British North America was first both this year and last.

Following are the names of the leading countries importing electrical goods from the United States in the month of March and the value of such imports:

Appliances—British North America, $119,390; Brazil, $87,964; United Kingdom, $61,747; Mexico, $52,729; Germany, $43,425; Belgium, $29,487; Japan, $25,632; Cuba, $23,452; France, $20,399; Central American states and British Honduras, $16,149; British Australasia, $15,716; Philippine Islands, $10,736; Argentina, $8,871; other South American, $52,492; other European, $10,684.

Machinery—British North America, $186,746; Mexico, $163,656; United Kingdom, $127,396; Brazil, $126,590; Japan, $105,312; British Australasia, $51,250; France, $38,418; British Africa, $13,692; Chinese Empire, $9,739; Central American states and British Honduras, $7,776; Germany, $6,568; British East Indies, $5,486; other European, $33,848; other South American, $24,273.

Electric Transmission Towers.

At a meeting of the Chicago branch of the American Institute of Electrical Engineers on April 26th, Mr. D. R. Scholes, chief engineer of the Aermotor Company, addressed the meeting on "Electric Transmission Towers." Mr. Scholes illustrated his remarks with a number of lantern slides. Among the reasons given by the speaker for the extensive use of steel towers was the scarcity of wood in certain countries.

Views were shown of the first transmission line erected by the Aermotor Company, when windmill towers were employed with a post at the top to hold the wires in position. Mr. Scholes talked at some length on the development of the genuine electric transmission towers constructed of galvanized iron. In mountainous countries, the speaker said, the various sections of the towers were frequently carried by mules to the place of erection.

Towers are usually spaced 500 feet apart, the height varying from 40 to 45 feet to the lowest wire. Special towers are built for suspension insulators. A view was shown of a tower built for the Drainage Canal transmission system at Lockport, Ill., which required a small base. The bases of towers range from 12 by 12 feet to 17 by 17 feet. Mr. Scholes gave a number of tables showing the cost of erecting towers on the basis of spacing. A distance somewhere between 400 and 600 feet represents the minimum outlay. Various forms of towers constructed to meet local conditions were referred to. In some cases the towers are required to carry six transmission wires, two grounded wires for lightning protection and two telephone wires.

The discussion was participated in by George H. Lukes of the North Shore Electric Company, P. Junkersfeld of the Chicago Edison Company, and Messrs. Sholer and Hope.

Southwestern Convention To Be Held at San Antonio.

The third annual convention of the Southwestern Electrical and Gas Association will be held in San Antonio, Tex., on May 14th, 15th and 16th. San Antonio is an interesting and hospitable city, with ample hotel accommodations. It is the purpose to make this the banner convention of the association. Special entertainment will be given by the San Antonio Traction Company and the San Antonio Gas and Electric Company, including special plans for the ladies. Excellent papers on live subjects have been provided for and the Question Box will be a feature. The electric railway, electric light and power, gas, telephone and all public-utility interests are invited. H. S. Cooper of Galveston is president of the association.

Indiana Traction Men Before the State Tax Board.

Indiana electric railway men appeared before the Indiana Tax Board last week with a view of convincing the commissioners that no increase in taxation should be made and why in some instances the assessments should be decreased. Their remarks brought out some interesting facts concerning electric-railway operation. Charles L. Henry, dean of the interurban business in Indiana and president of the Indianapolis and Cincinnati Traction Company, said that the first real expensive mistake the Indiana traction men made was when interurban lines were first projected. "We considered them mere means of transit between large cities and suburbs, and they were constructed with that idea in view. Now it has been clearly shown that they are a means for through transit, and the old construction is not fit for lines carrying long-distance traffic, and the companies are up against the immediate necessity of reconstructing their roadways." For this and other reasons Mr. Henry thought the roads should not be taxed so highly as they were last year. He stated that his line would not be a paying investment until completed into Hamilton, Ohio, so as to give him through passenger and freight business between Indianapolis and Cincinnati.

J. Levering Jones, president of the Fort Wayne and Wabash Valley Traction Company followed Mr. Henry and said he did not ask for a reduction in the assessment this year, but he hoped to show that there should be no increase. He said the company was spending much money in bettering and improving the property and building 42 miles of new line between Logansport and Lafayette. "Our line showed a net increase in its earnings this year over last of only eight per cent., and this did not provide a surplus. If the net earnings of any of these roads should show a shrinkage of eight per cent., it would mean bankruptcy and receiverships. Wages have increased five per cent. Material is higher and cost of operation much greater. The Indiana traction roads are just now going through the transition from their infancy to maturity, and this is an expensive process. They were built independently, in small systems, each having an individual power house, and the expense was too great to make them profitable. Now, however, they are being taken into combinations and the management conducted more economically. This will be the salvation of the roads and conducive to better facilities for the public."

Mr. Jones told the board there was no money in the freight and express business as now conducted by the interurban roads. "Interurbans," he said, "are essentially passenger roads, and everything must be subordinated to that traffic. When these lines are made into trunk lines the long-distance hauls will make the freight business profitable." Many other prominent men spoke before the commissioners, all voicing the sentiment that the electric interurban roads have not yet reached their full development and possibilities, and are just beginning to enter upon a paying basis. Therefore no increase should be made in the tax assessment.

Mr. Fuchs an X-ray Victim.

Genuine regret will be felt at the death on April 24th, at his home in Chicago, of Wolfram C. Fuchs, probably the best-known X-ray expert in Chicago and a man of international reputation in his specialty. Mr. Fuchs' death, caused by carcinoma, is directly due to the effect of the X-ray. His life, or a large portion of it, was devoted to experimental or expert work based on Roentgen's wonderful discovery. He founded the first large X-ray laboratory in Chicago, and to him many of the leading physicians and surgeons of the city brought their patients. He was not only an enthusiast in his profession, but he built up a large business commercially. But until recent years the destructive and insidious effect of long-continued exposure of the human body to the X-ray were not understood, and the early operators did not take proper measures, by leaden screens and otherwise, to protect themselves—they who were subject to the mysterious radiation for many hours daily. Mr. Fuchs received severe "burns" (if the baffling attack of the Crookes tube may be termed a burn) about the hands, and although he received the best medical advice the city afforded and submitted to more than one amputation, cancer developed, and he succumbed, sincerely mourned by his friends and associates.

WOLFRAM C. FUCHS.

Mr. Fuchs was born in Berlin 41 years ago, and received his education as an electrical engineer in the Polytechnic at Potsdam, Germany. When the late President McKinley was lying upon his deathbed at Buffalo, dying from a gunshot wound, Mr. Fuchs was called into consultation as an X-ray expert. The decedent was engaged in electrical pursuits in Schenectady, Milwaukee and Chicago before entering upon his X-ray work. He leaves a widow and two children.

The Electrical Show at Lincoln, Neb.

As a result of the untiring efforts of Homer Honeywell, manager, and Theodore B. Mitchell, manager of the new-business department, of the Lincoln Gas and Electric Company of Lincoln, Neb., the people of that city enjoyed free of cost an excellent electrical and gas exhibition on April 22d to 27th inclusive. The idea of the exhibition was to educate the people to the great possibilities in the use of electricity and gas. The Lincoln company is an enterprising one, and as one result Lincoln is one of the best lighted cities of its size in the United States.

The exhibition was largely attended and a number of sales were made by the exhibitors. The Auditorium, in which the show was held, was decorated in artistic fashion. The interior of the building was brilliant with electric lights, over 4,000 incandescent lamps being used. The ceiling was covered with a curtain of green crepe paper, in the dangling ribbons of which the lighted bulbs glistened. The exterior of the building was lighted by 1,000 lamps and presented a most attractive appearance. In the balcony an orchestra played popular airs, and in the booths which lined the central portion of the hall coffee and biscuits were produced on electrical and gas devices for heating and cooking.

Mrs. Hiller, the well-known teacher of the art of cooking, gave daily lectures on the various phases of home life and modern housekeeping. Benjamin Adams, superintendent of the local central-station company, was in daily attendance doing all in his power to help matters along and giving any informaton deesired.

On Friday evening, after the show, the exhibitors were the guests of the company at a banquet held in the Lindell Hotel. Mrs. Hiller was toastmistress, and the evening was most enjoyably spent. The show closed on Saturday afternoon. The exhibitors are already looking forward to next year, when it is hoped the company will again have an exhibition. They united in congratulating Messrs. Honeywell and Mitchell on the success of the show and the excellence of the arrangements.

The Westinghouse companies were represented by W. R. Pinckard of Chicago, S. G. Peticolas and W. G. Williamson. They exhibited motor-driven sewing machines, washing machines, coffee mills, mangles, automatic attachments for maintaining water level in tanks, sign flashers, arc lamps, fan motors and portable instruments, including a testing wattmeter and detail apparatus.

The Haller Machine Company of Chicago exhibited an extensive line of late sign creations and letters.

The Barr Iron Company of Cleveland exhibited electric irons, coffee percolators, heating pads, stoves, griddles, broilers, etc.

The Wagner Electric Manufacturing Company of St. Louis exhibited an instructive line of motors and other electrical devices.

An interesting display was that of R. Williamson & Co. of Chicago. The chandeliers shown were of late designs and the effect was artistic and pleasing. Franz Brzeczkowski, the representative of R. Williamson & Co., was kept busy explaining the useful as well as the decorative effects of his fixtures, at the same time keeping his ever pleasant smile and pronouncing his name, which no doubt is a great business getter for his firm.

Korsmeyer & Co. of Lincoln exhibited a line of handsome domes for both electric and gas lighting. The company's exhibit was in charge of W. C. Potts, manager of the fixture department.

The Bryan-Marsh Company of Chicago had on exhibition the tantalum and metallized-filament lamp in various candlepowers and sizes on a rack made of piping. Considerable interest was manifested by visitors. The company was represented by F. M. Henkel. Mr. Houghton of this company arrived Friday.

The Lincoln Sign Works, Lincoln, Neb., exhibited a line of electrical signs and letters. The company was represented by G. O. Loomis.

The Nebraska Telephone Company's exhibit contained a number of different sets of telephones. The booth was in charge of Frank A. May, chief solicitor, assisted by a corps of solicitors, who were busy giving away souvenirs.

The Lincoln Gas and Electric Company displayed a number of labor-saving gas appliances in its industrial exhibit. The exhibit was looked after by Charles Reese. In the specialty booth the company exhibited a mercury arc rectifier, sign flasher, meters, transformers, fans and numerous electrical devices and novelties. The man in charge was S. W. Cheney.

The Lincoln Telephone Company (Independent) was represented by M. J. Caster, who explained the operation of the automatic telephone. The company had several telephones in the building and visitors talked from one end of the building to the other.

QUESTIONS AND ANSWERS.

Speed and Periodicity.

L. M., Chicago: Please state what speed a four-pole two-horsepower dynamo should attain to generate at 60 cycles.

ANSWER.

A four-pole dynamo must run at 1,800 revolutions per minute to get 60-cycle current.

Humming of Arc Lamp.

L. M., Chicago: I would like to know if the humming noise of an alternating-current arc lamp can be stopped, and how it can be done.

ANSWER.

By cushioning the various loose parts of the lamp, and especially the reactance coil on top, the humming noise can be greatly reduced. The laminations of the reactance coil should be clamped tightly together. The cushioning can best be done by springs or by felt washers.

Rectification of Alternating Current.

M. R., Valdez, Mexico: Can you advise me of some current rectifier to produce direct current from an alternating 104-volt circuit, reducing the electromotive force to six volts?

ANSWER.

A mercury arc rectifier, such as the larger electrical manufacturing companies sell for automobile charging, will answer the purpose. By means of a special reactance coil the direct-current voltage may be reduced to six volts, with 104 volts alternating current.

Wireless Without a Ground.

E. F. F., Chicago: Is it possible to construct a wireless apparatus to send a message one mile or more without a ground?

ANSWER.

It is; but if a ground connection is not used something in the nature of a capacity area must be substituted for it. This may be in the form of a metallic plate of fairly good size—say, a few feet square—lying upon, but insulated from, the earth, or it may be in the form of a metallic cylinder insulated from the earth.

This capacity area should be connected with one terminal of the spark-gap at the transmitting station, or with one terminal of the coherer or detecting device at the receiving station.

The Telefunken system used in Germany, which consists of a composite of the Braun, Siemens & Halske and Slaby-Arco systems, ordinarily employs a capacity area instead of the direct earth connection. This system is effective over a distance of 100 miles or more.

Victoria Falls and Rio de Janeiro Power Projects.

W. R. L., Niagara Falls: Can you furnish me with some definite information in relation to the Victoria Falls power project in South Africa or anything about the one said to be in course of construction in Brazil, near Rio de Janeiro? Or could you refer me to a source of information?

ANSWER.

The literature of the Victoria Falls power-transmission project in the technical journals is extensive, for the proposal has been vigorously attacked as impracticable in the present state of the art and as not being justified, financially, by economic conditions. On the other hand, the plan has not lacked vigorous defenders and has been of especial interest because the Thury high-tension direct-current system of power transmission has been seriously considered in connection with it. Many references to the project have been made in the Western Electrician during the last three years. The plans have been changed from time to time. A comparatively recent outline of them was given by the London correspondent of the Western Electrician under date of December 19, 1906, and published in the issue of this journal for January 5th last, page 27. But Mr. Ralph D. Mershon, Room 2504, 60 Wall Street, New York, has been retained as consulting engineer by the Victoria Falls Power Company, and no doubt he can give full and late information on the subject.

In relation to the Rio de Janeiro project, possibly Mr. W. J. Clark, manager of the foreign department of the General Electric Company, 44 Broad Street, New York city, can give some information.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XIV.—Motor-starting Devices.

Controllers.

For almost all direct-current variable-speed motor work some kind of controller is necessary. These controllers are made in both manually operated and automatically operated forms. The hand-operated forms are used, as a rule, for all kinds of motor-driven machine tools, cranes, hoists, etc., while the automatic controllers are required for electric elevators, mill rolls, and other work involving large amounts of current.

The hand-operated controller is usually similar in its mechanical form to the well-known electric-railway car controller, and consists of a row of contact fingers, to which the terminals from the armature, field and resistances are connected. These contact fingers rest against a cylindrical drum having contact pieces, so that as the drum is revolved different combinations of the terminals leading into the controller are made.

A reversing switch is generally used in connection with these controllers, so that motors can be operated in either direction. In order to reverse the direction of rotation of the motors, it is necessary either to change the direction of the current through the armature, or through the fields, and this reversal in the controllers is made by reversing the connection of either the field terminals or the brush terminals.

Two other devices are also found in direct-current controllers—magnet blow-out coils and arc shields. The arc shields are simply pieces of incombustible insulating material in the form of partitions which extend between the different contacts so as to prevent an arc jumping from one contact to another. Magnetic blow-outs consist of electromagnets. There is repulsive action between an arc and a magnetic field similar to the repulsion between two similar poles of magnets, and when the magnetic field is directed against an arc it tends to blow it out.

Where considerable variation of speed is required in motor driving, the variation is obtained either by varying the field resistance of the motor, by inserting resistances in the armature circuit, or by a combination of both of these methods, and the function of the controller is to perform either or both of these operations, and to alter the connections of the circuit in such a way that as the controller handle advances step by step the speed of the motor increases by a definite amount.

The controller used on street railways has still another function. Railway motors are almost always used in pairs upon a car, and when two motors, or multiples of two, are used, what is known as the series-parallel control becomes available. In this type of controller the two motors are first connected in series, which gives only one-half of the line voltage to each motor, which causes it to revolve at practically half speed. For the highest speed the two motors are connected in multiple, each taking the full line voltage. Between the starting and half speed, and between the half-speed and full-speed positions, various resistances are inserted, some of which are cut out at every succeeding notch of the controller, so that the acceleration from starting to full speed is gradual and approximately even, instead of by violent jumps, which would occur, for example, by passing directly from half-speed to full-speed position.

The design of the resistances used with motors is quite different in the case of starting resistances and running resistances. The former can be made comparatively small, as they are only designed to be used for comparatively few seconds, while in the case of armature resistances, they must be made of sufficient carrying capacity to carry the current for which they were designed continuously, without undue heating. For this reason it is also necessary that the latter be given the maximum radiating surface. According to the way the resistances are designed, the corresponding notches on the controller are designated as running notches, or as starting and intermediate notches.

Controllers may be placed in any location where it is desirable for the operator to handle them, without reference to the location of the motor. Frequently it is desirable to operate the handle of a controller at some distance from the point where the controller itself is located. This is generally alluded to as mechanical remote control, and is effected by removing the controller handle and ratchet to any point desired, and making the connection between them and the controller by means of gears and shafts. In this way controller handles are often mounted on the tool carriages of lathes, and are connected to the controller through a splined shaft and bevel gears.

Automatic controllers are entirely different in construction and method of operation to the hand-operated controllers described above. Automatic controllers are desirable when very large motors are used, which require a very heavy current. In such cases the contacts of the hand-operated controllers would have to be made extremely large and heavy to carry the amount of current required, and as the amount of current grows larger, the proportions of the hand controller become too large and unwieldy for manual operation. The automatic type of controller then becomes necessary, and each of the contacts which were made within the drum type of controller are in the automatic type represented by a complete switch, frequently termed a unit switch, which is operated by means of an electromagnet.

The connections of the automatic type of control are sometimes extremely complicated; but the general principle upon which such switches operate may be briefly explained here. Each switch, corresponding to each contact of the hand controller, is operated by an electromagnet, by means of which it is closed and opened. An attachment is provided which may be adjusted to open and close the electromagnetic switch when more than the predetermined maximum amount of current for which it is set passes through it. The whole group of unit switches is controlled from a small switch, sometimes known as the master switch. When this switch is moved by the operator the starting current is first thrown onto the motor, and when this current reaches the definite amount for which the switch is set, the next switch is closed automatically by means of its magnetic device, and so on; each of the unit switches is successively automatically operated, each one closing when the current passing through the previous switch reaches its predetermined amount.

In a controller of this kind, therefore, the single operation of moving the first switch causes the motor to start and to gradually accelerate until full speed is reached. In practice, where this system is used, the starting switch which the operator manipulates is a very small controller with notches upon it corresponding to each of the different running speeds, and also notches corresponding to reverse speeds of the motor. In manipulating this, all that is necessary for the operator to do is to bring his controller handle at one movement to any notch giving the desired speed, and the automatic mechanism starts the motor and it accelerates entirely automatically up to a speed corresponding to the position of the controller handle.

This method of control is also used for operating motors in multiple upon electric-railway cars. In one of these systems the individual switches are operated electrically by means of magnets, and in the other they are operated by compressed air from the air-brake system, the action of the compressed air being in turn controlled by the action of electromagnets. By means of these automatic controllers, any predetermined cycle of operations can be repeated an indefinite number of times, and nothing is required of the operator except to stop and start the machine by the simple motion of a handle.

For operating variable-speed induction motors a controller is generally used which is very similar to the type of controller used with direct-current motors. The variation in speed of the alternating-current induction motors is secured by inserting variable resistances in the secondary or rotor circuits, and these motors have a definite speed and torque for any particular amount of resistance introduced in the secondary circuit. Where these resistances are inserted in the circuit of motors operating continuously, they must be proportioned so as to carry full-load current in the same way that the armature resistance for direct-current motors is designed.

The function of the controller for these motors is to cut in or out definite amounts of resistance at each step; also to provide contacts for making and breaking the primary circuit as the motor is stopped and started, and to make other connections for reverse operation of the motor. In general appearance and construction these controllers are very similar to those used for direct-current machines.

Auto-starters.

For starting constant-speed polyphase motors, a type of controller is used which is entirely different from those heretofore described. It is common practice in starting small motors of this kind to throw them directly onto the line by means of an ordinary switch; but this is only practicable for motors up to three or four horsepower in capacity, as this type of motor tends to take an extremely large current when starting under load, which is liable not only to be dangerous to the motor, but which also causes severe fluctuation in the voltage of the line. Where such motors are supplied from central-station circuits to which lamps are connected, such variations of voltage could not be tolerated, on account of their interference with the lighting service, so some means must be provided by which a reduced voltage is applied to the motor at starting. This starting voltage is then gradually increased, until the motor carries full line voltage, so that no excessive current is drawn from the line in starting.

The controller used in this case is termed an auto-starter, and consists of a specially designed switch, to which are connected two auto-transformers. The auto-transformers are connected to the supply circuit, and they consist of a transformer or induction coil with a single winding, from which a number of taps are brought out. Each of these taps provides a different voltage, and by connecting one or more of them to the motor successively, by means of the auto-starter switch, one or more different voltages may be applied to the motor before it is thrown directly across the line. In the running position of the motor the auto-transformers are entirely disconnected from the circuit, so that the losses due to this apparatus only continue during the period of starting.

The auto-starter switches are made of various designs, according to the number of steps for which they are built, or, in other words, the number of taps from the auto-transformers which they utilize. Frequently only two points are used, one of which supplies just sufficient voltage to the motor to start the load, and the second of which throws the motor on the full line voltage. Such an auto-starter has but one starting position. Auto-starters are also built with various numbers of starting points up to six or eight or more.

Each time the auto-starter handle passes from one notch to the next, the entire circuit of the machine is broken for an instant, which tends to cause considerable burning of the contacts, and for this reason the contacts are closed and opened in a chamber filled with oil. It has been found that heavy currents can be safely and easily broken under oil, which prevents the burning of the contacts, and for this reason the contacts of auto-starters are immersed in oil, as the heavy arcing which would occur by opening the circuits in the air would quickly destroy them.

Some auto-starters of moderate capacities are entirely self-contained, the auto-transformers and the switch being combined in a single case. For larger motors, the auto-transformers and auto-starter switches are mounted separately.

While all of these starting devices may be considered in the nature of auxiliary apparatus, and therefore of secondary importance, it is nevertheless advisable that considerable care be devoted to selecting controllers suitable to the work to be performed. The wide range of speeds and the smooth acceleration which has made the electric motor an essential in many lines of industry are only available by the use of well-designed controlling apparatus.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Radio-telegraph Consolidation Dispute.

Dispute has broken out between the rival radio-telegraph companies over the claim of the United Wireless Company that it had succeeded in merging all the companies interested in wireless telegraphy into one corporation. The Marconi Company of America declares that there has been no merger and that the books will prove that not a single share of stock has been transferred to anyone representing the United Wireless or DeForest companies. In contradiction to this statement, Col. C. C. Wilson, vice-president of the United Wireless Company, says: "We own a controlling interest in the American De Forest Wireless Telegraph Company and in most of the minor subsidiary companies. It is useless for the Marconi people to say we do not own any stock in the company. United Wireless is a

holding company, strictly speaking, and I do not consider a capital of $20,000,000 too great for such an enterprise."

The New Automatic Telephone System at Ironton, Ohio.

The American Automatic Telephone Company of Rochester, N. Y., was incorporated in January, 1906, to manufacture and sell automatic telephone switchboards, with the right to engage in the general manufacture of telephone apparatus, if desired. The company preferred to begin operations with an entirely new automatic system, based upon new principles in the automatic art. The first application was in the Ellis Hospital, Schenectady, N. Y., which was soon followed by a system in the Eastman Kodak Works, Rochester, N. Y. The latest application is the subject of this article, namely, the exchange of the Home Telephone Company, Ironton, Ohio. This exchange is equipped for 400 direct lines and 100 four-party lines, making in all a capacity for 800 customers' stations.

Fig. 1. Switchboard Frame in Two Sections (without Cabinet).

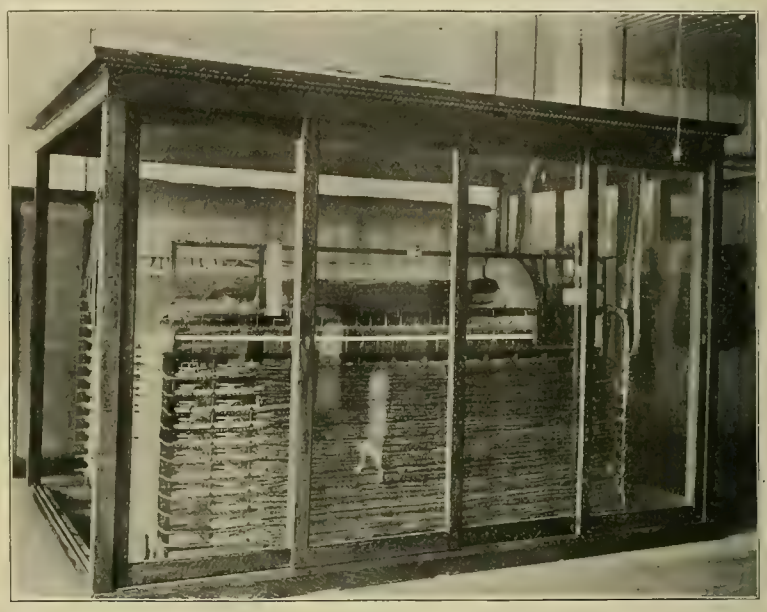


Fig. 2. Switchboard Frame in Cabinet.

A NEW TYPE OF AUTOMATIC TELEPHONE EXCHANGE AT IRONTON, OHIO.

The switchboard frame, of which there are two sections, is shown in Fig. 1 without the encasing cabinet. Fig. 2 shows the switchboard frame with its encasing cabinet. The latter is made of highly polished golden oak, with glass. There is an entrance door at one end of the enclosing cabinet, and the sides are provided with sliding doors, so that the switches and wiring are readily accessible, and are at the same time thoroughly protected against dust. In addition to the dust protection afforded by the cabinet, it should be noted that the construction of the switches and their arrangement in the frame is such that they are self-protected from dust. All contact springs are horizontal, and no contact is exposed to dust settling by gravity.

Fig. 3 shows relay rack, with a polished golden oak glass encasing frame; also the wire chief's desk. Fig. 4 shows power equipment.

In addition to the advantages claimed for automatic over manual systems of secret, uniform, quicker, more reliable and cheaper service, the Rochester company asserts that it is the first to have adopted a central-energy system of automatic exchanges, and in doing so it has developed the system along manual lines in methods of operation as closely as possible, wherever it was desirable, thus making the scheme more readily understandable by manual men, and less difficult to educate attendants.

FIG. 3. RELAY RACK AND WIRE CHIEF'S DESK.

It is also declared that this is the only automatic system using two wires, and making no use of the ground for selective purposes; therefore, there can be no failures from change of earth potential. The two-wire system has also made it possible to develop a simple sub-station selector, there being only one electrical contact, and that with a commutator arrangement similar to a dynamo, except, of course, that there is but one segment on the commutator.

At Ironton the system is provided with Dean harmonic party lines, but any system of selective ringing can be used, and party lines may be equipped with lock-out attachments of simple design, if desired, making secret service possible on party lines as well as on direct lines.

Automatic pay stations may be provided if desired.

Metered service may be provided, where it is desired to operate a service on a metered basis, arranged to register in the central office every call that has been answered. This is done mechanically and electrically, and is not dependent upon an attendant.

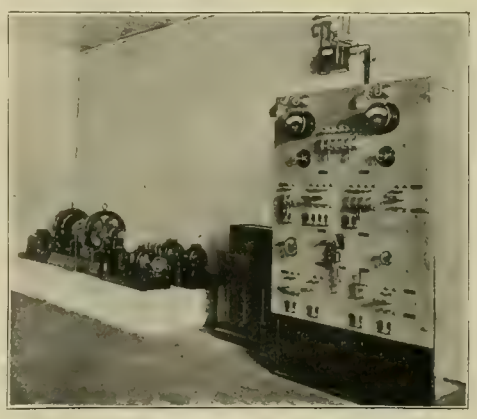


FIG. 4 POWER EQUIPMENT.

Figs. 5 and 6 represent respectively the switch base and bank base, with operating mechanism, consisting of the motor magnet shown at the right of switch base. The release magnet is shown at the left, and a ratchet wheel carries brushes for making connection with the bank contacts. The motor magnet has a spring steel driving pawl attached to the upper extremity of its armature, which engages with the teeth of the ratchet wheel, and serves as the means of moving the wheel forward one step each time the motor magnet is energized. It is possible to drive this wheel forward over its entire course in one-half second, and to stop it with precision while moving at that rate with its brushes resting upon anyone of the bank contacts desired.

Just back of the driving pawl there is another spring steel pawl, which also engages with the teeth of the ratchet wheel. This pawl serves, when the switch is in operation, to retain the ratchet wheel in any position to which it may have been advanced by the driving pawl.

To the armature of the release magnet there is attached a steel release spring, the upper end of which normally rests against the left-hand end of the driving pawl. This spring is provided with a notch just below the point at which it rests against the driving pawl, the arrangement being such that when the release magnet is energized the release spring is moved forward until the notch passes over the end of the driving pawl. Thus when the release magnet is de-energized the release spring draws both the driving pawl and the retaining pawl from engagement with the teeth of the ratchet wheel, allowing the latter to return by its spring tension to its zero position. The first following movement of the motor magnet displaces the release spring, and permits the driving and retaining pawls to again engage the teeth of the driving wheel.

It will be noticed that there are no cords to become entangled. Current is fed to the brushes by the feeder springs attached to the right-hand end of the bridge which supports the shaft of the ratchet wheel. The ends of these feeder springs press upon segments at the lower end of the brushes.

The switches are equipped with male jacks, as shown at the top, and the banks with female jacks, located to coincide with each other. All switches of a given class are interchangeable. It is therefore possible to remove and replace one by another in a second or two. The service is in no way disturbed while the change is being made. This feature is important, because it admits of the adjustment of switches at a convenient testing table, after which they can be placed in the frame with assurance that they are in proper working order. Another good feature of the arrangement of the bank and switch bases is the positive alignment when the switch is inserted in the bank base. The male portion of the switch is provided with a tongue which is A-shaped at its edges, and the female portion of the bank base is provided with V-shaped grooves into which the A-shaped tongue is inserted, making an absolute alignment between the switch and the bank, both horizontally and vertically.

The bank base is of the four-point type, two rows of contacts being for line connections, and two rows for exchange control purposes. This is

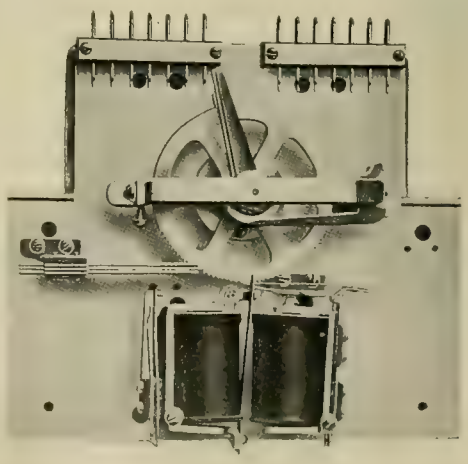


FIG. 5. SWITCH BASE.

the largest bank in use in any exchange. A large percentage of the banks have only three rows and some only one row of contacts.

In practice the brushes of the switch never pass off of the bank contacts. The normal position of these brushes when the switch is at rest is on the first contact of the bank. It is thus possible to adjust the brushes with a firm spring tension against the bank contacts, thereby assuring a more perfect contact than would be possible were the brushes normally out of engagement with the bank contacts, as has heretofore been the practice. For this reason no calls can be missed by a failure of the brushes to properly enter upon the contacts. The switch has but one movement, namely, horizontal.

Tests have been made in which switches have operated over the entire bank of contacts 500,000 times without intermission or failure, and running day and night for that purpose. As 50 steps are necessary to pass the brushes over the entire bank of contacts, it follows that the pawls engaged the teeth of the ratchet wheel 25,000,000 times in this test. At the end of the test the pawls and the ratchet wheel were found to be in good working condition, showing scarcely any wear.

Fig. 7 is a standard central-energy wall telephone equipped with sub-station selector. The only change necessary to convert it into an automatic was to open the line circuit on the rear of back-board, extend the two ends through the back-board, and connect them to the commutator contact of the sub-station selector. This can be done with any style of central-energy wall telephone. Moreover, if it is desired to change an existing manual plant to automatic, it can be done without removing the telephone from the premises and without interruption to the service, except for the brief interval occupied in attaching the sub-station selector, and after the sub-station selector has been attached, the telephone may continue to be used manually until the automatic central-office equipment is installed, at which time it will only be necessary to transfer the lines in the central office from the manual board to the automatic board to complete the automatic service.

Each sub-station set may be supplied with a lamp, if desired, receiving its current from the central office over the telephone wires, lighting the dial as soon as the subscriber removes the receiver from the hook. The light will be sufficient to find the number for making calls, or the numbers in the directory, without first illuminating the room.

To call with this sub-station selector, the receiver of the calling party is first removed from the hook. The pin is then inserted in the hole on the dial of the sub-station selector corresponding to the first

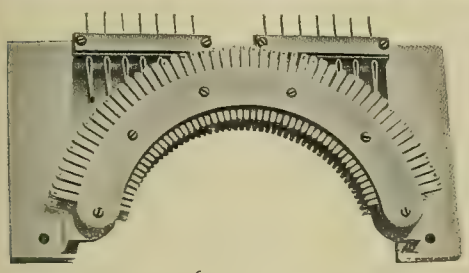


FIG. 6. BANK BASE.

number of the combination desired, and by means thereof the dial is revolved to the right as far as it will go, after which it is allowed to rotate back by its own spring tension to its normal position. The operation is repeated for the second, and all following combinations desired. In rotating backward the mechanism of the sub-station selector opens and closes a single commutator contact a number of times, corresponding to the number of the hole in which the pin had been inserted, thus transmitting its impulses to the switches. With two movements of the dial it is possible to select any of 2,500 subscribers, and with three movements this number may be increased to 125,000 selections.

Hanging the receiver on its hook opens the circuit, releases the switches and restores them to normal. The release being instantaneous, it follows that the calling subscriber is immediately able to make another call. It is, therefore, possible to make calls at a more rapid rate than is the case in a manual system, where the attention of the operator must first be attracted before a disconnection can be made.

It will be noted that the system of numbering is different from any other system, either the present manual or automatic, and is known as the hyphenated-number system, either single or double numbers being transmitted at one time, as desired, and as hereafter described.

When a busy telephone is called, an audible busy test is transmitted to the subscriber. In large exchanges it is practicable to use a phonograph, or telegraphone, to announce the fact when a busy line is called.

As there are less switches than there are telephones, the lines being represented by a line and cut-off relay, exactly the same as in manual practice, instead of a switch, it follows that successive calls rarely pass through the same set of switches; hence, should a subscriber in making a call happen to select a switch which has for some reason failed, it is only necessary for such subscriber to restore his receiver to its hook, remove it again, and repeat the call. In the latter case an entirely new set of switches and circuits will be assigned. The wire chief, however, will have received notice through lamp supervision located on his desk of such defective switch, which can, as above stated, be replaced with a perfect switch in a second or two.

The system herein described is one in which two motions of the dial are used to complete a

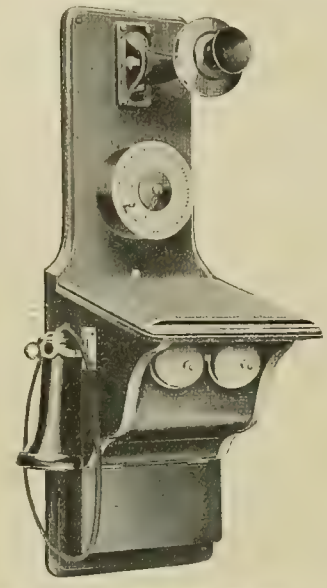


FIG. 7. WALL INSTRUMENT EQUIPPED WITH SUB-STATION SELECTOR.

call. The switches necessary to an exchange based on two motions of the dial are Distributor, B, C, D, X and G switches. When a subscriber removes the receiver from the hook, the talking circuit is closed through the springs of the sub-station selector, or calling device. This operation energizes the line relay, which removes the ground battery from the contact representing the calling subscriber on a row of semi-circular bank contacts.

Above this "busy" row of contacts and swept by wipers mounted on the same shaft are the corresponding rows of "line" and "mate" contacts. Thus, on the banks of a B switch there are three rows of 50 contacts, representing the "line," "mate" and "busy" of 50 subscribers' lines. On the instant that the line relay acts, a distributor switch is started by the forward contact on the line relay springs. This distributor switch in its rotation throws ground on a bank point representing the starter wire of a B switch in the group from which the call is to be made, starting it to sweep its arc of bank contacts. As soon as the wipers have traveled to the point from which the ground has been removed on the "busy" row of contacts, the calling subscriber's line has been found, and, having found the caller, it stops, returning ground battery to the point from which the line relay had removed it. In stopping, the B switch also throws ground on a corresponding point in a fourth row of contacts on the banks of the B switch. This last-mentioned ground contact operates the cut-off relay.

On the same instant that the B switch leaves its normal position in its search for the calling line, the X switch starts to rotate in search of an idle C switch. The B and X switches being in series, then, the subscriber is now connected direct to the line jacks on the C switch, which may call into any one of 50 groups, each group representing 50 subscribers. The above operations are all accomplished in from one to 1½ seconds.

The group to be reached is designated by the first number called on the dial at the calling subscriber's station. The calling device, or sub-station selector, as it has been named, has only two springs. These, with the receiver-hook springs of the common-battery variety, are the only springs in the subscriber's station. The springs in the sub-station selector are normally closed, and are so arranged that the contact is opened and the circuit interrupted when the dial is operated. These interruptions always correspond to the number pulled on the dial, which may be from 1 to 50.

Thus, if 35 be pulled on the dial, the impulses occasioned by opening the circuit 35 times would be taken up by the mechanism and magnets of the C switch, causing it to rotate to the thirty-fifth point on the bank-contact arc. This thirty-fifth point, then, represents a trunk to the thirty-fifth group of 50 subscribers. All the trunks to this group are terminated on the banks of the D switches for this group, and these D switches find the calling trunk in practically the same manner as the B switch found the subscriber's line.

Then comes the simple operation of calling 21 on the dial, and one is connected with the sub-station 35-21 through the G switch, which is the last to rotate. This G switch is equipped with a greater number of relays, and has a more complex circuit for purposes of ringing the called subscriber's bells, detecting busy lines, etc. When a subscriber is done talking he hangs up his receiver, which makes his line test open. This permits certain relays on the switches to make back contacts, which operate to release the call, and restore the switches to normal.

On party lines in this system the group of 50 subscribers is in reality four groups, on the banks of which are represented 50 line circuits. A certain

FIG. 8. DIAL OF SUB-STATION SELECTOR, EXACT SIZE.

number (any that is desired) of G switches is supplied with 16-cycle harmonic ringing current. Then for each of 33, 50 and 66-cycle ringing current the same number of G switches is installed. To the banks of all these G switches all the 50 line circuits are multipled straight through, so that the initial number of the call to any one of these party-line subscribers merely indicates which ringing current is desired on any one of these 50 lines.

Fig. 8 shows the exact size and style of dial numbering. The lines coincide with the holes on dial in Fig. 7. The sub-station selector attached may also be attached to the standard desk telephone.

The Strawberry Valley Tunnel Project.

Some interesting engineering work is being done in connection with the Reclamation Service of the United States government. One of the most recent of these undertakings has been inaugurated near Vernal, Utah, known as the Strawberry Valley project. This project includes the irrigation of several thousand acres of productive soil in the southern part of Utah County. A storage dam having a capacity of about 100,000 acre-feet and reaching a height of 45 feet will be thrown across the Strawberry River. Water from this reservoir will be led through a tunnel more than 3½ miles long to the distributing points, where it will be diverted into canals for irrigating the various ranches.

The construction of this dam will make possible the electrical development of a considerable water-power, and a power house having a capacity of 2,250 kilowatts is contemplated. The power will be used not only for lighting various surrounding small towns but for motor-driven centrifugal irrigating pumps.

A temporary power house will be erected at once at Spanish Fork, some 33 miles from the construction camp, so that electricity will be available for building operations. The electrical equipment will form the nucleus of the plant which will eventually be installed on the Strawberry River.

The electrical equipment for this temporary power plant will be furnished by the General Electric Company, the initial apparatus including two 425-kilowatt three-phase generators direct connected to Leffel waterwheels. The generators will furnish current at a potential of 11,000 volts to step-up transformers, which in turn will raise the voltage to 22,000 for transmission. Switchboard equipment will be provided for both the main station and two sub-stations.

At the sub-stations motor-generator sets will be installed for supplying direct current for hoisting motors and other purposes. The shafts on the motor ends of these sets are extended to take pulleys from which air compressors are belt driven. The compressed air is used for driving rock drills.

The Kenosha (Wis.) Electric Railway Company has increased its capital stock from $150,000 to $1,000,000.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

What Can Be Done in a Village of 1,500 by Real Electrical Enterprise.[1]

By F. H. Place.

In response to your request that I furnish you with an article on the ways and means that I have adopted in the handling of our plant, I will take the liberty to begin with a short history of the company to show that our operating conditions have not been above the average; in fact, they have in most ways been the reverse.

New Bremen is a village in the western part of Ohio, the population of which was given by the 1900 census as 1,345. It has had the usual village growth since that date, and is at the present time about 1,500.

Retrospective.

In 1893 the Village Council entered into a contract with a manufacturing concern whereby the latter was to install for the village a small street-lighting plant, to be paid for when it was in good running condition. In lieu of a bond to protect the installing company it was given a franchise. This was supposed to be merely a matter of form, and was very carelessly drawn, with the result that some important matters were overlooked, namely, the right of the grantee to dispose of the franchise so acquired, and the life of the franchise. These two points have been a bone of contention ever since, and for the last two years (nearly) the town has been trying in the courts to oust the present owners of the rights so granted from the streets of the village.

The feeling has at times been very bitter on both sides, especially as the street lights have been shut off, the town refusing to pay for the service, even though the company was willing to continue at the old rate without a contract until the suit had been settled.

Efforts have even been made to boycott the company and compel it to come to the town's terms.

However, to go back. Before the new plant was ready to operate a new council was elected, and as its views did not run parallel to those of the old council it refused to complete the contract, which was sold to private owners together with the questionable franchise.

These purchasers installed another engine, and, with variable results, operated it until 1899, when the present New Bremen Electric Light Company was incorporated and took over the plant and all its rights.

Two months later the plant was destroyed by fire, but was at once rebuilt and the service renewed.

In October of the same year the station was again wrecked, this time by a runaway engine, and it was at this time that the writer became interested and took active charge of the company.

At this time the gross earnings of the plant were about $2,800 per annum, of which $1,300 was derived from the commercial earnings.

The first move was to install a generating set of 1,500 lights capacity.

On May 1, 1900, a five-year contract was secured from the village at an increase over the old price, and active efforts began in earnest.

In 1904 the village installed a municipal waterworks plant, and finding that it was rather more expensive to operate than they had been led to believe, the village "dads" began to figure how much they could save the poor taxpayer if they could only annex the street-lighting service.

The company at once took notice.

We realized that the chances were good to lose the street contract at its expiration; also that we were not then prepared to stand the shock. We kept our nerve, though, and at once prepared to start a day service and go after power load. Every energy was devoted to the solicitation of new commercial service and a large new generating set was installed.

In the fall of the same year a dynamo was installed in a local sawmill which contracted to run every evening during our peak, so that we would be able to carry our new commercial load and still complete the town contract to the letter.

True to our expectations, the town authorities refused to renew their contract, though they had discovered that owing to legal and financial causes they were unable to carry out their pet plan. They ordered us to vacate, and when we refused to pay any attention to their notice they started ouster proceedings.

Our company at once cut off their service and lost a $2,000 per year customer, which was at the time somewhat over one-fourth of the total earnings. Immediately and in the face of the discouraging prospect we installed still additional power and began the most strenuous period of our corporate existence.

Within nine months we had not only replaced the lost earnings, but more besides, so that at the annual meeting of that year we were able to report to the stockholders an increase in the gross earnings over the previous year of 7 per cent.

At the present we have slacked up in our gait temporarily, but we can well afford to take it easy this year, for our earnings are at the present time at a rate that will carry us well over $11,500 for the year. This is at the rate of about $8.50 per year for each man, woman and child in the incorporated limits of New Bremen.

Operating Conditions.

Our station location is central to the load, but we are cramped for room.

Motive power is gas engines, aggregating 325 horsepower.

Dynamos are belt driven, each set independently driven, with five sets in parallel. Capacity is 240 kilowatts.

Distribution is 125 volts, two wire, for lighting, and 550-volt for power and long-distance lighting.

Our current costs to deliver about 3¼ cents per kilowatt.

Lamps of all sizes installed (incandescent), about 7,000; motors, all sizes, about 90 horsepower; arc lamps, 42.

Competition.

(1) Natural gas at 25 cents per thousand.—The gas company makes us pay 35 cents for the gas that we use as a reward for our success in putting them out of the lighting business. Gas was formerly largely used for lighting, but now there are not over 50 or 60 jets in service.

(2) Gasoline plants.—There have been four of these installed in the town at various times, but we have eliminated them all. In two cases the machines were so defective as to help us in the good work, and our favorable long-hour rates finished them. The other two we purchased outright, getting thereby two good contracts and afterward shipping the disturbing apparatus out of our territory.

(3) Isolated plants.—Three of these had been installed before we began our 24-hour service, but now there is only one left, and it is in a factory whose load is not very tempting. The other two we purchased and used the generators for motors. A day service did away with any probability of any more being installed.

Service.

By all means run 24 hours per day or shut down. Any town that is able to maintain an electric-light plant will stand for a 24-hour service if the management has any life about it. It may not pay the additional running cost in cash, but there will be a return in good will from your old customers that will more than make up the deficiency, and one year is ample time in which to put the proposition on to a paying basis.

I closed contracts aggregating over $1,000 per annum on the strength of a day service, this before we ever put in the switches. All of it was not new load, but over 50 per cent. of it was.

One 10-horsepower motor and 25 fans represented the power factor, and right here let me say that if you do not intend to dig up motor load you had better not think about a day service, for the two must go together, at least in any town under 5,000. Also remember that such load won't come to you if you don't go after it.

Most power customers are already provided for in some way or other, and the average man is very prone to leave well enough alone, at least when it takes dollars to change.

Don't you lose any sleep over gas engines, for a man who has fussed and spluttered over a balky gas engine is about as near pie for a motor solicitor as you can get. We put seven such out of service within 90 days, trading motors for the offenders and afterward disposing of the engines as we could pick up a customer who stood no possible chance of ever being reached with our service.

Another thing that is not nearly as necessary in a small place as in a large place is regulation. Our experience is that customers will stand for pretty violent fluctuations and say nothing about it, providing you come right back to the standard; but if you let your voltage fall off, say five volts, and stay there, then I pray to be away from the telephone and also from the desk on pay-day.

We aim to carry a margin at all times of 10 volts. That is, with a service pressure of 125 volts we burn lamps of 115 volts. Then we clear out all dim and smoked lamps at least every 90 days, and the meter reader keeps his eyes open for such between times. Also we never refuse a customer a new lamp when he presents one that he thinks is not as bright as it ought to be. As a result we have very few complaints from either the quality of the service or the size of the bill, although we will admit that our meters will read high per lamp-hour of consumption.

Rates.

Our rates are somewhat peculiar in that they do not discriminate against the small customer and yet favor the long-hour party:

	Per K. W.-Hr. Cents.
All load connected used ¼ hour per day per month	20
Excess to ½ hour	10
All load connected used ½ hour per day per month	15
Excess to 1 hour	9
All load connected used 1 hour per day per month	12
Excess to 2 hours	6
All load connected used 2 hours per day per month	9
Excess to 3 hours	3¾
All load connected used 3 hours per day per month	7¼
Excess to 4 hours	3¼
All load connected used 4 hours per day per month	6¼
Excess to 5 hours	2½
All load connected used 5 hours per day per month	5½
Excess to 6 hours	1½
All load connected used 6 hours per day per month	4¾
Excess to 7 hours	1¼
All load connected used 7 hours per day per month	4¼
Excess to 8 hours	1¼
All load connected used 8 hours per day per month	3⅞
Excess to 9 hours	1¼
All load connected used 9 hours per day per month	3 2-3
Excess to 10 hours	1¼
All load connected used 10 hours per day per month	3 1-3
Excess to total	3

This rate carries no minimum or meter rental, and on this service we will supply anything that a customer may ask for that is in our line.

For residences we consider two kilowatt-hours as being the amount equivalent to a one-hour-day-month demand for each living room; while for bedrooms one is taken, and for all other rooms, halls, porches or out-buildings, one-half.

For stores and other business places, halls, etc., we take the actual maximum demand, as shown by a portable wattmeter. For churches we take one-fourth the actual maximum demand. Motors are taken the same as stores. On this rate we find that we average about seven cents per kilowatt-hour.

In connection with this rate we get our rental for free installations by adding 0.25 to the lighting constant for each $1 that we have actually invested on the premises in material or labor. For instance, supposing a residence of seven rooms—kitchen, dining room, library, parlor, three bedrooms, porch and hall—the lighting constant would be 12, and 12 kilowatts would in that case be charged at 12 cents per kilowatt. In case the wiring had been installed at our expense at a cost of, say, $20, then five would be added to this figure, making the constant 17, and the cost of the 12 kilowatts as before would be 8½ at 15 cents and 3½ at 9 cents, which would return us a rental of 15 cents in this case.

Our rental returns under this method will amount to about one cent per month per dollar invested, but will change from month to month as the consumption changes.

In order to grasp this part more comprehensively the reader must bear in mind that we are ready to furnish, on rental as above, wiring, fixtures, utensils, heaters, fans, motors and any equipment that the use of our service may require. We have at the present time about $5,000 invested in this manner alone.

This will be understood better as the reader proceeds.

Wiring.

The former owners of the plant seemed to think that they were running a supply business with their station as a side issue. My ideas were the opposite, and the first thing that I did after coming into control was to eliminate all profit from the supply end of the business, making it subsidiary to the lighting business.

Lamps are sold to our flat-rate customers at the actual cost and furnished free to our meter customers.

Wiring, when charged for at all, is installed at the actual cost of the material used, and the labor of installing is donated to the prospective lighting or power customer. However, fully three-fifths of the wiring installations in the town have been placed absolutely free of cost to the customer. A regular memorandum contract (see copy at end of this article) is entered into, and such contracts are filed and the cost of the installation is charged over to the plant extension and development account.

I am thoroughly satisfied from my personal experience that given five prospective users of electric current, four will be willing to use and pay for the service providing the installing cost is removed, while only one of the five would use it and pay for the installing. Besides, I have proved to my satisfaction that this one will also usually waive the free installation and pay for it anyway, so that we simply get five customers in place of one and get a fair return on the money invested in the enterprise besides.

This free wiring unlimited has been our best producer of results of all the many plans that we have tried. It is especially attractive to the renter, as the landlords in small towns are not in the habit of installing the modern conveniences, usually leaving the tenant to suit himself in the matter, with the result that they are not installed.

Motors.

We both rent and sell motors, as the customer may desire; if the latter plan is adopted at actual cost and the installing is assumed by the company,

1. The interesting and in some respects remarkable account given in this article is presented herewith by Mr. Place at the request of the editor of the Western Electrician. The title given is that of the editor and not of the author. Mr. Place is general manager of the New Bremen (O.) Electric Light Company. His straightforward recital is most instructive, highly creditable to himself and should be an inspiration to the average manager of a small plant. Ed. W. E.

the expense is charged to the operating expense account.

If a prospective customer has an engine or other machinery which a motor installation will render unnecessary, we take it off his hands at as favorable a figure as possible, afterward disposing of it somewhere outside of our field. We have found that this need not be done at a loss, as we have been able to make a small profit on such trades, but even if there was a small loss it would pay in the end anyway, for the more dependent people are on your service the easier it is to get along with them.

We have several installations where the entire equipment, motors, shafting, pulleys, belts, etc., are the property of our company.

The man placed in charge of this class of installation work should be not only a keen business getter for the company but also a first-class and original mechanic who will be able to adapt his company's service to all kinds of uses that will be presented, and at the same time be able to keep the principal object in view, viz., all-round economy for both the company and the user.

We guarantee all motors that are furnished by us indefinitely, whether we sell or rent, and will undertake to keep them in repair against any mishap unless from gross carelessness or abuse.

We protect all motors with sealed fuses, automatic starting boxes, and all large motors with breakers. In case the fuse is blown, our trouble man at once responds to the call and replaces the fuse, at the same time investigating as to the cause of the blow-out.

All motors, large and small, are cleaned up and looked over once every month.

Practically all motors are protected with kicking coils and lightning arresters, this latter precaution of course not being applied to the numerous fractional horsepower motors installed.

All heavy loads and those at quite a distance from the plant are placed on the 550-volt power-service mains, while other loads are placed on the lighting mains.

We do practically all of our own repairing.

Our day service was started with a 10-horsepower motor and 25 fans, together with such lighting customers as we had at that time on meter, using a 20-horsepower gas engine as motive power to drive a 7½-kilowatt 550-volt generator and a five-kilowatt 125-volt generator.

These machines were soon inadequate, and today our 550-volt circuit-breaker is set to kick out at 75 amperes, while a 40-kilowatt machine is running on the 125-volt service.

Among other loads that we are driving may be mentioned four dairy farms, two slaughter houses, a large creamery, coffee grinders, churns, cream separators, washing machines, sewing machines, etc.

We are driving the first milking machine installed in the state, milking 50 cows twice a day and doing the work of three men at a cost to the farm proprietor of about $6 a month.

Our experience with fans as renting material is not favorable, and while we will so furnish them, we do not push that item except to make use of a fan now and then as a lever to get our lighting service into the premises when we are sure that it will not come out again, fan or no fan.

General Lighting.

We as yet maintain two distinct services—a 24-hour metered and a sundown-to-sunrise flat rate. This last we are eliminating as rapidly as possible by educating the people up to the new standard. We have decided that we can effect the change from flat rate to meter with the least possible friction by this method. The only service that we furnish on the flat rate is lighting, and only to small customers. Any customer who desires to have any of the little conveniences that are possible with our service must take them through the meter.

As to arc lamps, we furnish these rent free and maintain them, having to date 42 in service on our commercial lines.

We have about 800 small lamps in sign work, but are not favorably impressed with the result. Merchants in small towns cannot afford to make a free enough use of them to render them profitable to a lighting company, and they will usually only light them on special occasions and during the holidays, when the average company would prefer the capacity to the returns.

We carry a trouble man until 9:30 p. m. and aim to attend to all service troubles at once. Right here is where many companies, large and small, are weak. Promptness or slackness in this item will go far toward making or breaking the largest company that ever operated. Many a prospective customer has ordered service and afterward changed his mind before the operating company found time to comply with the request.

Our aim has been not to give them time to change their minds, for any ordinary application will be met within 24 hours, and a large customer as quickly : . the wires can be run into the premises.

Heating Utensils.

With flat irons we have had excellent results. These we loan on rental, and now have over 50 in service. We find that they are used steadily about five months in the year and occasionally during the other seven; also that they will not only pay their first cost in additional returns within the first year, but they are first-class inducements to get new lighting customers.

As to repairs, the first year we put out 12 irons on a flat rate of $9 per year, and on this basis we lost 10 irons out of the 12 from burnouts.

Last year we canceled all flat-rate service on this class, and with 50 irons in use only had two burnouts.

Of air heaters we have installed some small ones where the space was small and the use required was intermittent, but we cannot at present hope to compete with natural gas at 25 cents per thousand.

We will, however, keep posted, and when the time comes we shall certainly take hold of the heating business.

Soliciting.

The writer has done most of this himself, but some business has been brought in by his assistants. Also some has been secured through the assistance of old customers. We offer a standing commission for all new customers, no matter who gets them, equal to the returns for the first month's service. If a customer comes in without being solicited he gets the commission himself.

We have paid two commissions for one customer, and while it is not the intention to follow this precedent, we much prefer the customer even at that price.

Newspaper advertising we do not place much faith in, as weeklies are too far apart between issues to be instructive. We have sent out some circulars and find that some returns can be traced to these, especially as to seasonable utensils, but a good personal conversation is worth $10 as against a circular being worth one cent.

Personal soliciting is much easier in a small place than in a city.

Country Lines.

Following the lead of the telephone companies, we have been experimenting with rural lines in our line of work.

For this purpose we have extended our 550-volt service on No. 8 and No. 10 bare copper wires, wiring for lights and small motors, all on meter at the same rates as applied in town and on the same conditions.

In lighting we wire two 250-volt lamps in series, controlling each such series with a switch, using porcelain sockets, keyless, not over one ampere on a circuit, all fuses outside the building, in the meter box, together with the service switch. Each of these installations is protected against line troubles by kicking coils and lightning arresters. As to motors, the same conditions apply as in town.

We have these lines out in three directions, in all about six miles of lines, and find that, after deducting the cost of all current delivered to them, they have paid us a profit on the installing cost of better than 40 per cent.

Does It Pay?

Our capitalization is $15,000, all paid in, with no bonds, and all our additional investments have been made out of the earnings, besides we have paid 33 per cent. in dividends in seven years. Here are the figures of earnings:

	Gross Earnings.	Net Earnings.
1899	$2,800.00	.....
1900	3,800.00	$1,500.00
1901	4,300.00	1,700.00
1902	5,400.00	1,900.00
1903	6,500.00	2,100.00
1904	7,500.00	2,300.00
1905	8,300.00	2,800.00
1906	9,000.00	3,100.00
1907 (estimated)	11,500.00	4,500.00

Dreams.

Before the ink is dry on a final settlement of our troubles with the town we will have broken ground for a new power station which will have a capacity of over 1,000 horsepower, using gas engines and producer gas. Current will be generated at 6,600 volts, two-phase, and distributed by means of single-phase circuits to the entire country population within a radius of 10 or 12 miles, the mains running to the centers of distribution being two-phase.

Within this area will come four towns, ranging in population from 400 to 1,500, one of which is now operating a municipal station and failing most signally in making it a paying proposition. As a sample for comparison that town is a trifle larger than our own, yet we earn more with our station in three months than they do in the entire year. We give a 24-hour service, and they only a night service, while our rates average two cents per kilowatt lower than theirs.

In our new plans the lighting item will become secondary and the power item first, for we intend to eliminate the engine from our field entirely, be it steam, gas or gasoline, traction, portable or stationary, nor will we be satisfied until the last steam whistle shall have ceased to disturb the country quiet.

Already have our rural customers used our power to thresh their grain, cut their fodder, fill their silos, husk their corn, grind their feed, pump their water, saw their wood, milk their cows, skim their milk, churn their butter and do their washing, to say nothing of lighting their houses and barns, and as yet we have but plowed one furrow about a large field from which we hope to reap a rich harvest.

Memorandum of Agreement

between The New Bremen Electric Light Company and .....New Bremen, Ohio, ...190.. I herewith extend to The New Bremen Electric Light Company the right to place their wires and other appurtenances for electric lighting in my property on.....Street, New Bremen, Ohio.

It is mutually undersood that all wires, etc., placed under this agreement shall in all ways be satisfactory to the insurance inspectors and be carefully and neatly installed.

It is also understood and same is hereby acknowledged that the ownership of such wire and all other material so placed remains in the possession of The New Bremen Electric Light Company, and that they may at their own discretion remove same from the building except that the owner or agent may, if desired, purchase at any time such wires and material in the building for the sum of .....for each outlet wired under this agreement.

The New Bremen Electric Light Co.

Owner or Agent..... Per .....

New-Business Notes.

Wherever metal working is an industry, electricity has proved a valuable assistant. Metals which never before could be successfully welded together are now completely and quickly united by electrical heat. Many trades are profiting by this knowledge, especially jewelers and dentists.

Clipping horses by electricity is not a new method, but not generally used yet. The clipper is operated in any position at a constant speed. By its great saving, in time alone, it should easily pay for itself. It is safe to say that the horses like it as much as the operator—it saves wear and tear on both.

The electric foot warmer is a close relative of the electric heating pad, which takes the place of the hot-water bag. This little foot-warmer requires but a small quantity of current, and can be placed anywhere, attached to the lighting circuit by a plug. It is especially useful under a desk or anywhere when one is likely to be seated for some time, and the weather is chilly.

If the very unromantic but efficient electric machine for milking cows lately put into practice becomes popular, no more sonnets can be indited to the buxom milkmaid, for she will cease to exist. This apparatus is operated by an electric motor, and Bossy may kick and switch her tail all she pleases, without doing any damage, because the new milker fills an unupsetable covered pail.—Bulletin of the New York Edison Company.

It is the opinion of officials of the Oregon Trust and Savings Bank of Portland, Ore., that for purposes of publicity, the electric sign is an unqualified success. Mr. George Estes, assistant cashier of the bank, writes to the editor of Public Service, saying that a great amount of attention is attracted and comment created by the startling effect of a huge sign recently installed by the bank, and after sufficient trial to test its merits as an advertising medium, he pronounces it an unqualified success for the purpose of bank publicity. The sign bears the words, "We pay 4%," which has become the slogan of the bank. The words are flashed on and off every five seconds. A border gives the impression of two wriggling serpents of light pursuing each other around the words.

Most people are familiar with three principal uses of electricity, viz., for lighting, heating, and power purposes. The following applications of electric energy are, however, more or less outside of the ordinary, although more firms and individuals are adopting them every day: Electroplating; electrotyping; automobile battery charging; electric welding of metals; electric furnaces, dental; electric furnaces, laboratory; electric branding irons, meat; electric branding irons, boxes, etc.; electric soldering irons, for every service; electric flatirons, common; electric laundry irons, special; electrically heated laundry rolls; electric silk hat irons, etc.; electric embossing press heaters; electric glue pots; electric sealing-wax heaters; electric vulcanizer for rubber tires; electric massage and vibratory appliances; electric cigar-lighters; electro-therapeutic current devices, and light rays; electric sterilizers for surgical instruments; electric cauteries; electric (ozone) water purifiers; electric time stamps; electric lifting magnets; electric ore separators; electric thawing of frozen pipes; magnetic chuck for lathes; electric curling-iron and grease paint heaters, for theaters; magnetic "Old Man" machine shops, and construction work; magnetic dental hammers; electromagnet for oculists, for removing metal splinters from the eye; magnetic flux coil for producing partial anesthesia.—Electric City, Chicago.

Insurance men report that electrical conditions in Mobile, Ala., are not up to the highest regulation possible on account of inadequate municipal control, but a disposition toward better conditions is shown. The maintenance of the fire-alarm system is characterized as having been lax, and in general the fire department needs men.

Rapid Construction of Pittsburg Electrical Warehouse, With Adventures by Flood.

For several years past the Western Electric Company of Chicago has maintained a sales office in Pittsburg for operation along Western Pennsylvania and West Virginia. The growth of the business in this part of the country has been steady and the demand for a supply stock at this point became imperative, hence the company's decision to make Pittsburg one of its distributing centers.

A plot of ground of 25,000 square feet on the Allegheny side of the river was purchased last fall and a five-story warehouse and office building has been erected thereon. The building is of the mill type of construction and is equipped with electric elevator service, automatic sprinklers and heated by natural gas. The company has a private siding from the Baltimore and Ohio Railroad running into

TENT ROOF TO FACILITATE RAPID CONSTRUCTION OF PITTSBURG ELECTRICAL WAREHOUSE.

the premises, and the location is an admirable one, it being but six minutes' ride from the heart of the business district and within a few blocks of the principal freight and express terminals. A large and complete line of electric and telephone supplies for immediate shipment will be carried.

The building was erected with remarkable speed and novel methods were employed. For various reasons it was imperative that the building should be ready for occupancy in three months. Possession of the property was not obtained until October 5, 1906, but in the meantime plans for the building had been drafted under the direction of the plant engineer, and a contract signed with Chicago builders, so that by October 7th the work of razing the old buildings was begun. Work was then pushed day and night, a considerable part of the time three

WOREMAN ESCAPING FROM PITTSBURG ELECTRICAL WAREHOUSE OVER THE ICE DURING FLOOD.

shifts of eight hours each being employed, the night work being made possible by artificial light.

On November 22d a large circus tent 130 by 100 feet was raised, and from that time work was continued without interruption on account of weather, the tent being moved up from story to story until the roof was completed. The roof was on and the building enclosed by January 1, 1907, and the moving of the stock from the Shadyside plant was begun. This consumed a period of 30 days, by the end of which time the interior work on the building had been practically completed, so that it was possible to move the offices on February 1st.

The erection of this building attracted much local

NEW PITTSBURG ELECTRICAL WAREHOUSE IN TIME OF FLOOD.

attention in Pittsburg, as it set a new mark in the building records of that city.

A description of the new Pittsburg house at this time would be incomplete without reference to the flood which visited the city between March 13th and 17th. The location of the warehouse, so close to the Allegheny River, placed it inside the bounds of the flooded district, which covered an area of many square miles. The site of the building is, however, at an elevation relatively higher than any other property fronting on the Allegheny, and in designing the building the river's past record for floods was studied carefully. In order to avoid possible damage from that source no cellar was built, and the first floor, which is of concrete, was raised to a point one foot above the high-water

NEW ELECTRICAL WAREHOUSE IN PITTSBURG.

record of the last 50 years, a precaution which seemed to them to preclude the possibility of a flood ever reaching the floor. But the Allegheny, swollen by spring freshets, broke its bounds, and inside of 36 hours showed a rise at Pittsburg of approximately 28 feet.

In common with other business houses within a radius of three blocks of the river the Western Electric Building was surrounded by water early on March 14th, so that it was necessary to pass to and from the building in a wagon. Shipments were made up to that afternoon, by which time the water had reached a depth of over four feet around the building, and prevented the exodus of those employes who had remained. At this time the water was still a foot below the first floor, but as the previous high-water mark had been reached and the rise still continued all stock on the first floor which could be injured by water was removed to the floors above. The carpenters in the shop were then pressed into service to build a boat, by means of which the remaining employes were carried out in safety, a distance of two blocks to the dry land, and a force of men was located in the building for the night. This home-made boat, which was constructed in less than an hour, was made watertight by the use of juste and "W. E." compound, and was appropriately christened the "Carrie Mohr" by the breaking of a bottle of transmitter disinfectant on her bow.

The water continued to rise on the night of the 14th, and at midnight reached a point 20 inches above the first floor level. This was equivalent to a mark of 36.2 feet on the government scale, upon which eight feet is the normal mark. This height had never before been reached, and the damage to property in Pittsburg has been estimated at as high as $50,000,000. On the morning of March 15th the flood dropped rapidly, so that with the aid of fire hose it was but short work to clean the first floor in the building and the cable yard, which is also elevated above the street and property adjoining.

The flood brought down a considerable quantity of ice, as is clearly shown in one of the accompanying pictures.

Business was resumed with a loss of less than a day's time and long before the majority of business houses affected were able to recover. The property suffered no damage except for a slight settling of the concrete floor in several spots; neither was there any considerable damage to the stock, a condition most gratifying when it is known that other business houses suffered so extensively. Like the record of the Western Electric house at San Francisco, although in a smaller way, the history of the flood of Pittsburg points signally to the value of the company's highly developed system of plant engineering.

The Weston Portable Multimeter.

The Weston multimeter, illustrated here, is a new form of electrical measuring instrument which possesses a wide range of usefulness in the measurement of electrical quantities. It will quite ac-

WESTON PORTABLE MULTIMETER.

curately serve the purposes of a direct-current voltmeter, milli-voltmeter, ammeter, mil-ammeter, ohmmeter, ground detector and Wheatstone bridge.

When used as a voltmeter, milli-voltmeter, ammeter or mil-ammeter, it is nearly equal in accuracy to any of the corresponding separate Weston portable direct-current instruments and having substantially the same ranges. In fact, the part of the multimeter which is designed to be used for the several purposes mentioned is similar in mechanical and electrical construction to the well-known Weston portable direct-current instruments; but it differs from the regular forms in that a special movable coil is employed in the multimeter, which adapts it to better meet the several requirements of the combination of which the indicating instrument forms a part. But there is no claim, of course, that the apparatus as a whole is equal in all respects to each of the Weston instruments for which it serves as a substitute.

The multimeter consists of a Weston type Wheatstone bridge, a battery of 12 silver chloride cells and an indicating instrument with detachable shunts. The calibrated scale of the instrument has 160 divisions, with the zero placed at 10 divisions from the end, so that when the instrument is used as a galvanometer in connection with the bridge, both positive and negative deflections may be observed. Many novel features are embodied in its construction, and its design is such that compactness and durability are combined with convenience of arrangement, and an exceptionally high insulation resistance.

The instrument is furnished in the following combination of ranges only: Voltmeter, 0.075 volt, 3 volts, 150 volts, 750 volts; ammeter, 0.015 ampere, 1.5 amperes, 15 amperes, 150 amperes; bridge, three dials, measuring to 999 ohms with even ratio arms.

Electric-sign Warfare in Toledo.

There is in Toledo, Ohio, at this time an interesting contest between the Toledo Railways and Light Company and the Toledo Gas, Electric and Heating Company, known as the "gas merger." The former company has heretofore had full control of the street lighting and all the commercial electrical work in Toledo, for it was practicallly without opposition except from the Yaryan Heating and Light Company in the resident sections. The "gas merger" is a consolidation of these smaller plants with the Toledo Gas Light and Coke Company, and since its incorporation there has been an improvement in all the plants. The "gas merger" started out after all the electrical business there was in the city, and immediately had a contest upon its hands.

The Toledo Railways and Light Company purchased a large "talking" sign and installed it on a building at the corner of St. Clair and Adams Street, so that it shone directly into the windows of the Gas, Electric and Heating Company. The sign was used to advertise the Toledo Railways and Light Company's business and one or two mercantile houses. Now the "gas merger" announces that it has bought an immense electric sign to be placed on a building one block farther up

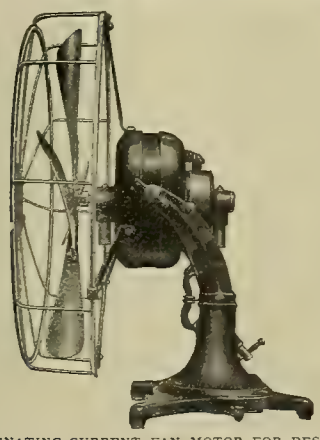
Adams Street, and so located that it will shine into the offices of the Toledo Railways and Light Company. The Huebner-Toledo Brewing Company, the stockholders of which are also heavy owners in the "gas merger," have also erected a large electric sign on Adams Street, which is of such brilliance that it cannot help but share the honors of the Railways and Light sign. It is understood that several more signs are going up in the near future.

Western Electric Alternating-current Fan Motors.

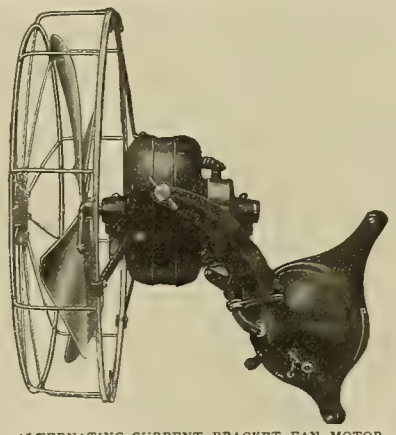
An alternating-current fan motor is now being placed on the market by the Western Electric Company which bids fair to be a great success. Heretofore the principal method of operating fans by alternating current has been by the induction motor. The induction motor, the company points out, has always had one drawback, and that is its uncertainty in starting immediately when the current is turned on. The starting torque is so small that it requires several spasmodic revolutions of the armature before the steady speed is obtained. The Western Electric new alternating-current fan motor has a specially constructed commutator, and the company guarantees this motor to start when the current is turned on, because it does not operate on the induction principle, but in the same way as the regular series direct-current fan motor.

Another advantage of this motor is its "universal" feature, which allows it to be used either as a desk or bracket fan, and the change from one to the other can be made in a minute. The company calls it the "Two-in-One" type, because it really makes one type of fan serve two purposes. An ingenious diagonal joint in the standard makes this change possible, and a glance at the illustrations will make this clear.

All of the working parts of the motor are completely enclosed, so that it is impossible to clog up the machinery with dust or dirt. From a mechanical standpoint the blades are great savers of current, the angles at which they are built following along specially designed lines, thereby furnishing maximum breeze with minimum current consumption.



ALTERNATING-CURRENT FAN MOTOR FOR DESK USE.



ALTERNATING-CURRENT BRACKET FAN MOTOR.

Large Motor-operated Gate Valves.

The electrically operated valve is a mechanical refinement demanded by the size of recent hydraulic and hydro-electric developments where the necessary control of large volumes of water requires valve openings which it would be practically out of the question for the station attendants to operate without the application of power. About 120 miles from the city of Los Angeles, Cal., on the canyon of the Kern River, a new power house just being completed by the Los Angeles Edison Company, is practically ready to supply electric power to the city from 43,000 horsepower in waterpower development. The power plant will be equipped with valves electrically operated by means of eight Allis-Chalmers direct-current motors. They will be used on 28-inch gate valves built by the Risdon Iron and Locomotive Works of San Francisco. These motors are of the vertical type, series-wound, and of four horsepower each.

All-metal Pressed-steel Terminals.

Frank B. Cook of Chicago says that his "all-metal" terminals have several advantages over the terminals which are made partly or entirely of wood. Cook's terminals are constructed entirely of pressed steel, and no castings are used in their construction. This makes the terminals light in weight and exceedingly strong. The chances of breakage are done away with, and there is no woodwork to swell, split, warp or burn up. As the metal boxes or panels in the metal terminals cannot warp, the covers will always slide up and down easily and will not stick in damp weather. All the metal parts of the terminals are heavily galvanized so they cannot rust. The cans or covers are made of sheet steel, which is also heavily galvanized, and the terminals are therefore exceedingly durable.

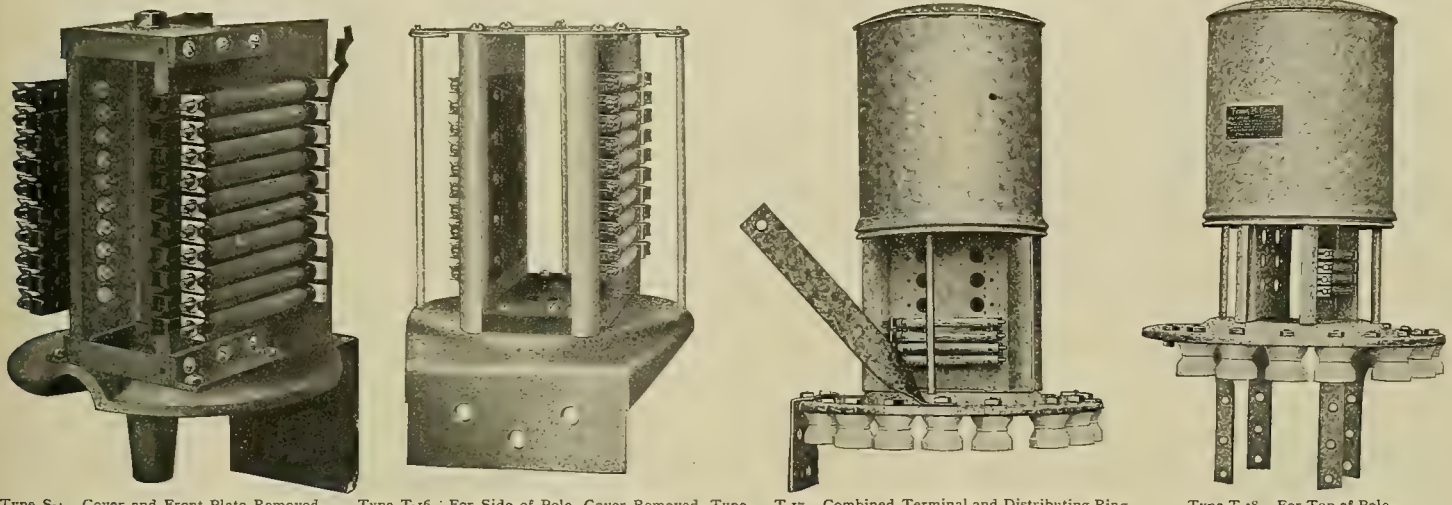
Mr. Cook considers that his type S-4 terminal is the best type on the market. This terminal has the tubular fuses and carbon lightning arresters mounted on a sheet-metal moisture-proof cable box, and the protectors are so arranged that connections are very easy of access. The cable is brought in through the self-soldering nozzle shown in the illustration, and the conductors are fanned out and soldered to the clips inside the moisture-proof cable box, the front plate or cover being removed for this purpose. This terminal is also made so that the cable wires can be brought through a hollow rivet and soldered outside of the box. This makes the cable connections very easy of access at all times.

After the cable wires have been distributed and soldered the front plate may then be fastened on securely, a rubber gasket rendering the joint moisture-proof. The back of the box, inside, is lined with an insulating fiber to prevent the cable wires from grounding on the box. As an additional protection to the cable the plug in the top of the box may be unscrewed and the box filled with paraffine or compound. No pot-head is necessary with this terminal, as the box itself forms a moisture-proof ending for the cable. The jumper wires are soldered to the rear connection, and are led out through holes in the base plate.

The types T-16, T-17 and T-18 are all made for use with pot-heads. As in all Cook types of terminals, they are equipped with special springs that hold the covers in place when they are raised and which also lock them in place when they are down. This makes it unnecessary to hang the cover up on the pole or to have a chain from which the cover dangles while it is off.

These three types of terminals are all equipped with individual protector mounts, which can be put on as needed. Any initial capacity can thus be secured, and the capacity of the terminal can be increased as desired by simply adding protector mounts. These terminals are designed particularly with a view to economy in first costs and are especially recommended for multiple-tap cable work. All the terminals are made for either solder or screw connection.

This method of forcing the fuse contact springs through the hard-rubber blocks, Mr. Cook says, is a radical improvement. The blocks are heated and the springs are forced through, so that when the rubber has cooled again the springs are held absolutely rigid. This construction also prevents any surface leakage on account of moisture collecting on the blocks between the springs. Type T-16 is arranged for fastening to the side of the pole. Types T-17 and T-18 combine the terminal and distributing rings. The protectors can be mounted one pair at a time, and the porcelain knobs can also be added one at a time, as needed. Type T-17 is arranged to fasten to the side of the pole, and type T-18 is for the top.



Type S-4. Cover and Front Plate Removed, Showing Cable Inserted. Type T-16. For Side of Pole, Cover Removed. Type T-17. Combined Terminal and Distributing Ring. Type T-18. For Top of Pole.

COOK'S "ALL-METAL" PRESSED-STEEL TERMINALS.

Wiring Rules in Great Britain.

The Institution of Electrical Engineers has issued a revised edition of its wiring rules. These have been completely revised and constitute the fifth edition, the fourth edition having been published in 1903. Since then representations were made to the Council of the Institution that the next edition should be thoroughly representative, and consequently a standing committee has been appointed which consists of members of the Institution, the fire insurance offices, the Municipal Electrical Association and the Electrical Contractors' Association. This committee is further assisted by the Engineering Standards Committee and the Cable Makers' Association.

The chief alterations in the rules concern flexibles. Pure Para rubber or vulcanized rubber is specified as the insulation, and pure-rubber flexible must be tested for 15 minutes with a pressure of 1,500 volts alternating between the conductors at a frequency of 50 periods. Vulcanized rubber flexible has to undergo the same test after 24 hours immersion in water. Although not expressly stated in the rules, the committee is strongly in favor of pure-rubber flexible for all purposes, but it only recommends it for use with pendants. All conduit must be electrically and mechanically continuous and connected to earth.

The new standard of the Engineering Standards Committee has been adopted for pure copper, superseding Matthiessen's standard.

Cable tests are now specified to withstand 2,000 volts, either between conductors or between conductor and water, for half an hour.

There are a number of other alterations.

The question of flexibles is just now receiving much attention in England. Professor Schwartz of the Manchester University has read a paper before the Institution, in which he, too, recommends the use of pure-rubber flexible for all purposes. His specimens showing the great state of preservation of such flexible after many years' use compared with vulcanized flexible were very striking.

High-voltage Direct-current and Alternating-current Systems for Interurban Railways.[1]

By W. J. Davis, Jr.

The magnitude and direction of engineering development in apparatus for the electrical equipment of high-speed interurban railways is well illustrated by a study of the systems adopted by some of the more important lines recently built or now under construction. These systems may be divided into three classes:

(1) Six hundred-volt direct-current, using either overhead trolley or third rail.

(2) Twelve hundred-volt direct-current, overhead trolley.

(3) Single-phase alternating-current, 3,300 or 6,600-volt, overhead trolley.

As apparatus for the operation of the 1,200-volt direct-current system is now being manufactured in this country only by the General Electric Company, the list of roads given below comprises only those using General Electric equipment, and is limited to sales to new roads made during the last year.

The largest installation undertaken during the last year was that of the West Jersey and Seashore Railroad, comprising equipment for 145 miles of single track, and 35,600 horsepower in railway motors. On account of the limited time required for the completion of this installation (six months from the date of selecting power-house site) it was impossible to furnish apparatus of special type, making the selection of the 600-volt direct-current system obligatory. For this reason the equipment of this road is not included in the following statistics:

	Length of track, miles.	No. of cars.	Size motors.	Total motor H. P.
Six Hundred Volts, Direct Current—				
Texas Traction Company	63	15	4 of 75 h.p.	4,500
Elmira, Corning & Waverly	15	7	4 of 60 h.p.	1,680
Buff., Lockport & Roch.	70	10	4 of 75 h.p.	5,700
Oregon Railway	40	8	4 of 75 h.p.	2,400
	188	49		14,280
Twelve Hundred Volts, Direct Current—				
Cent. Calif. Trac. Co.	16	6	4 of 75 h.p.	1,800
Pitts., Harmony, New Castle & Butler	63	12	4 of 75 h.p.	3,600
Indianapolis & Louisville	41	10	4 of 75 h.p.	3,000
Ind., Colum. & So.	..	3	4 of 75 h.p.	900
San Jose & Santa Clara	9	8	4 of 75 h.p.	2,400
	129	39		11,700
Single-phase, 3,300 or 6,600 Volts—				
Washington, Baltimore & Annapolis	52	25	4 of 125 h.p. / 2 of 125 h.p.	11,500
Cent. Ill. Const. Co.	40	10	4 of 75 h.p.	3,000
Anderson (S. C.) Ry.	35	3	4 of 75 h.p.	900
Rich. & Chesa. Bay	15	4	4 of 125 h.p.	2,000
	142	42		17,400

Total horsepower motors sold, 43,380, of which 600-volt, direct-current, has 33 per cent.; 1,200-volt, direct-current, 27 per cent. and single-phase, alternating-current, 40 per cent.

It is interesting to note that two-thirds of the total motor capacity sold consists of 1,200-volt direct-current and single-phase alternating-current motors, indicating the eagerness of electric-railway builders to take advantage of the reduced cost of construction and equipment, and economies in operation resulting from the use of higher secondary distributing voltages. The magnitude of the possible savings will depend upon the local and service conditions and will vary over a wide range.

Generally speaking, increased voltage at the trolley will be attended with reduction in cost of copper and sub-station apparatus and by increased cost of car equipments due to the inherently heavier and more expensive character of the motors and control systems. Where the car movement is especially frequent, as in case of rapid-transit suburban service in the vicinity of the larger cities, requiring from two to four tracks, the 600-volt direct-current systems will generally prove the cheaper, a result largely due to the lower cost of the motors.

On account of the variable character of the conditions encountered, each problem requires a special investigation before the relative merits of the three systems can be reliably determined, but the following general limitations will be found to hold true:

(1) Street railways and elevated roads in cities should unquestionably be equipped with standard 600-volt direct-current apparatus; (2) suburban lines 10 to 15 miles in length, operating cars on frequent headway, should be equipped with 600-volt direct-current system; (3) for high-speed interurban railways operating cars 50 feet or more over all at speeds of 40 miles an hour or more: (a) The 600-volt direct-current system is the most reliable on account of being most fully developed. (b) The 1,200-volt direct-current system is somewhat cheaper in cost than the 600-volt system, but is as yet an untried system. (c) The single-phase alternating-current system will in most cases show material saving in cost over the direct-current system and has been developed to a point where it may be considered commercially successful and capable of giving satisfaction in operation, if properly proportioned for the service to be performed.

1. A paper read before the Chicago branch of the American Institute of Electrical Engineers, March 26, 1907. The author is a railway engineer of the General Electric Company.

There are certain conditions which render the alternating-current motor system unduly expensive or impracticable, namely, the enforced use of a frequency greater than 30 cycles, the presence of grades greater than eight per cent. or the necessity of obtaining perfectly balanced three-phase load under all conditions. In such cases the 1,200-volt or 600-volt direct-current systems will prove the most economical, preference being given to the latter, although the cost of installation will be greater. The single-phase alternating-current and 1,200-volt direct-current equipments may both be made to operate satisfactorily on standard 600-volt direct-current systems, and assuming equal reliability, the question becomes one of first cost and economy in operation. The following table will show approximately the relative cost of equipping a typical suburban road with the several systems:

Comparative Cost Per Mile, Single Track.

	Direct-current, 600 volts.	Direct-current, 1,200 volts.	Alternating-current, 6,600 volts.
Roadbed complete, including grading, ballasting, etc.	$15,000	$15,000	$15,000
Trolley and feeder installed	3,800	3,000	2,100
Track bonding	600	530	480
Transmission line, installed	1,500	1,500	1,300
Sub-stations, installed	2,200	1,600	600
Power station, installed	2,450	2,450	2,570
Cars and equipment	1,800	1,970	2,300
Telephone	120	120	120
Total	$27,470	$26,170	$24,470
Saving over 600 volts, direct current		1,300	3,000

It is of interest to compare the operating economy of the three systems, eliminating those items which are of equal value in each. The comparison given below is based on coal at $3 per ton, coal consumption 3.5 pounds per kilowatt-hour, sub-station attendance $1,750 per annum, maintenance of car equipments 0.4 cent per car-mile for 600-volt direct current, 0.5 cent for 1,200-volt direct current and 0.6 cent for alternating current, and fixed charges at 10.5 per cent.

Relative Operating Cost Per Mile, Single Track, Per Annum.

Per mile of track, one-hour headway:	Direct current, 600 volts.	Direct current, 1,200 volts.	Alternating current, 6,600 volts.
Car-miles per day	64	64	64
Kilowatt-hours per day at power house	275	275	245
Cost of coal per annum	$470	$470	$419
Cost of sub-station attendance	175	79	46
Maintenance of motors and control	94	117	140
Total	$739	$666	$605
Saving over 600-volt, direct-current, exclusive of fixed charges	....	73	134
Saving in fixed charges	....	137	315
Total annual saving	....	$210	$449

Another method of comparison is to capitalize the annual saving, exclusive of fixed charges. Assuming 15 years as the average life of equipment and construction work, the present value of the annual saving in operating expenses per mile of track at five per cent. interest will be:

For the 1,200-volt direct-current system ..... $ 756
To which add saving in first cost ..... 1,300 = 7.5 per cent.
Making total capital value of $2,056

For the 6,600-volt single-phase system $1,390
To which add saving in first cost ..... 3,000 = 16 per cent.
Making total capital value of $4,390

The above comparison is based on service and construction conditions applying to the typical high-speed interurban electric railway, the fundamental assumptions and principal data being as follows:

Length of road, 50 miles or more.
Cars, 52 feet over all, weighing 21 tons without equipment or load and seating 56 passengers.
Car equipment, four 75-horsepower motors.
Maximum speed on tangent level track, 45 miles per hour.
Schedule speed, 24 miles per hour, including stops and slow running through towns.
Headway, maximum service, ½ hour.
Frequency of stops, one in two miles, interurban.
Average car energy, 85 watt-hours per ton-mile at car.

	Direct current, 600 volts.	Direct current, 1,200 volts.	Alternating current, 6,600 volts.
Cost of cars equipped	$10,800	$11,800	$13,800
Spacing of sub-stations	10 miles	22 miles	32 miles
Maximum voltage drop, trolley line	25 per cent.	25 per cent.	10 per cent.
Efficiency of system, generator bus-bars to cars	71 per cent.	71 per cent.	84 per cent.
Average efficiency, car equipment	75 per cent.	75 per cent.	73 per cent.
Average power factor of system	96 per cent.	96 per cent.	85 per cent.

As the 1,200-volt direct-current system is still in process of development, a brief description may prove of interest.

The roads which are now being equipped may be divided into three classes: (1) Those which are required to operate on 600-volt direct current at full maximum speed, as on the 1,200-volt section; (2) those which are required to operate on 600-volt direct current, but at approximately half-maximum speed; and (3) those which operate only on 1,200-volt trolley.

The first class requires motors wound for 600 volts, but designed to stand 1,200 volts without danger of flashing or injury to the insulation. The motors are connected four in multiple when run on 600 volts and in two parallel groups of two motors in series when run on the 1,200-volt sections.

In the second and third classes the motors may be wound for either 600 or 1,200 volts, preference being given to the latter, on account of improvement in tractive power at the slipping point of the wheels. In order to secure satisfactory commutation qualities and to prevent tendency to flashing at the commutator at the high-voltages encountered, all motors for the 1,200-volt system are provided with a compensating winding in the shape of series-wound auxiliary poles, located midway between the magnetizing poles, and so proportioned as to neutralize the armature reaction under all loads. The additional insulation required causes the motors to weigh 15 per cent. to 20 per cent. more for a given output than 600-volt motors. This additional weight is not due to the interpolar construction, as, on the basis of equal voltages, the inter-polar motor will weigh about the same or a little less than the standard railway motor.

The control system is substantially the same as that used on the 600-volt system with the exception of some slight changes in the insulation of the primary circuits. The secondary circuits are all energized at 600 volts, as are also the car heaters and lights, and for this purpose a small dynamotor is furnished for use when run on 1,200 volts, the function being to change the voltage to 600. The capacity of this dynamotor as furnished with quadruple 75-horsepower equipment is 38 amperes, which provides for the lighting, heating and air-pump circuits for one car, and secondary control circuit for a train of six cars.

Transformers—Air-cooled and Oil-insulated.[1]

Air-cooled Transformers and Their Protection.

By John Pearson.

Transformers play a very important part in transmission systems at the present time. Two types have been used a great deal—air-cooled varnished-linen insulated, and oil-cooled oil-insulated transformers. The air-cooled transformer is cleaner to handle and repair, and there is practically no fire risk; with the oil-cooled transformer the fire risk is considerable.

The oil-cooled transformer is stronger, and will stand greater static strains; for instance, in cases of lightning, when there may be extremely high difference of potential across the coils, and discharges may occur through insulation across the coils, if the working current does not follow, the oil will fill up and reinsulate the puncture. If the working current does follow, the result will probably be a short-circuit on the system, and either automatic devices or the operator will open the circuit-breakers. If the working current is not allowed to follow too long, the oil will fill up the puncture, and when the transformer is thrown in again, it will not show any defect.

The air-cooled transformer will not stand up under severe static strains as well as the oil-cooled and oil-insulated transformer; for instance, if a static discharge occurs through the insulation across a coil, even though the puncture is not larger than that caused by a small sewing needle, the working current will instantly follow and start the insulation burning, which will, of course, disable the transformer.

There is some difference of opinion as to which is the best way to connect up the high-tension side of transformers in generating stations. One engineer prefers delta connections, and another star connections. With delta connections, if one transformer becomes disabled, a large portion of the load can be taken care of by the remaining two transformers. This cannot be done where one side is connected up in star. The writer prefers the star conection on the high-tension side of transformers with the neutral or center of the star grounded. Under this condition one of the high-tension terminals of each transformer is at ground potential, and one at line potential, and use can be made of a static by-pass across each coil.

Some air-cooled transformers have six high-tension coils connected in series, wound in pancake form, and placed side by side. Numbering the coil next to the line 1, and next to the center of the star 6, it has been found that test papers show severe disturbances in coils three and four, while nothing has been shown in coils one or six. And again, test papers have shown severe disturbances in coils one and six, while nothing has been shown in any of the other coils. Four years ago the writer examined coil 1 of a disabled transformer, and found punctures in three places in the middle layers.

In building air-cooled transformers it seems nearly impossible to use the insulation one should, on account of sacrificing efficiency. In two years' experience with air-cooled transformers at the St. Croix Power Company's station, it was nothing unusual to see one or two transformers at the end of a 25-mile overhead line burn during a lightning storm. On account of static discharges through insulation across one or more coils, static by-passes were put across each coil, which prevented discharges through insulation across coils,

1. Papers and discussion at the Minnesota branch of the American Institute of Electrical Engineers February 8, 1907.

although a year later discharges had taken place between the first layers of No. 1 coil and the nearest low-tension coil. About that time the neutral was grounded, and since then the transformers have worked successfully for two years and without a single burnout. It is not enough to have transformers of high efficiency; they must be able to stand up under severe static strains. If enough insulation is impracticable then by-passes must be used.

Consider a high-tension group of transformers connected to a long-distance transmission line, the high-tension windings connected in star, the center of the star grounded, each transformer having six pancake coils, standing side by side, and an electric by-pass across each coil. Consider these conditions and it is plain to see that in case of a severe static disturbance of abnormal frequency, such as is caused by lightning, that it will be easier for the transformer if the strain is divided over all the coils than if it strikes only the first coil. The brass knobs forming the by-pass have capacity to each other, and to the ground, the coils standing side by side and connected to the knobs have capacity to each other and to the ground. The high-tension coils also, of course, have capacity to the low-tension coils to the transformer core and frame, which should all be grounded.

By this arrangement the transformer and knobs forming the by-pass becomes to a certain extent a condenser. A condenser takes a larger current at high frequency. At low frequency the capacity of the coils and knobs is negligible; the conditions are, however, entirely different at very high frequency, where the effct of the capacity of the coils and knobs becomes noticeable. Each knob and the coil to which it is connected absorbs a charging current that is proportional to the frequency and to the potential difference of the knobs and coils against ground. It is plain that this difference is greater when the coils are connected to the knobs than when the knobs are independent of the coils.

Experiences with Oil-insulated Transformers.

BY F. R. CUTCHEON.

The curent from the St. Croix Power Company's plant is carried underground at 25,000 volts into the heart of the business district, and is there stepped down in the St. Paul Gas Light Company's Cedar Street station for use in six-phase synchronous converters and for 2,200-volt alternating-current distribution. The transformers for the synchronous converters are six in number, with one spare transformer, all of 300-kilowatt rating, designed for 22,500 volts on the high-tension end and 78 volts supply to the converters. In addition to these there are four 200-kilowatt transformers with the same primary voltage but with secondaries having 25 extra taps, brought out at one terminal, with 20 volts between taps, these giving a range of voltage from 2,100 to 2,600 volts. These transformers are connected on the Scott system to change from three to two-phase current, an extra primary tap being provided to give the right ratio.

All of these transformers are oil-insulated and self-cooling; they are shell-type transformers, having six primary and six secondary coils. Both the primary and the secondary coils are divided into two sets of coils, four leads being brought out in each case. In the 200-kilowatt transformers the extra leads are dead-ended in the oil.

When the plant was started it was found that the synchronous converters would not deliver a sufficiently high voltage. The transformers at this time were connected in delta; but in order to get the necessary additional voltage the connections were changed, the connections of the primary coils being changed from series to multiple, and the bank connected in star instead of delta on the primary side. By these means an increase of 15 per cent. was obtained in the secondary voltage.

With the delta connection it was not considered necessary to have any reserve transformers, since the converters could be operated on two transformers in open delta, but when the connections were changed to star, a reserve transformer became a necessity. The transformers were arranged in two banks, each feeding the converters on one side of the Edison three-wire system. In order to have the extra transformer interchangeable it was placed between the two banks, so that the secondaries could be connected to any of the four bus-bars, fish-plates being prepared and always ready so that the damaged transformer could be cut out and the good transformer quickly substituted. On the high-tension end a pair of high-tension bus-bars were provided. One of these serving as the center of the star has a coupling provided for connection to the spare transformer; the other is connected to the line lead of the spare transformer and has a coupling opposite each of the active transformers, so that in the case of trouble it is only necessary to disconnect the damaged transformer and swing the line lead for that transformer over and couple to the spare bus-bar, while a similar change is made on the other bus-bar. Then the spare transformer is ready for use.

In regard to transformer ratios, we have had an experience that may be a warning to others in similar cases. The 200-kilowatt transformers, as previously stated, were built for 22,500 volts primary, and from 2,100 to 2,600 volts secondary. Our alternating-current distribution system does not require more than 2,160 volts at any time on the station bus-bars, while the minimum voltage is 2,080. This is a range of less than five per cent., while the direct-current bus-bar voltage varies over 20 per cent.; the consequence is that in order to regulate the voltage on the direct-current system we are obliged to vary the voltage on the high-tension line at the delivery end from 20,000 volts at night to 25,000 during the peak of the load. At the latter voltage it is readily seen that the alternating-current distribution voltage could not be less than 2,300 volts. This condition has only recently reached an acute phase by reason of the rapid growth of the direct-current load. It is hoped to remedy it by the use of automatic feeder regulators, which will absorb the excess voltage.

The transformers were originally intended to be placed in the main dynamo room, provided with good ventilation. Later developments, however, made this impracticable, and for lack of other space they were placed in a small closed basement. It was soon found that they could not be kept cool there except by blowing large quantities of air through the basement, and even with a 10-horsepower blower forcing the circulation the temperature rose as high as 85° or 90° C. The makers were not willing to guarantee the transformers at this temperature, and having failed in their guarantee they settled the matter by providing water-cooling coils. A well about 250 feet deep was sunk in the station, the water from which is usually at 5° or 10° C., and pumped about 50 gallons per minute to cool a total capacity of 2,700 kilowatts in transformers and induction regulators. This cooling system has introduced new troubles. The first met was from atmospheric condensation on the pipes running into the oil, sometimes producing a gallon of water in a week in one transformer. The burning out of one of the 200-kilowatt transformers was attributed largely to this cause, hence to remedy it the pipes where exposed to air were covered with magnesia pipe covering. This has been effective.

In order to regulate the cooling of the transformers, each one was provided with a fixed thermometer and valves, and readings of the thermometers are taken during heavy load periods. In case a transformer begins to heat, it seems to exert a back pressure on the water supply, which ceases entirely to flow through that coil. It is then necessary to shut off the rest of the coils and force water through the hot coil until the coil is cooled. A system of thermostatic valves has been planned which will make this regulation automatic. The piping for the cooling coils, buried in the concrete floor, was recently discovered to be badly eaten out by electrolysis. Whether this is the work of induced alternating currents or stray direct current has not yet been determined.

During the early months of their use these transformers all leaked oil badly, the cases being in four sections, bolted and calked. As much as 10 barrels of oil were used to make up the leakage during the first six months, calking or shellacing seeming to be of little use. Since the cooling coils have been put in the leakage has been greatly reduced, though about four barrels of oil are used each year, a good share of which is lost by evaporation.

Considerable trouble was experienced from the oil soaking up through the 2,200-volt leads between strands and forming a syphon. Once this action was fairly started it would remove several gallons of oil per day. To remedy this the insulation was stripped at the highest point of the leads and the strand, soldered together solidly.

When first installed the transformers for the synchronous converters were connected up with single-conductor lead-covered cable. The induced currents in the lead were so strong as greatly to increase the heating of the cables, and where cables came in contact short circuits occurred, which vaporized large quantities of lead. Finally a large part of the lead was stripped off and the remainder insulated with wooden clamps.

Having recently installed a 1,500-kilowatt steam-turbine alternating-current generator at the steam plant, we have endeavored to use the four 200-kilowatt transformers as step-up transformers so as to operate the synchronous converters from steam power. But it has been found that the ratio of the transformers when so used is even worse than when used as step-down transformers. It is evident that in the one case voltage must be supplied to overcome the internal drop from the low-voltage end, while in the step-down transformer this extra voltage is supplied on the high-voltage end. With a regulation of two per cent. this means a difference of four per cent. in the voltage ratio when stepping up at full load from that stepping down at full load; this effect is so marked as to make impracticable the use of the transformers in reverse.

Discussion.

J. C. Vincent: If the stoppage in the flow of cooling water referred to by Mr. Cutcheon is due to the collection of air in the coils it would seem that this could be prevented by allowing the water to flow in an upward direction through the coil.

E. P. Burch: Another method would be the connection of the water coils of the transformers in series.

J. C. Vincent: A peculiar trouble has lately been discovered in some 550-kilowatt air-blast transformers. A number of fires occurred in the bases of the transformers, and these were traced to static discharges between the two piles of laminations. It was found that, probably in shipment, the laminations had got out of place, and often the two piles were nearly or quite in contact. An exploration revealed a considerable current, in some cases as much as 25 amperes flowing between the piles. This was evidently due to an induced voltage of 35 volts, equivalent to one turn of the transformer. The static discharge is more difficult to account for. Sometimes the sparking would occur across a gap of one-sixteenth inch. These troubles are being overcome by rebuilding the piles and putting in additional insulation between the laminations every half inch, then grounding each of these insulated sections to the frame of the transformer.

George D. Shepardson: I would suggest the possibility of the static charge, of which Mr. Vincent speaks, being due to the friction of the air blast. Another point is the desirability of grounding the section with resistance wire so that in the case of the breakdown of insulation between the sections the local current would be limited.

A. R. Fairchild: One of the transformers referred to was tested standing on the floor with no air flowing through it. The sparking was just as severe as when over the air chamber. When either pile of laminations was grounded the static sparking seemed to be increased, but when both were grounded it disappeared altogether.

J. C. Vincent: On one transmission line, 13,000 volts, we have lost three air-blast transformers in lightning storms in the Stillwater sub-station at the end of the line, where the overhead line comes directly into the station. In another sub-station (Wildwood), about the middle of the line, the sub-station is reached through about 200 feet of paper cable. Here we have never lost a transformer.

Electric Motor Drive for an Alaskan Gold Dredge.

The Bonanza Basin Gold Dredging Company, which has been operating in the Bonanza Basin district of Alaska with steam-driven gold dredges of various designs recently made arrangements for obtaining a supply of electric current from the Dawson Electric Light and Power Company of Dawson City. In order to take advantage of the electric power which is now available, the dredging company has ordered the alteration of the big Allis-Chalmers dredge, which is the "sluice type," steam-driven, to the "stacker type," electrically driven. This alteration necessitated the use of separate motors for each specific drive throughout the dredge, in addition to the substitution of new winches and gravel-handling devices required by the change from sluice to stacker type. The current to be used will be three-phase, 60-cycle, 2,300 volts.

The motor equipment will be made up as follows: The bucket-drive motor will be of 100 horsepower, 2,300 volts, for variable speed and reversing; a 50-horsepower constant-speed 2,300-volt motor will drive 12-inch pump; two variable-speed 30-horsepower 440-volt machines will drive the main and ladder winches; a 15-horsepower constant-speed 440-volt motor, operating at a speed of 1,130 revolutions per minute, will operate the screen and stacker hoist; the stacker will be driven by means of a constant-speed motor, 15-horsepower, 440 volts; a three-inch primer pump will be driven from a 10-horsepower constant-speed machine.

When the sluice box was opened preparatory to the periodical clean-up, after quite an extended period of operation, it was found that the bed of the slough, which had just been worked, had yielded an assortment of stuff the equal of which, according to the papers at Dawson City, had never been seen before in the mining regions of the West. The collection disclosed, among other things, two Russian bronze ikons, or sacred figures, which had probably been carried into the region by Russian explorers many years before the Klondike was heard of. In addition to the ikons were found eight American pennies, probably thrown into the slough by some prospector in a fit of disgust when he realized that they possessed no purchasing power in the Yukon district. There were also recovered about 100 pounds of unexploded cartridges; gallons of bullets, many of which had a coating of amalgam, which necessitated their treatment for the gold adhering; 120 pounds of nails of all sizes; an alarm clock; a saw set; two massive gold charms; an opal with its setting from a broken scarf pin; innumerable pieces of watch chains, knives, forks, keys, lock, native bismuth, etc. During the season many large clean-ups were made. The gold was coarse, and nuggets worth from $10 to $20 apiece were recovered.

Indiana Telephone Items.

The Farmers' Mutual Telephone Company of Spencer County has filed articles of association, proposing to build a telephone system in Spencer County with the principal office and exchange in the town of Dale. The capital stock is $10,000. John Meier and others are directors.

The London Telephone Company is a new organization incorporated to take over, enlarge and improve the Scott Telephone Company property in London. A new exchange will be built and new equipment installed, and the wires will be extended throughout Shelby County. Harry Harrett is president.

It is reported that the Home Telephone Company of Elkhart had made a contract for the absorption of the Central Union local exchange in that city. This is one of the largest local exchanges operated by the Central Union in Northern Indiana, where the proposed merging of the Central Union and Independent telephone interests is now being agitated.

The Central Union Telephone Company has completed the installation of the Central-energy system in its local exchange in Columbus. The battery was charged from the Crump power house, the process requiring eighteen hours. The wires are now being cut into the new board.

At a meeting of the executive committee of the Indiana Independent Telephone Association and a subsequent conference between the members of the committee and a number of prominent Independent telephone men, it was decided that a stand would be taken at the approaching annual meeting to demand and insist that in case of acceptance of the Central Union Telephone Company's offer to retire from the local exchange business the Central Union must retire from all the local exchanges in Indiana or none. This includes Indianapolis, where the Bell company has a very good local exchange and is building an eight-story exchange building. It is understood that the Central Union is offering 15 per cent. of all tolls originating on Independent lines, but it was the sense of the conference that not less than 25 per cent. would be accepted. The Independents are left to build new Independent toll lines where the Bell lines are not sufficient, and also to operate their toll lines now constructed.

A contract for the erection of a new telephone exchange building in Rushville for the Rushville Co-operative Telephone Company has been let. The building will be equipped with one of the most modern automatic systems known.

The second annual convention of the Indiana Independent Telephone Association, to be held in Indianapolis May 15th and 16th, will be the most important session ever held, according to the members of the executive committee. It is asserted with confidence by the Independents that the meeting will mark in an unmistakable way the complete victory of the Independents in the telephone field, and will be distinguished, it is said, by the consideration of serious proposals of surrender by opposition interests in this and adjoining states. This convention will consider the plan of taking over the Bell local exchanges and arranging with the Bell representatives for a division of long-distance business. It is declared that the proposition comes from the Bell people authoritatively and the Independents regard the proposition as nothing more or less than the distress signal. The Bell people, on the other hand, say that the proposition they have made is intended to forestall future legislation, which is certain to enforce an exchange of business. It is proposed, therefore, by the Bell people that the rival telephone interests get together before the law steps in and compells them to do so.
law steps in and compels them to do so. S.

Telephone News from the Northwest.

G. B. Bailey and associates have filed articles of incorporation for the Badger Mutual Telephone Company of Orange, Wis., with a capital stock of $10,500.

The Liberty-Newton Telephone Company of Liberty, Wis., has increased its capital from $1,400 to $3,300.

After a number of drastic bills had been introduced in the South Dakota Legislature for the purpose of regulating telephone companies, a compromise measure was passed which created a telephone commission with powers similar to those of the State Railway Commission. The commission consists of the governor, state treasurer and one member appointed by the governor. W. E. Ege of Centerville has been appointed to this position.

The Farmers' Telephone Company of Ellendale, Minn., has been organized with M. Dunnigan as president, and N. Norby, secretary. A line will be constructed at once.

The Caryville (Wis.) Telephone Company has been organized with John Eddington as president and E. E. Larson as secretary. The new company will connect with the Wisconsin Telephone Company's exchange at Eau Claire.

C. R. Sargent, manager of the Interurban Telephone Exchange Company at Alexandria, Minn., has resigned, becoming effective May 15th. T. W. [illegible] of Sleepy Eye, Minn., succeeds him.

The Nansen Telephone Company has let the contract to G. Hague for building a telephone line from Howard, S. D., to Carthage, Oldham and Clearwater.

The Farmers' and Business Men's Mutual Telephone Company has incorporated at Calamus, Iowa, with a capital of $9,000. Charles Mordhorst is president, and H. Johnson, secretary. R.

Pacific Slope Telephone News.

Los Angeles capitalists have retained Attorney L. F. Puter to ask the City Council of Eureka, Cal., to pass an ordinance authorizing the sale of a franchise for an Independent telephone system.

The Pacific Telephone and Telegraph Company is erecting a new Class A two-story office on the corner of Piedmont Avenue and Forty-fifth Street. It will be finished in October at a cost of $50,000, and will accommodate 60 operators.

The People's Telephone Company which was organized by farmers residing near Whitmore, Cal., purposes to construct a line from Whitmore to Redding. Joseph Covey is the president and G. R. Milford, secretary.

The Home Telephone Company of San Francisco has just announced that it will at once push the construction of its system throughout the city, notwithstanding the claims of the graft prosecutors that its franchise obtained just after the fire last year was secured by fraud. The management has been informed that as long as the franchise was granted in legal form, the authorities will not declare it forfeited and the work will be allowed to proceed. Expenditures of $2,000,000 for materials have been authorized already, it is stated. The company's local office is at 789 Market Street.

The Home Telephone Company of Alameda County, which was promoted by the same interests as the San Francisco organization, has completed two telephone exchanges in Oakland, Cal., at Twelfth Avenue and Eighteenth Street and at Nineteenth and Franklin streets, with sufficient capacity to serve the entire city. Over $200,000 has been expended on the system, including underground conduits in the central portion of the city, and contracts are being taken for business which is to be commenced in the near future. The company's warehouse and engineering offices are located at Nineteenth and Cypress streets. A.

Southeastern Telephone Developments.

Work is progressing rapidly on the new Independent telephone system throughout Johnston County, North Carolina. Connection from Raleigh, N. C., will be by means of the lines of the Raleigh Telephone Company, reaching Smithfield, N. C., and other towns. The Raleigh Company is at present putting up a line to Wake Forest, N. C.

The Home Telephone Company, operating a number of exchanges over the state, is making an endeavor to secure a franchise in Vicksburg, Miss. N. D. Smith, representing the Home company, has been in Vicksburg for some time.

T. L. Dysard, who superintended the construction of the Iredell telephone system at Statesville, N. C., an Independent system, has gone to his home at Greenup, Ky., from which he will shortly take his departure for Detroit, Mich., to superintend the building of a telephone system there in building.

The Carolina Telephone Company has let the contract to F. E. Killette for the erection of a new telephone building at Wilson, N. C.

The People's Telephone Company has been chartered at Ramseur, N. C., with $20,000 authorized capital stock, by J. M. Barnhardt and W. J. Palmer of Lenoir, N. C., and others. L.

Independent Triumph in Washington.

The Pacific Telephone and Telegraph Company and the Farmers' Company of Wenatchee, Wash., west of Spokane, have come to an agreement whereby the Pacific company is to turn over its local business at once, and the two systems will be combined as soon as the change can be made. A three-section multiple common-battery switchboard will be installed and a new long-distance section will be put in. The Pacific company agrees to remain out of the local field for 10 years. The Farmers' company has completed its line to Pshastin and is now constructing a line from the Dunkard settlement to Monitor. The company was incorporated in 1903. Z. A. Lanham is president and H. C. Littlefield is secretary.

Big Telephone Merger Declared Off.

According to advices from Rochester, N. Y., the American Telephone and Telegraph Company has decided to withdraw its offer to purchase the Independent telephone business controlled by the United States Independent Telephone Company of Rochester, to which reference has been made in recent issues of the Western Electrician. It may, therefore, be assumed that the action taken by Attorney-General Jackson of New York to prevent the merging of the two companies will not be defended.

The allegation in the complaint was to the effect that the proposed sale was in violation of the Donnelly Anti-trust law of New York state.

Proposed Consolidation of Independent Long-distance Companies.

Indiana telephone men have made public the plans now being formed for a consolidation of the Independent long-distance telephone companies of the country. They say that the proposed consolidation will give through service from Philadelphia to St. Louis, and to the Northwest, as far as Chicago and Milwaukee. The deal as outlined by the Indiana men provides for the consolidation of the United States Telephone Company of Ohio, the New Long-distance Telephone Company of Indiana, the long-distance lines of the Pittsburg and Allegheny Company of Pittsburg, and the long-distance lines that are being built by the syndicate which has taken over the automatic telephone system in Chicago. It is expected, also, to include the Kinloch Long-distance Telephone Company of St. Louis, which controls the long-distance lines in Southern Indiana, Southern Illinois and in Missouri and Kansas. The plan further provides for setting aside $1,000,000 to build trunk lines from the East to connect the present Independent lines in Indiana with Chicago and Milwaukee.

GENERAL TELEPHONE NEWS.

A telephone line will be constructed from Kernsville, N. C., to Oak Ridge.

The Walnut (Ark.) Telephone Company has been incorporated by A. J. McDevitt and others.

The McKinney (Tex.) Telephone Company has increased its capital stock from $30,000 to $45,000.

U. Hudlow and others have organized a company to build and operate a telephone system at Moreland, Ark.

The Farmers' Mutual Telephone Company of Dale, Ind., has been incorporated by C. W. Randolph and others with $10,000.

Squirrels, of which there are a great number in the parks in the city of Bowling Green, Ohio, have been giving the telephone company no small amount of trouble. They work their way into the cable boxes and gnaw the lead covering off the cables.

The Council of Pilot Mound, Manitoba, has decided to have nothing to do with a municipal telephone system, but will let the government construct it. At Pilot Mound there are already two systems, and when the government builds there will be three distinct concerns.

The following-named telephone companies have recently been incorporated: Sheldahl (Iowa) Telephone Company, capital stock, $6,000; Walnut (Ark.) Telephone Company; West (Tex.) Telephone Company, $25,000; Anderson County Telephone Company, Lone Elm, Kan., $6,000; Rush Center (Kan.) Telephone Company, $5,000.

Officers of the Home Telephone Company of Spokane, Wash., announce that the new Spokane concern has no connection with the Home companies of California, except by long-distance arrangement. For the state of Washington the Empire Electric Company has been formed to construct the lines of the Home company. Robert Tucker is president of the electric company.

The capital stock of the Columbus Citizens' Telephone Company has been increased from $1,250,000 to $1,750,000. David C. Beggs and John H. Mohler have been added to the directorate. The money realized from the increased capital stock will be used principally in the establishment of an East Side exchange. The statement given out at the meeting shows a growth since the company was organized in 1899 from 1,957 telephones to more than 20,000 at the present time.

Referring to the abstract of the Special Telephone Commission for Chicago, published in the Western Electrician of April 13th, Prof. Dugald C. Jackson of Boston, a member of the commission, writing to the editor of this journal, says: "Please note that the measured rate for a single-line business telephone at $60 a year included 1,200 calls for the year instead of 300 calls, as stated in your abstract. The 300 calls is the number given for each quarter of the year, when the payments are made $15 a quarter."

Hon. W. H. Cushing, minister of public works for Alberta, Canada, announces in connection with the government telephone system now being built that a crew has commenced work on a line from Coleman, at the western boundary of the province, through the Crow Nest Pass east to McLeod. Next year this branch will be extended further east to Lethbridge, Taber and Medicine Hat. Work will be commenced immediately on the line from Wetaskiwin to Daysland and another from Lethbridge to Stettler. As soon as possible a crew will be put to work on a line from Edmonton to Lloydminster and southward to Calgary. This last line will parallel the Bell Company's line putting the government in direct competition with the Bell Company. These new lines will give telephone connections to 53 new towns, in each of which a government or municipal system will be installed.

CORRESPONDENCE.

Continental Europe.

Paris, April 16.—Among the new projects for electric incline railroads in Switzerland is a new line which it is proposed to build between Orsières and Champex. The proposed road will start from Orsières, which lies at an altitude of 917 meters above sea level, and continue on a slight down grade for some distance. Then it will rise on a regular slope to a high point known as the Signal, lying at 1,481 meters altitude. A narrow gauge of one meter is to be used for the track, and the line will have a total length of 1.5 kilometers. The trip is to take about 20 minutes in all. In the present case the cars will be drawn up the incline by cable, using drums operated by electric motors. The grade varies between 20 and 47 per cent. It is estimated that it will cost $160,000 to build the road.

Some 15,000 horsepower is to be obtained from the Reuss River, a mountain stream of Switzerland, which is well adapted for running hydraulic plants. Arrangements are being made to this end between the state and the government of the Uri Canton, and these are now practically finished. The water of the Reuss is to be taken off in five different places along the stream, seeing that there is a very high fall, which can be divided into several sections to advantage. The five proposed hydraulic plants will lie between Andermatt and Amsteg.

A novelty in the way of arc-lamp methods is the use of magnetic oxide of iron to replace the carbons. According to Eminger's recent experiments, a thin shell or cylinder of sheet-iron is filled with iron oxide well compressed. Pure oxide can be used, or it is mixed with titanium oxide. In the arc lamp the electrode is placed opposite a copper rod and the arc is formed between them. It is claimed that the copper does not become used up. On the trials the greatest economy is found with a good proportion of titanium oxide, about 30 per cent., and the arc is from 0.6 to 0.8 inch long, using 65 volts. One candlepower horizontal is obtained by 0.3 watt, or even less. The light is of a good quality in this case.

A concession for an electric railroad has been demanded by Engineer Brener of Fribourg, Switzerland. It is to run between Buchs and Nesslau, passing from the first-named station toward the north, by way of Grabs, Wildhaus and Stein. Ordinary track as well as the rack-rail system will be used on the different sections of the line, and the track will be laid on one side of the cantonal route. The line begins at Buchs at the railroad station of the State Railways, and at Nesslau it will connect with a new steam railroad which is to be built. The total length of the electric railway is 30 kilometers, of which about 10 will use the rack-rail system, as there is a grade of 15 per cent. About $5,000,000 is the estimated cost of the line.

The constructors of electric motors in Germany have decided to raise their prices again, and this will be about 10 per cent., making a total increase within the last year of 25 per cent. The high price of copper and brass as well as other materials is said to be the cause.

It is proposed to build a large electric plant at Rome for public and private lighting, and at present the Municipal Council is considering the question. Some of the leading home and foreign electric companies will be asked for bids, commencing with proposals for the primary and secondary wiring. Steam-turbine alternator groups are to be used in the station, and there will be at least three of these to begin with, which will cost about $140,000, while the boiler outfit will cost about half this sum.

In Spain a new company has been formed at Santander which proposes to extend a series of light and power lines throughout the province of Santander. On the other hand, it is stated that the representatives of two important foreign syndicates are now at Barcelona for the purpose of looking up the industrial field. One of these syndicates is to apply for a concession for a hydraulic plant, and the other will probably do the same for an electric railroad. Besides these, it appears that a French syndicate is considering a project for hydraulic work and mining plants in the region of Barcelona. A. DE C.

Great Britain.

London, April 20.—A definite expression of opinion from the new London County Council will be given in a few days as to its policy with regard to the electric power bill introduced into Parliament by its predecessors. As with the socialist party, so with the moderate—they both have an extreme section. The extremists now desire that the whole bill shall be withdrawn, while the more thinking section aim at a co-operation with private enterprise which has been proved over here to work exceedingly well. But even then the problem is not an easy one, for there remains to be settled the claims and rights of the existing companies who have been created piecemeal but have nevertheless created remunerative businesses, and also the borough councils, but a very small proportion of which make both ends meet.

There are signs that the much-maligned "Electrobus" will yet make its appearance on the streets of London. Fortunately, from the critical point of view, the company has adopted well-known makes of battery, viz., Tudor & Chloride, instead of the unknown make, as was the case when the first bus was exhibited. The feature of the chassis now adopted is that each of the four wheels is driven by a separate motor.

Another type of electric car will shortly be manufactured here, which makes use of Hagen batteries. A limousine of this type, seating seven persons, outwardly closely resembles a patrol car, the batteries being carried under a bonnet in the front of the car, and the controller operated by a side lever. The characteristic of the equipment is that the various speeds are not obtained by varying the accumulator groupings but by means of the motors, of which there are two of the series type. The controller gives five speeds forward, two electric braking positions and two reverse speeds.

Quite a stir has been created in municipal tramway circles by an endeavor on the part of the postmaster-general to secure the insertion of a clause in a few municipal tramway bills now before Parliament, giving him the right to use their tramway standards for the purpose of carrying telegraph wires. It certainly does seem a clumsy way of doing things, for if it is successful only a few undertakings would be put under this obligation. A general act giving the necessary powers on all tramway systems would have been the right method, although there would then have been opposition all the same. G.

Dominion of Canada.

Ottawa, April 27.—The Ontario Electric Smelting and Refining Company has been incorporated with a capital of $2,000,000. The object of the company is to smelt, refine and otherwise treat all kinds of ores by electricity through a patent process, and to establish its first plant in Cobalt. A small one will also be erected in Ottawa.

The scheme of utilizing the refuse of the city of Montreal for lighting purposes is the subject of a report to the civic lighting committee by Mr. A. Parent, superintendent of civic lighting. Mr. Parent expresses the opinion that sufficient energy could be generated in this way to light the whole of the city, practically.

The sum of $2,500,000 is what the Bell Telephone Company of Canada proposes to spend on extensions and improvements to its system throughout the Dominion this year. Of this amount, about $800,000 will be spent in Montreal alone. The present number of subscribers in the city and suburbs is about 20,000.

An abstruse calculation has been sent the Ontario government by the Queen Victoria Niagara Falls Park Commission. It involves a computation in respect of rentals to be collected from the various companies developing electrical energy above the amount governed by the annual fixed rental. Principal Galbraith of the School of Practical Science and Sir Aemilius Irving, solicitor of the park, consider that basing the rental on the maximum peak load would arrive at a fairly equitable determination. The report of the commissioners says: "The three corporations which have obtained franchises to develop the waterpower of the Niagara River within the limits of the park have, in the aggregate, already expended $17,000,000 in carrying out their plans for the generation of electric power, and it is estimated a further sum of $10,000,000 will be required to complete the works to full capacity." W.

New England.

Boston, April 27.—The Berkshire Street Railway Company has been authorized to issue additional stock amounting to $250,000, to be offered to stockholders at $160 per share, the proceeds to be used for paying the company's floating debt and buying property. This company is controlled by the New York, New Haven and Hartford Railroad Company.

The White Mountains Telephone and Telegraph Company, which received its charter from the last New Hampshire Legislature, has secured the franchises of the Pike Telephone Company, the Plymouth and Campton exchange, the Woodsville (Vt.) exchange and the Woodstock (Vt.) exchange. These franchises cover lines serving 1,900 subscribers.

The Lewiston, Brunswick and Bath Street Railway has been sold to the Lewiston, Augusta and Waterville Street Railway Company, which now controls 150 miles of electric railway in Maine.

C. A. Adams, professor of electrical engineering at Harvard University, will give an illustrated lecture on "The Synchronous Motor" at next Monday's meeting of the Worcester Polytechnic Institute Branch of the American Institute of Electrical Engineers.

The Boston Elevated Railway Company and the city solicitors of Malden and Everett, Mass., have agreed upon the form of a bill providing for the building of an elevated railway from Sullivan Square, the present Charlestown terminus of the elevated road, to Everett and Malden, and the legislative committee on street railways has the bill under consideration.

Thomas J. Gargan of the Boston Transit Commission has been traveling in Europe for nine months, and has closely studied the subways in that part of the world. He declares that the Boston subway system is better than any he saw abroad, especially in the matter of ventilation.

The Rhode Island Company has announced that 615 motormen and 598 conductors will have their pay increased 10 per cent. next Sunday. This is on a basis of a day of ten hours. The employes had not asked for an increase. B.

New York.

New York City, April 27.—The New York Central Railroad, through Chauncey M. Depew of its board of directors, says that it will not be possible to consider this year the proposition to electrify its lines running through the Adirondacks in order to guard against forest fires. Mr. Depew says that the railroad has too much other work on hand at the present time to undertake this enterprise just now; also that the work of electrifying state railroad lines is very expensive and that it is yet in an experimental stage.

Chief Engineer Lacombe of the light and power bureau of the Department of Water Supply, Gas and Electricity has recommended, in a report prepared by him, that, if the lighting companies agree to abide by the bills fixing the price of gas for public lighting in Manhattan and the Bronx at 75 cents and of electric lighting at 7½ cents a kilowatt-hour, the claims of the companies under the old Oakley contract should be paid.

The Lake Champlain and Lake Placid Traction Company, formed to operate an electric railroad from Westport on Lake Champlain to Lake Placid and also Ausable Forks, has just filed incorporation papers.

The Rapid Transit Commission has received a letter from E. P. Bryan, vice-president of the Interborough company, submitting a plan for the change of tracks at Ninety-sixth Street, with a view to obviating the congestion. After full discussion the matter was laid over to the next meeting of the board for final action.

It is officially announced that the first of the Hudson River tunnels will be opened for traffic on October 1st. The first train service will be between Fourteenth Street and Sixth Avenue, Manhattan and Hoboken. The tunnels to be used are the twin tubes of what is known as the McAdoo or Hudson Tunnel companies, reaching Manhattan at the foot of Morton Street, proceeding under Christopher Street, thence to Ninth, and on to Sixth Avenue.

Judge Rasalsky in the Court of General Sessions has denied the motion for an inspection of the minutes of the grand jury which indicted the New York Central Railroad and Mr. A. H. Smith, vice-president and general manager, and Ira McCormick, superintendent, for the wreck at Woodlawn in which twenty-four lives were lost.

The unsatisfactory results of the trial of the Poulson switching system at Coney Island last Sunday, due to the lack of power required to move the 45 trains which are necessary to a full demonstration of the system, and a general misunderstanding of the signals, will make another trial necessary. Arrangements are being made by the Board of Estimate to give the system a complete practical test next Sunday morning.

One of the prettiest features of metropolitan life is the little electric runabouts that are beginning to throng the parks and boulevards. Their natty appearance, with the impression of comfort and security that they seem to convey, fully accounts for the rapidity with which they are coming into public favor. Where only a short time ago the electric automobile was a rarity it is now the most popular vehicle and is rapidly forcing itself to the front for park and city riding. D. E. P.

Southeastern States.

Charlotte, N. C., April 27.—The franchise of the electric-railway company of Newberry, S. C., headed by Henry L. Parr, has been extended from 25 to 40 years. The franchise requires work to be started within 18 months. The power will be brought from the power plant at Broad River, being built by the Parr Shoals Power Company.

The secretary of state of Alabama has been informed of the organization of the Sand Mountain Electric Company of Albertsville; capital stock, $50,000.

The handsome new power house of the Charlotte Consolidated Construction Company, Charlotte, N. C., collapsed on April 22d, entailing a loss of from $15,000 to $20,000. The building was just being completed for the installation of gas generators, which the company will introduce as an innovation in the South as a means of generating electric power.

Machinery is being moved to the new power house at Buckhorn Falls, to be installed in the power plant to be started up at that point shortly. Eugene Maxwell is superintending the work in progress at the plant. Transmission wires are now being extended to Fayetteville, N. C.

The contract for building the dam for the Reedy River Power Company near Laurens, S. C., has been let to C. R. Willard & Son of Spartanburg, S. C., the work to be completed by January, 1908. N. B. Dial is president of the power company,

which will sell electricity to numerous manufacturing plants in the surrounding country.

The United States Leather Company of Philadelphia, having secured tanneries at Lost River, Romney and other Virginia points, is making a survey for a trolley line to connect the several properties, the line to have a length of 30 miles or more, to Moorefield.

The 13-foot flywheel at the city lighting plant of Brookhaven, Miss., burst on the night of April 16th, working damage to the extent of $1,000. L.

Ohio.

Toledo, April 27.—A general strike of electrical workers in Youngstown seems imminent. The inside men have demanded an increase of 50 cents a day. As a compromise the contractors offered them a 40-cent-an-hour scale, which would bring the scale up to a daily increase of 20 cents. The linemen, telephone men and outside workmen at the same time demand an increase of 25 cents a day. There is a great amount of work planned for Youngstown this year, and if this strike develops into a serious proposition it will mean a heavy loss to many large electrical contractors.

The Dayton and Western electric road will install a concrete sub-station at Crown Point, a pleasure resort near Dayton.

Shelby, Ohio, is facing a peculiar proposition. The Shelby Electric Company is planning to practically doubling the plant and add 150 men. The only thing which interferes with the deal is the fact that the city of Shelby has no way of taking care of the additional families that will have to come with the enlarging of the plant. The president of the Shelby Electric Company says that within three years they will require 1,000 more men than they have working at the present time, and he has asked the citizens of Shelby to arrange for the immediate construction of 100 new houses.

The Youngstown and Southern Railway (electric) started its regular service between Youngstown and Columbiana on April 29th. At first the road was equipped for steam, but with ultimate electrification in view. In October, 1904, the line was first opened for passenger traffic between Youngstown and Columbiana, and the following month a regular schedule was inaugurated and has been maintained since that time, steam now giving way to the electric service. John Stambaugh is president and S. J. Dill, general manager.

The Cleveland, Ashland and Mansfield electric railway has purchased a 70-acre tract of land near Ashland, for use as a power house and car barns.

The Radium Electric Sign Company of Cleveland will move to Fremont very soon. It will occupy the factory formerly occupied by the Jackson Knife and Shear Company. H. L. S.

Indiana.

Indianapolis, April 27.—The commissioners of Hancock County at Greenfield have awarded a contract to C. M. Korkpatrick for the installation of a heating and lighting plant in the court house. The consideration is $15,000. Mr. Korkpatrick is in the market for material and equipment.

Charles R. Lane and associates of Ft. Wayne have secured a 25-year franchise to erect and operate a gas and electric light plant in Danville. Bids for the construction and equipment of the plant will be in order soon. The maximum rate for gas will be $1.35 per 1,000 cubic feet.

The municipal contract with the Seymour Gas and Electric Light Company expires on May 1st. A new contract will be let.

Consolidation of the Michigan City and Northern Indiana Gas Company, the Michigan City Light and Power Company, the Michigan City Gas Light Company and the Michigan City Gas Company was completed during the week by the filing of articles of incorporation. The new company will be known as the Michigan City Gas and Electric Company. It is controlled by the Geist syndicate and will control all gas and electric light and power business and franchises in Michigan City and other Northern Indiana cities.

The City Heating and Electric Company of Terre Haute has incorporated to conduct a supply house and do a general business of installing heating and lighting plants. Lesler W. Watson, Walter S. Dulnwig and Victor Peterson are directors.

Marion is boasting of being the best lighted city in the state. It is said to be the first city to introduce electric arches each with 100 incandescent lights in colors spanning the downtown streets. There are now 20 of these arches. The failure of natural gas has not caused Marion to retrograde. In fact the city is more substantial and busier now than at any time in its history. Electricity has kept the town to the front as a manufacturing city. Electricity has replaced gas in the factories, in the street lighting, in illuminating the stores and residences, for signs and advertising, and for domestic purposes, such as cooking and ironing.

The Toledo and Ft. Wayne Electric Railway Company has filed articles of incorporation. The capital stock is $100,000. The company will construct and operate an electric railway between Ft. Wayne and Bryan, Ohio, which will make up an important link of the great Toledo-Indianapolis-St. Louis system. The company's office will be in Ft. Wayne. The company also proposes to furnish electricity for heat, light and power purposes. John H. Zimmerman, Ira Grubb and Thos. Hood are directors.

Plans are about completed for the incorporation of a company to build an electric railway from Terre Haute to Kokomo, by way of Crawfordsville and Frankfort. It is proposed to do a coal-carrying business as well as passenger and freight.

The Pennsylvania Railroad is putting up strong opposition to the voting of a subsidy of $75,000 to the Winona-Ft. Wayne traction line, some of which would have to be paid by the Pennsylvania company.

The Indiana Railroad Commission is preparing to put in operation the recent law providing for the appointment of inspectors to examine the car equipment of steam and electric roads, and also to require two reports of all accidents on the line—one within five days and a fuller report within 20 days after the occurrence. Blanks for accident reports have been sent out. S. S.

Michigan.

Grand Rapids, April 27.—The Grand Rapids-Muskegon Power Company will not ask a franchise from the city. All the company wants is an ordinance regulating the distribution of electricity for commercial purposes. So far as the franchise is concerned the company will operate under that of the Edison company. W. A. Foote declares he intends to reduce the rates for lighting and power purposes, but rather than offer rates himself he has asked the ordinance committee, to which has been added General Manager Freshney, to collect data from other cities and let the city make the offer. Grand Rapids is now paying 12 cents a kilowatt-hour for current. This is on a basis of steam power to operate the electric-lighting plant. With water-power it is believed by the aldermen the price ought to be cut at least one-third, and perhaps more. The ordinance committee is collecting data from other cities, and believe the city's offer will be something like eight cents a kilowatt-hour.

The Commonwealth Power Company will commence in a few days on a pole line running from the village of Portland to its plant at the dam. It is the first step toward supplying farmers and others along their lines with electricity for lighting and power purposes. First a private telephone wire will be attached to the poles, but if a sufficient number of farmers along the line desire current, arrangements will be made to sell it to them. From Portland the line will be extended to Grand Ledge and Lansing. When lands on which the steel towers rest were contracted for, farmers were given to understand that it would be practical for them to light their buildings with electricity if they so desired.

If a scheme which is now being promoted is successfully carried out, Kalamazoo will offer power, heat and light to manufacturers seeking location. Frank M. Armstrong of Chicago is back of the scheme. Mr. Armstrong's proposition provides for a large central supply station. The power and light would be eectricity, while the heat would be from steam. L. W. B.

Illinois.

Peoria, April 27.—Chairman Erickson of the House committee on municipal corporations has introduced a bill giving all cities of the state power to establish and own as well as control and operate gas and electric light plants, and to furnish both for public and private uses. Also to regulate the sale and fix the price and standard of quality of these illuminants. The bill also provides for inspection. This bill is identical with a Senate bill that is now in committee on municipalities. Senate Bill 501, providing for municipal operation of telephone plants was favorably reported by the Senate committee on municipalities.

The formal transfer of the Peoria and Pekin Terminal to the Peoria Terminal Railway Company has been completed.

The new theory of "burning ashes" was tested at the electric-light plant at Greenview this week, and it is alleged that the experiment was successful. Salt, oxalic acid and other ingredients were mixed with the ashes.

President McKinley and B. R. Stevens, general traffic manager, together with M. G. Linn, general superintendent, of the Illinois Traction Company, were present at a banquet held here this week. During his visit Mr. McKinley said that possibly the Mackinaw-Lincoln line would be opened for business this fall. Nearly all of the right-of-way has been secured, and the work of construction will be commenced at once.

The Illinois Traction Company has placed an order for four refrigerator cars, which will be something new for the system and will resemble the express cars now used by the company. They will be used principally to haul meat and vegetables from St. Louis.

It is reported that the Burlington steam railroad will establish a factory at Aurora for the building of electric locomotives to be used on its branch lines.

The Illinois Traction Company is back of the incorporation of the Tri-City Traction Company with a capital stock of $1,000,000, principal office in Champaign, to build a road from Edwardsville, Madison County, to a point on the Mississippi River, near Venice, where the bridge will be built across the Mississippi to St. Louis, and from Granite City to East St. Louis. This is the company formed to take care of the entrance to St. Louis, including the building of the bridge and terminals in St. Louis, where it has purchased the ground to erect the necessary buildings and room for building the tracks for storage of cars. V. N.

Northwestern States.

Minneapolis, April 27.—The City Council at Mankato, Minn., has granted a twenty-year street-railway franchise to W. L. Hixon and H. E. Hance of Mankato. The franchise also gives permission to operate a lighting and heating system. The Polk interests of Des Moines have purchased the Colfax-Newton line of the Newton and Northwestern, and will install interurban service at once.

A petition in involuntary bankruptcy has been filed against the Bergen Electric Company of St. Paul.

It has been announced that the St. Cloud Electric Power Company will begin work next month on its new dam across the Mississippi River at St. Augusta, Minn.

An election will be held at Valley City, N. D., on May 6th to vote whether to sell the municipal lighting plant or to issue bonds for improvements and extensions.

W. R. Tucker of Moorehead, Minn., proposes the construction of a trolley line from Fargo, N. D., to Detroit, Minn., a distance of about 50 miles. It is estimated that it will cost about $500,000.

J. F. Heiberg has been granted a franchise for an electric-light plant at Ulen, Minn.

The City Council at Fergus Falls, Minn., has adopted a comprehensive plan for improving the electrical system there. The concrete dam will be raised to a height of 29 feet, and bids will be called at once for its construction, as well as for a new brick power house and for a complete new outfit of machinery.

A. S. Highley and associates are planning on putting in electric-lighting systems at Bristol and Salem, Wis., the total cost to be about $40,000. R.

Pacific Slope.

San Francisco, April 25.—The increasing demand for electric light and power is over-taxing the facilities of the San Francisco Gas and Electric Company, which is still somewhat short in its supply. The completion of hundreds of new buildings each month and the reconstruction of old ones is causing an increased demand for electric light that it seems cannot be met by one company. Two new independent concerns are bending their energies to get this business and have their plants installed in time for the peak load next winter. The San Francisco Gas and Electric Company in addition to other efforts to increase its generating capacity is installing at the Mutual Electric Company's Speer Street plant, which has been purchased, a 1,000 kilowatt direct-current generating set which was taken from the old Jessie Street Station. It consists of a vertical Union Iron Works triple-compound engine direct-connected to two 110-volt direct-current generators.

The Merchants' Association of Fillmore Street has subscribed a fund of $10,000 for a special permanent lighting service on Fillmore Street, extending from McAllister Street to Sacramento. The new system is to be completed by July 4th. Permission of the Board of Supervisors has been asked for the erection of metallic arches carrying a number of ornamental incandescent lights at each street intersection. The Kearny Street Improvement Club has also planned to install special electric lights on that thoroughfare.

On the night of April 18th, the anniversary of the calamity of 1906, the shattered dome of the City Hall was illuminated by several thousand incandescent globes as was the custom on gala occasions for several years before the fire. The rewiring and placing of the lamps was accomplished at considerable risk, largely by volunteer work by members of Electrical Workers No. 6 and of the new No. 1 union under the direction of Otto Schiller. The sight of this illumination brought tears of mingled joy and grief to the eyes of many citizens who had seen the destruction and were celebrating the rebirth of San Francisco.

The Fagan Electric Company has been incorporated in San Francisco with a capital stock of $25,000 to carry on an electrical supply and wiring business.

The Oakland Gas, Light and Heat Company, a Pacific Gas and Electric interest which has a monopoly of the light and business in Oakland, Cal., has voluntarily ordered a reduction of 10 per cent. in its base rates for electricity. The company's rate on illuminating gas has also been cut from $1.15 per cubic foot to $1.00. The new rates will become effective June 1st. Additional equipments and main extensions, ordered for gas and electricity, will aggregate $1,400,000 in cost.

The Sonoma and Lake County Railway Company,

which was recently incorporated, purposes to build an electric road from Cloverdale to Lakeport, Cal., with a branch to Kelseyville.

The American River Electric Company is laying the concrete foundations for its steam reserve station on Banner Island. The machinery is now en route from the East. The company's main hydro-electric power plant is located near Placerville, Cal., and lines extend to Stockton and other cities.

The Northwestern Electric Corporation will expend $40,000 in improving its gas and electric system which supplies Walla Walla, Wash. Automatic regulation for the hydro-electric plant on the Walla Walla River will be installed.

The Portland Railway Light and Power Company of Portland, Ore., has purchased a lot at Northern Hill and will erect a transforming station there.

County Surveyor Bell and a crew of men have started for Mount St. Helen to run the lines for the ditch of St. Helen Mill and Power Company, which has acquired the water rights and secured a patent to flume water and erect an electric plant on the headwaters of the Toulle and Green rivers. According to the promoters' estimates the plant can be made to furnish power energy to light the towns all the way to Tacoma and Portland and operate electric railways through Western Washington and Northern Oregon. C. C. Brown is the manager of the company.

Several water appropriations were recently filed at Red Bluff, Cal., for the use of the water of neighboring streams for electric power purposes. Two claims filed for water on Antelope Creek were for 15,000 miners inches, each. The appropriators are C. A. Buress, L. J. Joiner and E. Finley.

It is announced that the Petaluma Gas and Electric Company will install at Petaluma, Cal., a steam plant with a capacity of 2,000 horsepower.

The Coast Counties Electric Company, which is a subsidiary of the Pacific Gas and Electric Company, is preparing to remodel its system. The hydro-electric plant on Big Creek will be doubled in capacity. The capacity of the distributing station at Santa Cruz is to be increased by moving the present sub-station equipment at Watsonville to Santa Cruz and installing a smaller auxiliary plant at Watsonville. A.

PERSONAL.

The death is reported of D. P. Bacon, president of the Poplar Bluff (Mo.) Light and Power Company.

Mr. Farley Osgood, the well-known electrical engineer, has resigned his position as general manager and chief engineer of the New Milford (Conn.) Power Company, to take effect May 31st.

Dr. Ira Remsen, president of Johns Hopkins University at Baltimore, was announced as the principal speaker at the Class Day exercises of the Michigan College of Mines at Houghton, Mich., on May 3d.

Harold Almert, the Chicago electrical engineer, is devoting much of his time to the reconstruction of the central-station properties in Wichita, Kan. About $100,000 has been or will be spent on the rehabilitation.

Mark Eldredge, a graduate of the Worcester Polytechnic Institute in the class of 1906, has been appointed electrical engineer in the United States Reclamation Service. His work will be in Dakota and Wyoming.

F. H. Gale of the advertising department of the General Electric Company was recently elected president of the Technical Publicity Association at the third annual meeting, held in New York. Rodman Gilder, publicity manager of the Crocker-Wheeler Company, Ampere, N. J., was elected secretary of the association.

William Loeb, Jr., secretary to President Roosevelt, has been offered and will accept, it is said, the presidency of the Washington Railway and Electric Company, one of the largest transportation lines of Washington, D. C. It is understood that Mr. Loeb will not sever his connection with the president until January 1st next. The company will be reorganized, it is reported.

Henry Beyer, president of the Beyer Brothers Electric Light Company of Morton, Ill., was accidentally killed in that town while coiling the end of a wire which was strung on a pole line. The trolley of a passing interurban car came in contact with one of the wires of the lighting company. The current passed down the wire and through Mr. Beyer's body. He was so severely shocked that he died within an hour.

At last week's meeting of the American Institute of Electrical Engineers in New York the following-named associates were transferred to full membership: Cyrus Koiner, secretary-treasurer and engineer of the National Limited and Improvement Company, St. Louis, Mo.; Carl Magnusson, professor of electrical engineering, University of Washington, Seattle, Wash.; L. H. Thullen, electrical engineer of the Union Switch and Signal Company, Pittsburg, Pa.; Robert F. Hayward, general manager, Mexican Light and Power Company, City of Mexico; Peter Junkersfeld, electrical engineer, Chicago Edison Company, Chicago, Ill.; Albert B. Herrick, consulting electrical engineer, New York city.

H. W. Sayles, formerly electrical engineer for the Diamond Meter Company, and H. I. Waggoner, formerly with the Northwestern Electrical Equipment Company, have formed the Electrical Testing Company of Peoria, Ill., for the purpose of standardizing meters and instruments. They will also make competitive tests of meters for lighting companies. Mr. Sayles and Mr. Waggoner are both technical men and have had a number of years' experience in this class of work.

Major W. A. J. O'Meara has been appointed to succeed as engineer-in-chief to the General Post-office of Great Britain Mr. John Gavey, who retired under the age limit on April 15th. Major O'Meara was appointed assistant engineer to the postoffice in 1902. He served through the Boer war and displayed administrative capacity of a high order, for he managed the affairs of Johannesburg for nearly twelve months during the interregnum between the establishment of military and civil control.

Bion J. Arnold has received frequent offers from the colonial government of Australia to go to that country and take charge of the electrification of the suburban and interurban roads in the province of Victoria, near Melbourne. The lines are owned by the government, and the project of converting them to electric operation has been under consideration for several years. Recently a new offer was received from the Australian authorities which is being considered. If his services are not demanded until next winter Mr. Arnold will go to Melbourne for a period of about three months. This summer and fall will find Mr. Arnold very busy as head of the Board of Supervisory Engineers which will rehabilitate the street-railway lines of Chicago, and this matter will receive his first attention. When winter comes, however, the plans for the Chicago work should be well under way and Mr. Arnold may then be able to leave for a few months. By that time it will be summer in Melbourne. This plan has been communicated to the Australian authorities.

ELECTRIC LIGHTING.

It is proposed to erect an electric-light plant at Hempstead, Tex.

The electric-lighting plant at Bowie, Tex., has been sold to Wright Bros. of Newport, Texas.

The plant of the Fulton (N. Y.) Light, Heat and Power Company will be doubled in capacity.

The ratepayers of Calgary, Alberta, have voted in favor of selling debentures to the value of $35,000 for an extension of the electric-lighting plant.

The Faribault (Minn.) Gas and Electric Company will install new dynamos in its electric-lighting plant. A three-phase 60-cycle system will replace the old single-phase 125-cycle system.

The Georgia Railway and Electric Company has practically completed the installation of a 3,000-horsepower gas engine at the Davis Street electric station at Atlanta, to be used in supplementing the waterpower of the company. The company will in a short time install another 3,000-horsepower gas engine at the same station, the second one to be a turbine.

ELECTRIC RAILWAYS.

G. N. Vancleave is promoter for an electric railway from Linden, Ind., to Attica.

W. J. Harris and J. E. Giroux of Reno, Nev., have asked the City Council for a franchise for an electric road to cover the principal streets and to connect with the University of Nevada.

Fire on April 24th destroyed the car barn and repair shop of the Cincinnati, Georgetown and Portsmouth Electric Railway Company at Cincinnati. Many cars were burned. The loss was $100,000.

The Chicago and Southern Traction Company has filed notice at Springfield, Ill., of an increase in its capital stock from $2,000,000 to $5,000,000. The road is to run from Chicago to Kankakee, Ill., 80 miles, of which 40 miles is already in operation, it is said.

A new type of electric locomotive has been put on the West Jersey and Seashore Railroad, according to the daily papers. The engine, which weighs 96 tons, uses power from the third rail, but has sufficient storage battery capacity to allow it to run independently of the third rail for a time. It is said that several engines of the type will be used for hauling freight.

A strike of 450 employes on the street-car lines of the Utah Light and Railway Company at Salt Lake City, was declared on April 28th. Numerous scenes of disorder followed attempts to operate a few cars with non-union crews, and all efforts to maintain even a partial service were soon abandoned. The strike was called by an announcement from President Bancroft that he had not agreed to arbitrate matters other than the wage scale, it having been previously reported that all differences between the company and the men would be settled by arbitration.

PUBLICATIONS.

The H. T. Paiste Company, Philadelphia, is issuing a new catalogue, No. 8, of electric-light supplies. It covers a great variety of articles, the page numbers referring to Catalogue No. 12.

R. D. Wood & Co., engineers, founders and machinists, 400 Chestnut Street, Philadelphia, have issued a catalogue in which are described and illustrated centrifugal pumps for waterworks and high-pressure fire service.

W. N. Matthews & Bro. of St. Louis are about to distribute their new net price book covering the "money-savers" handled by them. The booklet is conveniently arranged and neatly printed in two colors. The subjects dealt with are Stombaugh guy anchors, Kearney cable clamps, Hold-fast lamp guards, Lima jack boxes and plugs, Hargis cable-splicing joint and Callahan cable rollers.

The growing demand for direct-current electric motors that can be applied either to the individual or group drive of machinery has led to a number of important changes in both the mechanical and electrical design of such motors. To meet the rigid requirements of modern service the Allis-Chalmers Company of Milwaukee has brought out a line of motors designated as type K which supersedes types N and B. These motors are well described and illustrated and their applications noted in Bulletin No. 1057.

In Bulletin No. 5 from the Duncan Electrical Manufacturing Company of Lafayette, Ind., it is stated that there are over 150,000 Duncan meters now in use, and that these instruments have found their way into nearly every known quarter of the globe. This little bulletin contains some important facts about meters, and the various Duncan types are well illustrated and described; also prices are given. The illustrations show various types of direct-current wattmeters and alternating-current meters, monetary meters and switchboard meters.

The Massachusetts Chemical Company of Walpole, Mass., has issued a very convenient and attractive loose-leaf catalogue and price list of insulating materials. Besides manufacturing and selling standard sizes and weights of insulating tapes, also shellacs, varnishes, cements, cable wax, flux and Chatterton compound, the company makes a line of its own specialties and is prepared to produce to specifications any insulating compound or substance for use in the electrical manufacturing trade. Hundreds of insulating products are described in the book and their uses defined. In addition, much time and care have been devoted to matters of scientific and general interest, for example, an article entitled, "Vacuum Impregnating vs. Heat and Liquid Impregnating."

"A Study in Graphite" is a recent booklet published by the Joseph Dixon Crucible Company which gives in detail a series of tests of graphite as a lubricant made by Prof. W. F. M. Goss of Purdue University. There are complete descriptions of the tests, together with illustrations of the testing machine, made from photographs and drawings. The condition of the bearings and journal is shown by photographs taken at different stages of the tests. Because of the high character of the matter and the heavy expense attached to the conduct and publication of these tests, it was decided to make a nominal charge for the booklet. A limited number of copies, however, will be distributed free of charge to all those interested in the science of graphite lubrication. The company is addressed at Jersey City, N. J.

A quantity of well-designed and carefully prepared advertising literature is being sent out from the Hawthorne plant of the Western Electric Company. One little booklet contains some interesting facts about the company. It gives the location of American and foreign houses and agencies, floor space of plants, number of employes, sales, items of interest about the plants, etc. Another booklet, somewhat larger, contains instructions for the installation and maintenance of telephone power-plant machines, including alternating-current motors. This booklet seems to cover every detail of operation. It is well illustrated and contains much of value to those interested in the subject. There are also several strikingly illustrated return post-cards which offer profitable hints to the observing. All of these publications are pleasing in appearance and at the same time offer much of practical value.

TRADE NEWS.

The address of Rossiter, MacGovern & Co. has been changed from 17 Battery Place to 90 West Street, New York city.

The A. D. Granger Company announces the change in its New York office to rooms 1518-20 West Street Building, 90 West Street, corner of Cedar, where it has much larger and more com-

[illegible] commodious offices arranged for the better conduct of the business. The company handles engines, boilers, etc.

Wall Street gossip is to the effect that for the months of February, March and April, 1907, the General Electric Company did business at the rate of $78[illegible] a year.

The Board of Public Works of Ft. Wayne, Ind., will receive bids until June 12th for the construction and equipment of a municipal electric light and power plant for lighting streets and public buildings. The estimated cost is $100,000.

Stone & Webster, Boston, Mass., announce the opening of a Chicago office in the First National Bank Building. Mr. Arthur J. Veitch, formerly with Peabody, Houghteling & Co., is now associated with Stone & Webster and will have charge of the Chicago branch.

The San Francisco office of the General Electric Company is now permanently located in the Union Trust Building, San Francisco. Since the fire, the office has been located in the Union Savings Bank Building at Oakland, large temporary warehouses having also been erected in the same city.

A business man of Holland advises a United States consul that he desires to enter into correspondence with manufacturers of high-efficiency electric incandescent lamps, with a view of taking the agency for the Netherlands. The inquiry is No. 950, on file at the Bureau of Manufactures in Washington.

The Navy Department at Washington is calling for proposals until May 14th next for 15 I-T-E circuit-breakers of 400 amperes capacity for 220-volt circuits; 2,150 feet of ebonite in two-foot lengths, for the use of the torpedo station at Newport, R. I.; 500 sheets of mica, exactly 0.005 inch thick and six inches square, also for use at Newport, and 800 yards of lead-covered cable, navy standard, for delivery at the New York Navy Yard.

Charles W. Farr, founder and president of the Farr Telephone and Construction Supply Company of Chicago, has resigned the presidency and managership of that company to become the president and manager of a new company, 170-172 West Adams Street, Chicago. The new company will do a general electric supply business, having already secured some good agencies for different lines of electrical goods. It will manufacture and put on the market the Farr electric deep-sea sounding apparatus. The two companies are not connected in any way.

The National Pole Company of Escanaba, Mich., is a new company just organized to take over the cedar department of the Pittsburg and Lake Superior Iron Company of Escanaba. This department pertains to the manufacture and handling of poles and other forest products. The rapid development of the cedar department has made it advisable to separate it from the iron properties. The stockholders of the new company are identical with those of the Pittsburg and Lake Superior Iron Company, and with but slight change the management and officers are the same. The National Pole Company will establish yards on the Pacific Coast, with headquarters at Everett, Wash., and also in eastern states. It already has well-established yards in Michigan, Wisconsin and Minnesota. J. C. Kirkpatrick is president and general manager of the new company. H. W. Reade is vice-president and E. A. Hubbard is secretary.

Francis Raymond, well known to electrical men, is giving up his business of electrical specialties to go with the Sheldon School, co-operating with the Co-operative Electrical Development Association. This strong combination will devote its efforts not only to produce and improve high-class salesmen but to improve the personnel of factories, central stations and other electrical interests. Mr. Raymond was born in Detroit in 1870; graduated from the Michigan Military Academy in 1886, and in 1892 from Cornell with degree of M. E. and E. E.; took the General Electric "expert course" at Lynn; was a foreman of railway construction, leaving the General Electric Company in 1893 to go with the Columbia Incandescent Company as a salesman until 1896; was with the American Electric Heating Corporation (Simplex Electric Company) until 1897; Gregory Electric Company from 1897 to 1899; western sales manager for the General Incandescent Arc Light Company from 1899 to 1905, since when he has been in business for himself. He is an associate member of the American Institute of Electrical Engineering, Western Society of Engineers, Sons of Jove, Chicago Athletic Association, Military Order of the Loyal Legion. He is a Mason, first vice-president of the Business Science Club, secretary of the Electrical Salesmen's Association, etc.

The Williams & Bernhard Company, commercial engineer and sales agent, opened its offices in St. Louis on April 15th. The purpose of the new company is to afford manufacturers of electrical apparatus expert representation and to act as general sales agent, marketing the entire output or acting as local sales agent in St. Louis territory. The principal figures in the company are Guy V. Williams and John H. Bernhard, both of whom have had a valuable experience. Mr. Williams entered the electrical field in 1896 in St. Louis as city salesman for the International Electric Company, and later he became connected with the Columbia Incandescent Lamp Company as its traveling representative in the states of Iowa, Minnesota and Wisconsin. He established this company's branch office in Minneapolis. In December, 1899, Mr. Williams accepted a position with the Bryan-Marsh Company of New York as northwestern manager, and established a district office in Minneapolis, which he successfully conducted until the latter part of 1902, when he was transferred to New York to become general manager of the eastern division of that company, including the two important district offices at Boston and Philadelphia. In the meantime the National Electric Lamp Association was organized, and took over the Bryan-Marsh Company, together with some others, and during the formative period of the new company Mr. Williams had to meet and solve many peculiarly difficult and delicate situations. In May, 1905, the Westinghouse Lamp Company, then the Sawyer-Man Electric Company, was undergoing reorganization, and Mr. Williams accepted a position on its staff as technical adviser to the sales department, in which capacity he took an active part in the reorganization, which has been so successfully accomplished. This position he now relinquishes to engage in his new venture with Mr. Bernhard. Mr. Williams is an associate member of the American Institute of Electrical Engineers and charter member of the Illuminating Engineering Society. Mr. John H. Bernhard is a native of Holland, where his father owns and operates a large shipbuilding company. He graduated in 1900 as mechanical, and 1901 as electrical engineer, and immediately set about to supplement his technical education with practical experience to be gained only in the workshops and at the bench. After a varied technical experience in great Britain and on the Continent he came to the United States in 1905 to study American manufacturing and commercial methods. In furtherance of this purpose he engaged as a traveling salesman for an electrical jobbing house, which position he now relinquishes to engage with Mr. Williams in the new enterprise. Mr. Bernhard is an inventor, holding European patents and having pending in the United States Patent Office applications for others. He is also an excellent linguist, speaking fluently Dutch, English, French and German. With such a record for experience and achievement, these two young men enter their chosen field of work with every prospect of success.

BUSINESS.

The Blake Signal and Manufacturing Company of Boston has appointed the Erner & Hopkins Company of Columbus, Ohio, agent for the state of Ohio for its tube flux.

The Electrical Mechanics' Development Company of Asbury Park, N. J., has been capitalized at $100,000 to deal in electrical devices. Oliver H. Brown and others are the incorporators.

The Washington Electrical Supply Company recently organized at Spokane will carry a large stock, it is said. The incorporators are Lester M. Simpson and W. C. Jones of Spokane, and R. C. Kemp of Butte, Mont.

W. N. Matthews of W. N. Matthews & Bro., St. Louis, manufacturers of the Stombaugh guy anchor, Kearney cable clamps and other well-known specialties, was a Chicago visitor last week. Mr. Matthews said that so far this year business had been exceptionally brisk.

"When your interest has taken the form of a final decision in favor of demanding only telephone and switchboard cords that will give the best service, command us to serve you. You may be overcharged for something good, but you never get a poor thing cheap. Stromberg-Carlson cords are serviceable, well made, properly designed, finest quality; there is no reason preventing you from ordering some of these cords today." Enclosed with the above the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., is sending out an illustrated booklet, "Cords," that tells the whole story of how, why, where and when Stromberg-Carlson cords are made.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 23, 1907.

850,904. Electric Curling Iron. Jacob L. Burgard, Chicago, Ill., assignor of one-half to Herman Bollin, Chicago, Ill. Application filed April 5, 1906.

In a curling iron are combined a pair of pivoted jaws each having a handle attached thereto, a resistance coil inside each working jaw of the iron and insulated therefrom, electrical connection between one terminal of each resistance coil and wires connecting the opposite terminal of each resistance coil to a source of electrical energy.

850,912. Process of Making Articles by Electroplating. Thomas A. Edison, Llewellyn Park, Orange, N. J. Application filed October 5, 1903.

The process of making hollow, seamless articles consists in coating a former with a wax-like material, applying a conducting coating thereto, electroplating a [illegible] copper on the conducting coating, applying electrolytically a coating of iron to the copper deposit, applying heat to melt the wax-like material and permit the composed coating to be removed, and finally separating the copper deposit from the iron. The process may be employed specifically for making a storage-battery can or receptacle, for the electrodeposition of iron and for manufacturing steel.

850,913. Secondary Battery. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Original application filed November 28, 1902. Divided and this application filed December 7, 1903.

In a storage battery are combined with a can and [illegible] therein, an escape tube in the top [illegible], [illegible] in the tube, a casing carried by the [illegible] tube, and a [illegible] diaphragm for the casing.

850,917. Space Telegraphy. Lee de Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Application filed January 29, 1907.

In a space telegraph transmitting system are a circuit [illegible] and an electrode, a casing having the electrodes secured therein, a quantity of water in the casing, and members of good heat conductivity secured to one of the electrodes and projecting into the water. (See cut on next page.)

850,924. Electric Heater. Edward E. Gold, New York, N. Y. Application filed May 4, 1906.

Combined with an electric heater is a junction box therefor having a pair of openings for receiving a pair of parallel wires, and having also a single opening for receiving a wire entering or departing in a transverse direction to the direction of the wires.

850,926. Electric Motor. John B. Gury, St. Louis, Mo. Application filed July 16, 1906.

The motor comprises a rotatable armature provided with shaft, a pinion on shaft having a ratchet connection therewith, a manually operable slide bar having a toothed ratchet adapted to engage the pinion, whereby the armature is adapted to be rotated when the slide bar is actuated in one direction, the slide bar having a circuit closer mounted thereon, terminal contacts located in the path of the circuit closer and normally disconnected from each other in a normally open motor circuit, the circuit closer being adapted to engage and connect each of the terminal contacts to close the motor-circuit after the armature has started to rotate.

850,937. Automatic Control System for Elevators, etc. Benjamin N. Jones, East Orange, N. J., assignor to the Marine Engine and Machine Company, Harrison, N. J. Application filed April 29, 1903.

In a system of electric control, combined with a motor circuit and means for varying the resistance in the motor circuit, are a time-interval magnet comprising a coil, a core, a conducting plate loose upon the core, a pair of terminals or contacts in the circuit through the coil, a second pair of terminals or contacts connected with the means, the plate being adapted to be moved from one pair of terminals to the other pair.

850,938. Exercising Apparatus. John H. Kellogg, Battle Creek, Mich. Application filed November 16, 1905.

The apparatus described consists of a dumb-bell comprising an electric motor inclosed in a casing forming one of the dumb-bell balls, a padded ball, a handle or grip connecting the motor-casing thereto, a shaft for the motor, and a weight arranged on the shaft to throw the same out of balance.

850,944. Electroplating Solution. Richard H. Marshall, Scottdale, Pa., assignor of one-half to Albert H. Kelley, Scottdale, Pa. Application filed October 18, 1906.

The solution contains double cyanide of a metal of the nickel group and double cyanide of silver, each of the metals being present in the solution in a quantity in excess of any other metal than the metals mentioned.

850,947. Controlling Device for Electric Motors for Driving Sewing Machines, Small Lathes, etc. Albert H. Midgley and Benjamin Reed, London, England. Application filed January 31, 1906.

In the device described combined with the motor are a switchboard having a number of resistance contacts arranged on the arc of a circle, a resistance having connections with the individual resistance contacts, a group of auxiliary contacts arranged on the arc of a circle beyond and connected with one of the terminals of the resistance contacts, a field-wire connection from the motor field to the resistance contacts, and a sector contact included in the supply circuit and having a connection with the motor armature.

850,972. Wireless Receiving Apparatus for Exploding Mines. Ferdinand Schneider, Langenfeld, Germany. Application filed January 3, 1906.

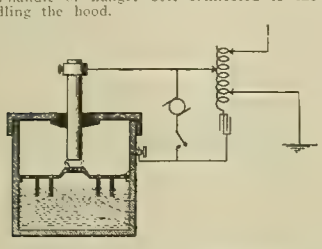
The receiving apparatus for explosive submarine and land mines adapted to be exploded with the aid of electric waves, comprises a mine chamber, an exploding device arranged in the chamber and sensitive to electric waves, and long insulated receiving wires connected with the exploding apparatus and arranged in such a manner that only the free ends thereof extend into the atmosphere, the other portions of the cables being situated below the surface of the water or earth.

851,003. Electric Arc Lamp. Otto Gross, Longsight, Manchester, England. Application filed December 20, 1904.

In combination with arc lamps having converging carbon tubes, arc a moving arcing plate upon which the carbons fall, a connection from the cross head, a turn buckle, a link, a bell-crank lever, a swivel connection and an arm, and a bearing for the arcing-plate support, the arcing plate being constantly and correspondingly influenced by a movement of the core.

851,009. Arc Lamp Hanger or Support. James E. Joyce, Hoboken, N. J. Application filed November 25, 1905.

In the device described combined with an arm are a sleeve of insulating material carried by the arm, a hood held upon the sleeve, a hook connected to the hood, and a bail-handle or hanger bolt connected to the arm and straddling the hood.



NO. 850,917.—RADIO-TELEGRAPHY.

851,024. Fixture for Electric Lamps. James B. McGinley, Allegheny, Pa., assignor to the National Metal Moulding Company, a corporation of Pennsylvania. Application filed February 19, 1906.

The fixture has a base formed of insulating material and provided at its ends with recesses for the reception of the ends of conduits and with grooves in its upper face connecting the recesses, contact plates projecting into the grooves provided with means for connecting the conductors to the plates.

851,027. Spark Coil. Charles P. L. Noxon, Syracuse, N. Y. Application filed February 5, 1906.

Combined are a primary circuit, a secondary circuit, mechanical means for making and breaking the primary circuit, means for interrupting the current in the primary circuit comprising an armature, the primary circuit including a number of electromagnetic means each having a core, the cores being independent of each other. The electromagnetic means operate to attract the armature to interrupt the current in the primary circuit and to hold the armature in its position assumed when interrupting the current while the first-mentioned means is making the circuit.

851,029. Trolley Retriever. Simeon F. Pierce, St. Paul, Minn. Application filed October 30, 1905.

In combination with a trolley pole are a cylinder, a piston and piston rod working therein, spring connection between the trolley pole and piston rod, means normally locking the piston rod in position to hold the trolley pole raised, and means actuated by an upward movement of the trolley pole to release the locking means.

851,031. Electrical Impulse-counting Switch. Homer J. Roberts, Evanston, Ill. Application filed November 4, 1905.

An automatic impulse counter comprises a spring-returned ratchet wheel, an escapement controlling the ratchet wheel, a magnet for actuating the escapement, circuit connections for the magnet, a working circuit, and means for sending pulsations of opposite polarity alternately through the magnet and over the working circuit.

851,032. Electric Fuse. Ulysses G. Rogers, Columbus, Ohio, assignor to Jacob Bernhard, Columbus, Ohio. Application filed May 17, 1906.

In an electric fuse are combined with an inclosing shell for the reception of the fuse wire, an arc-preventing device within the shell consisting of two strips of a non-conductor of electricity bent back and forth transversely on each other to form pockets, the pockets dividing the interior of the shell transversely.

851,046. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed March 20, 1905.

In an ore concentrator, combined with a revolving magnetic cylinder having means for causing flux dispersions at its periphery, are a magnet pole below the cylinder, a support forming a passage-way between the cylinder and magnet pole for the materials to be separated, a divider for separating the attracted from the non-attracted materials, a vessel adapted to contain a fluid medium surrounding the operating portion of the cylinder, and means for imparting a vibratory motion to the fluid medium.

851,051. Heat Coil. Arthur H. Adams, New York, N. Y., assignor to the Western. Electric Company, Chicago, Ill. Application filed October 9, 1905.

In a protector for electric currents, combined with a protector strip, are a heat cartridge and a support for one end of the cartridge, the support being constructed to engage the said strip and being reversible with relation to the cartridge.

851,071. Automatic Telegraphy. Albert C. Crehore, Tarrytown, N. Y., and George O. Squier, Washington, D. C. Application filed July 12, 1902.

The method described of telegraphing by an alternating-current generator, consists in sending a prolonged signal by first permitting a pulse of the generator of one polarity to flow to line, then suppressing pulses to cause the signal to be lengthened by the charge produced by the initial pulse, and finally permitting a pulse of the generator of the opposite polarity to the initial pulse to flow in order to terminate the signal. (See cut.)

851,074. Advertising Sign. James M. Dennis and Harry R. Dennis. Richmond, Ind., assignor to the New Castle Electric Sign Company, Newcastle, Ind. Application filed July 13, 1906.

The sign includes electric lamps with mirrors in front of them for directing the light from the lamps into the faces of wire screens.

851,086. Door-controlled Electric Elevator System. Richard H. Gay, Conesville, Iowa. Application filed June 29, 1906.

In an electric control for elevators, combined with a motor and its circuits, are solenoid controlled switches for the motor circuits, a rheostat, a hand-controlled master switch for directly controlling the rheostat, shunt circuits in which the solenoids for controlling the motor circuits are located and a door-controlled switch operatively associated with and positioned in the shunt circuits.

851,090. Telephone Meter. Newman H. Holland, Brookline, Mass., assignor to Charles Bate, Boston, Mass. Application filed June 8, 1903.

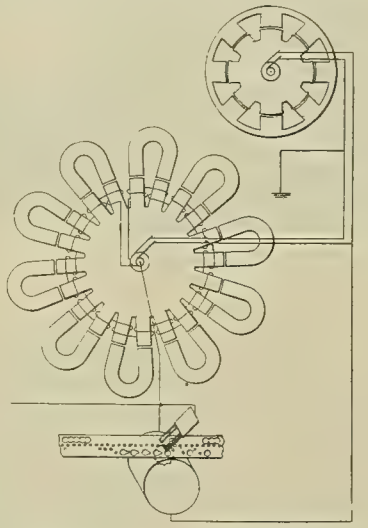
Combined with an actuating pawl and its operating member are a controlling device for the pawl, a locking member of the controlling device, and electromagnet cooperating with the locking member, a circuit for the electromagnet, and an automatic switch in the circuit operated by the controlling device.

851,111. Apparatus for Cleaning Ships. Charles E. Arnold, Brunswick, Ga. Application filed Nober 17, 1905.

In a hull cleaning device for ships are a rectangular tool carrying frame, a rotary cleaning tool mounted therein, means for driving the tool, an electromagnetic element secured to each corner of the frame and having the pole pieces provided with enlarged rounded ends constituting runners for the device, and leading-in wires for the magnetic elements.

851,149. Leakage Indicator for High-tension Lines. Jonathan E. Woodbridge, Rugby, England, and John B. Taylor, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed November 21, 1904.

In a leakage indicating means for transmission lines are a suitable current indicator actuated by a magnetomotive force, and means for producing a deflection of the indicator whenever the algebraic sum of the outgoing and returning currents of the transmission line has at any instant a value other than zero. (See cut.)



NO. 851,071.—AUTOMATIC TELEGRAPHY.

851,156. Galvanometer. Joseph Broich, Brooklyn, N. Y. Application filed June 27, 1906.

In a galvanometer, combined with a field magnet and a core in fixed relation with each other, are a movable coil shiftable into contact with one end of the core, means for supporting the movable coil, an arresting device carried by the core for holding the movable coil in a fixed position in contact with one end of the core, and means for holding the arresting device out of action.

851,157. Electric Fuse or Cut-out. Leonard B. Buchanan, Woburn, Mass. Application filed May 28, 1906.

In an electric fuse or cut-out are a shell or case containing a fuse wire, a helical spring having an eye at one end through which the fuse wire passes, and a support for the spring upon which it is held compressed by the fuse wire, and a fuse indicator adapted to be operated by the spring when released.

851,174. Telautograph. Arthur Korn, Munich, Germany. Application filed January 25, 1907.

In a telautographic system, combined with a transmitting tracer and its platen roll, are a receiving platen roll, a device for projecting a ray of light on the receiving platen roll, a galvanometer comprising a horseshoe magnet, a frame between the poles of the horseshoe magnet, a conductor stretched therein and an intercepter on the middle of the conductor, the intercepter being adapted to render the device operative and inoperative, and electrical connections between the transmitting tracer and its platen roll on the one hand and the conductor of the galvanometer on the other hand, the transmitting tracer being adapted to open and to close the circuit.

851,175. Dumb Waiter and Elevator. Louis E. Laurent, Trenton, N. J. Application filed May 18, 1905.

An elevator mechanism, comprises an electrical driving apparatus, a controller therefor made up of a circuit-maintaining member operable in connection with the driving apparatus, a swinging member mounted adjacent to the circuit-maintaining member, slides movably mounted in the swinging member, circuit completing contacts carried by the slides, and means for locking the slides in contacting position.

851,190. Burglar Alarm. Charles L. Wilkins, Columbus, Ohio. Application filed March 15, 1906.

The alarm and indicator comprises a shaft, means mounted on the shaft adapted to rotate thereon, an arm secured radially to the means, means for supporting the arm against rotation, electrical means for withdrawing the support, a dial, a pointer, and means adapted to obstruct the path of the arm, whereby the pointer is made to designate the region of the building molested, the means being actuated by the molestation of the connected regions of the building.

851,214. Wrapping Machine. Milton H. Ballard, Lynn, Mass., assignor to the Tripp Fruit Wrapping Machine Company, San Francisco, Cal. Application filed April 20, 1906.

In a wrapping machine are a paper-feeding device, a paper-cutting device to which the paper is fed by the feeding device, a stop motion for the machine, an electromagnet for operating it, a circuit for the electromagnet, a circuit-operating lever therefor located between the feeding device and cutting device, and adapted to be operated by the paper wrinkling between the devices.

851,218. Cigar Lighter. Charles E. Bessel, Jersey City, N. J. Application filed March 16, 1906.

The device comprises a supporting plate, a wire of high-electrical resistance arranged in a coiled shape on the supporting plate and means for holding the coiled wire flat on the plate.

851,222. Insulator Clamp. Walter G. Clark, Seattle, Wash., assignor to the Clark Electric and Manufacturing Company, a corporation of New York. Application filed September 2, 1905.

Combined with a grooved insulator and conductor are detachable means movably secured to the insulator for clamping the conductor, the means consisting of two cooperating clamping members encircling the insulator, and means for securing the members to each other and to the conductor.

851,239. Controlling Device for Electric Motors. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed September 27, 1904.

Combined with a motor having an armature and a shunt field are a resistance, an extra shunt field, circuits and contacts arranged when closed to connect the resistance across the armature of the motor and to energize the extra shunt field, and a magnet which closes the contacts whenever the speed of the motor gets excessive.

851,266. Line Selector of Intercommunication Telephone Apparatus. Franz Walloch, Berlin, Germany. Application filed November 22, 1904.

In a line selector, combined with a casing, are fixed contacts on the casing for connection with the line wires, a selector lever, a spindle on which the lever is secured, the spindle being rotatably mounted in the casing and slidably guided therein to permit the selector lever to pass over the contacts without touching the same, and means tending to bring the selector lever in engagement with the fixed contacts.

851,283. Hair Drier. Charles O. Falkenstrom and Uno L. Sundblad, Branford, Conn. Application filed December 20, 1906.

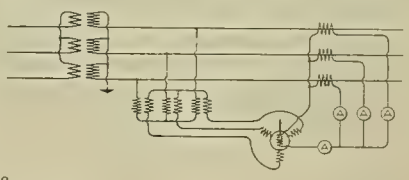
The hair drier comprises a box having a transverse partition, batteries below the partition, plugs passing through the partition and into electric connection with the batteries, a motor adapted to be supported by the box and electrically connected with the plugs, a box secured to the motor case, the shaft of the motor extending into the box, and fan blades secured to the shaft.

851,291. Starting Device for Hoisting Machines. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed July 23, 1904.

In a controller for electric motors are a starting resistance, an auxiliary resistance, a magnetic switch for controlling the auxiliary resistance, and a governing magnet for the magnetic switch, the governing magnet having two coils, one coil being connected to the auxiliary resistance and the other coil being in series with the motor armature.

851,336. Transmitter for Wireless Telegraphy. Georg von Arco, Berlin, Germany. Application filed June 27, 1905.

In a wireless telegraph apparatus are a transmitter, means for tuning the same, a sparking device for the transmitter, a detector responsive to current intensities, means for connecting and disconnecting the detector with the transmitter and its tuning means, and in parallel with the sparking device. (See cut on next page.)



NO. 851,149.—LEAKAGE INDICATOR FOR HIGH-TENSION LINES.

851,337. Warp Stop-motion for Looms. Edwin Barnes, Boston, Mass., assignor to William Firth, Brookline, Mass. Application filed November 14, 1906.

In a warp stop-motion, combined with an electric terminal and guide below the path of the warp, and a second terminal above the path, is a counterweighted gravity drop slidably engaged with the first terminal and guide, and constructed to move inward under abnormal downward movement toward the second terminal.

851,340. Means for Bonding Electric Conductors. Harold P. Brown, Montclair, N. J. Application filed February 9, 1905.

In a bonding apparatus are a bonding crucible provided with a recess for the reception of the brazing material and that portion of the bond which is to be brazed or soldered and a chamber near the recess for the reception of a body of chemically-reacting, nongaseous, heat-producing material.

851,353. Primary Battery. Charles E. Hite, Burlington, N. J., assignor of one-fourth to Thomas J. Byrne, Philadelphia, Pa. Application filed May 17, 1906.

In a primary battery are a receptacle, a number of electrodes seated therein by means of grooves, a coating of insoluble non-conducting material covering one side of each of the electrodes and extending to the sides and

[illegible] adjacent the edges of the electrodes to form [illegible] partitions between a number of cells.

851,355. Telephone Transmitter. Stephen C. Houghton, Rome, N. Y., assignor to the Wire and Telephone Company of America, Rome, N. Y. Application filed March 7, 1907.

[illegible] described is provided with a face [illegible] through it, a disk covering the hole [illegible] provided with perforations at [illegible]

851,362. Signal Apparatus. Ernest de Mérindol Malan, London, England. Application filed December 5, 1906.

Combined with a roller having contacts thereon, and [illegible] contacts supported in position to be engaged by the contacts on the roller, are a shaft journaled [illegible] to the roller and having lateral projections, a spring connected to the shaft, and electrically controlled means for opposing the action of the spring.

851,375. Support for Electric Cables. George G. Raymond, New Rochelle, N. Y. Application filed December 22, 1904.

The support comprises in combination a transverse arm having a socket surrounded by a flange, and a longitudinal arm having at one end a flange arranged to hook over the first mentioned flange to hold the longitudinal arm in place.

851,392. Lightning Arrester. Alton W. Ball and Mark T. Seymour, Stow, N. Y. Application filed October 24, 1904.

The arrester described comprises a suitable support, a grounded wire plate on the support having an upturned end, a line wire plate on the support and extending over the upturned end and separated therefrom, a spring portion on the line-wire plate to allow increased separation and compel its return to normal position.

851,402. Dry Battery. Samuel Cochrane, Jersey City, N. J., assignor to the Lincoln Electric Company, Jersey City, N. J. Application filed January 10, 1906.

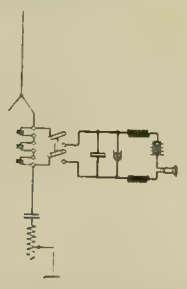
The battery comprises an outer cell of a fibrous material, saturated on its outer side with an insulating compound and on its inner side with an electrolyte, an electropositive element enclosed by the cell and in contact with the electrolyte saturated inner side of the cell, an electronegative element enclosed by the positive element and separated therefrom by a depolarizing agent.

851,403. Electric-lighting Device. Antone M. Cornelius, Chicago, Ill., and Willoughby V. Champlin, Rochester, N. Y., assignors to the Abet Manufacturing Company, Chicago, Ill. Application filed January 12, 1907.

In an electric-lighting device, in combination with a hollow handpiece, are a metallic socket and a terminal located in one end thereof, conductors extending into the handpiece and electrically connected at one of their ends to the terminal and socket and in communication with an electric supply.

851,410. Electro-thermal Switch. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 21, 1904.

An electro-thermal switch comprises a self-soldering heat-coil device, together with suitable switch contacts operated by the heat-coil device, the heat coil being adapted to be operated by abnormal current conditions, and to automatically resume an operative condition upon the cessation of abnormal current conditions therein, the switch having a number of axes of movement, one axis adapted to swing about the other to facilitate resetting of the structure as a whole.



NO. 851,336.—TRANSMITTER FOR RADIO-TELEGRAPHY.

851,415. Trolley. Charles Y. Haile, Uniontown, Pa. Application filed June 26, 1906.

Details are described.

851,420. Electro-thermal Switch. Richard B. Hewitt and James G. Nolen, Chicago, Ill., Nolen being assignor to Frank B. Cook, Chicago, Ill. Application filed June 5, 1903.

The switch includes a flexible metallic diaphragm, a confined body of air at one side of the diaphragm, a high resistance associated with the confined body of air, and circuit controlling contacts mounted at opposite sides of and opened and closed by the diaphragm.

851,440. Electrical Heating Element or Resistance. Edward G. Rivers, Richmond, England. Application filed June 11, 1906.

The plate described consists of a body portion of clay having one face thereof provided with a resistance material formed from a silicated carbon insert extending from the center of the body portion to the opposite edge thereof.

851,456. Block-signal System. Julian Van Zandweghe and Luis Viberti, Rosario de Santa Fé, Argentina. Application filed May 24, 1906.

In a block-signal system are combined a valve for controlling brake mechanism, a cam for holding the valve in a predetermined position, a spring for turning the cam, means for mounting a member of explosive material [illegible] the cam in another predetermined position, and electrically operated mechanism controllable by contacts of rolling stock for firing the member of explosive material.

851,458. Party-line Telephone System. Felton Vollmer, Winsted, Minn. Application filed November 22, 1906.

In a party-line telephone system are a talking circuit, contact mechanism for controlling the same, a revoluble shaft for actuating the contact mechanism, means for holding the revoluble shaft in a predetermined position for the purpose of allowing conversation to proceed over the talking circuit, and time-controlled mechanism for releasing the revoluble shaft.

851,461. Voltage Regulator for Series-wound Electric Generators. James W. Welsh, Edgewood Park, Pa. Application filed October 1, 1906.

The regulator described consists of a contact maker closing to offer a path for the flow of electric current around or in shunt with the field of the generator, an electromagnet having its coil connected across the generator brushes and its armature attracted to close the contact maker against a predetermined opposing force. (See cut.)

851,467. Means for Preventing Sparking. Frank W. Wood, Newport News, Va. Application filed January 2, 1907.

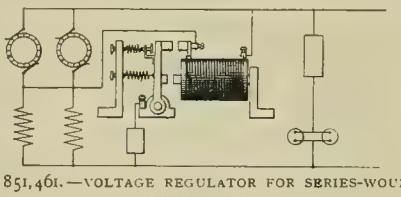
An electromagnet is provided with a number of superposed windings, wound in the same sense and connected in multiple, the resistance of each winding varying progressively, the convolutions of each winding also varying progressively but in inverse order. (See cut.)

851,492. Combined Lightning Arrester, Fuse-box and Insulator. Russel R. Burrin and Theodore F. Gaebler, Rockville, Ind. Application filed January 26, 1906.

The device consists of a fuse box having an elongated body with projecting arms at the extremities thereof with insulators formed thereupon for electric conductors, fastening devices passing through the insulators for attaching the device to a support, fuses within the box, and binding posts connected with the fuses.

851,500. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 12, 1902.

Combined with a trunk line are a cord circuit to connect with its outgoing end and a called subscriber's line with which its incoming end is adapted to connect, a supervisory signal associated with the cord circuit, a relay at the incoming end of the trunk actuated over a part of one side of the talking circuit, a testing circuit from the tip of the trunk plug completed through the normal contacts of the relay, and a second relay associated with the talking circuit and normally disconnected from the strand of the trunk cord.



NO. 851,461.—VOLTAGE REGULATOR FOR SERIES-WOUND GENERATORS.

851,506. Electric Fire Alarm. William H. H. Everett, Newton Falls, Ohio. Application filed September 22, 1904.

In the device described an alarm is given by means of an expansible fluid in a glass bulb causing contact points normally spaced apart to be brought into contact.

851,510. Massage Apparatus. George W. Fitz, Boston, Mass., and Frederic W. Hitchings, Cleveland, Ohio. Application filed March 3, 1906.

An applicator has an internal electrical heater, flexible conducting wires electrically connected with the heater and extending from the applicator, and a flexible cable enclosing the wires and provided with a wire wrapping at and adjacent to its junction with the applicator, and means for vibrating the applicator.

851,523. Automatic Block Signal. Newton C. Keeling, Bridgeport, Conn. Application filed October 31, 1906.

The block-signal system described comprises a switch mechanism and a signal at each end of a block, each switch mechanism comprising rotary, angularly-mounted contacts having means in the path of a trolley for rotating the same, co-operating contacts adapted to be alternately engaged by the rotary contacts, and circuit connections with the contacts for making and breaking the circuit through both of the signals.

851,552. Kickboard. William H. Nicolay, New York, N. Y. Application filed October 26, 1906.

Combined with a molding adapted to receive electric wires, are insulating tubes connected therewith, and a kick board adapted to enclose the lower end of the molding and the tubes.

851,560. Fuse-box. Charles Remelius, Newark, N. J., assignor to the Columbia Machine Works and Malleable Iron Company, Brooklyn, N. Y. Application filed February 6, 1907.

The device comprises a casing having an opening in the end thereof, a terminal connection within the casing, a swing arm pivotally mounted within the casing, electrical connection between the swing arm and the terminal connection, and a fuse device by which the swing arm is normally maintained in an operative position.

851,576. Controlling Mechanism for Belt Shifters. Alfred B. Wales, East Whitman, Mass., assignor of one-fourth to Edward W. McAllister and one-fourth to Ira W. Holbrook, Brockton, Mass. Application filed February 6, 1907.

In the apparatus described are a spring-actuated movable member, a pivotally mounted armature having a latch portion adjacent its pivot, a detachable connection between the latch portion and the spring-controlled member to retain the latter retracted, a detent to co-operate directly with and retain the armature in effective position, and an electromagnet to effect slight lateral movement of the armature and free it from the detent.

851,581. Motor-extension Receptacle. Gustav Willius, Jr., St. Paul, Minn. Application filed June 23, 1905.

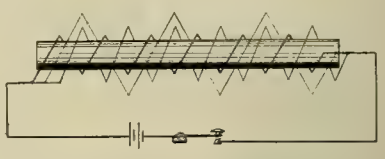
The device comprises a triangular member provided with an insulating handle and having an adjustable contact plate upon each side of the triangular member.

851,621. Wireless Signaling System. Simon Eisenstein, Berlin, Germany. Application filed August 25, 1905. Divided and this application filed July 3, 1906.

The system comprises a sending circuit, means for supplying a multiphase alternating-current to the sending circuit, an aerial conductor divided into as many branches as there are phases in the multiphase alternating current, and a spark gap in each of the branches.

851,627. Shade and Reflector for Electric Lights. Benjamin F. Norton, Eagle Grove, Iowa. Application filed July 2, 1906.

A conical shade and reflector for electric lights consists of two uniform mating parts hinged together at their tops and bottoms to swing apart horizontally, means for detachably fastening their free straight edges together so that the top of the cone will engage a lamp, a chain fixed to the outside and lower end portion of one of the mating parts of the cone and a hook at its top portion to support the chain and a clamp on the free end of the chain to be adjustably connected with a conductor.



NO. 851,467.—MEANS FOR PREVENTING SPARKING.

851,632. Motor. Paul Synnestvedt, Pittsburg, Pa., assignor to the Synnestvedt Machine Company, Pittsburg, Pa. Application filed May 7, 1904.

Combined are a four-pole motor having eight field windings, and means for commutating the strands of each coil, whereby the current is caused to traverse the windings first in series and then through the wires of each coil in parallel.

851,633. Electric Control Mechanism. Paul Synnestvedt, Pittsburg, Pa., assignor to the Synnestvedt Machine Company, Pittsburg, Pa. Application filed August 30, 1904.

An improvement in electric-controlling mechanism comprises in combination a number of magnetic poles, a number of windings on each pole and means for commutating the windings whereby adjacent windings on one pole may be put in multiple circuit and each winding in separate series connection with an opposite winding.

851,635. Manufacture of Magnetic Materials. Robert A. Hadfield, Sheffield, England. Application filed June 8, 1905.

A low hysteresis magnetic material contains iron with an addition of silicon and aluminum, the addition amounting together to form one-fourth to eight per cent. of the iron, and the proportion of aluminum amounting to from 25 to 75 per cent. of the silicon contents.

REISSUES.

12,640. Branch Box for Insulated Electric Wires. Morton Havens, Jr., Albany, N. Y. Application filed November 16, 1905. Original No. 775,037, dated November 15, 1904.

A branch box for wires comprises a hollow open body formed with one or more perforations for the passage of wires, a detachable cover formed with openings, detachable insulators in the openings, means carried by the hollow body which coact with the insulators to lock the latter in the box and means for fastening the cover to the box.

12,642. Spring Terminal Clip. John Schade, Jr., Brooklyn, N. Y., assignor to the Fahnestock Electric Company, a corporation of West Virginia. Application filed March 11, 1907. Original No. 845,268, dated February 26, 1907.

A fastening device for electrical conductors comprises a body member and a spring member, one of the members being provided with a hook tongue cut out of the body of the metal and adapted to coact with the opposite member to clamp a conductor.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on April 29, 1907:

426,437. Electric Heater. C. W. Drew and E. R. Frances, Minneapolis, Minn.
426,471. Brush and Holder for Electrical Machines. E. W. Rice, Jr., Lynn, Mass.
426,479. Apparatus for Manufacturing Electric-light Carbons. H. A. Tremains, Cleveland, Ohio.
426,499. Device for Measuring Electrical Currents. T. H. Hicks, Detroit, Mich.
426,522. Electrical Train Signal. G. D. Burton, New Ipswich, N. H.
426,554 and 426,555. Message-recording Instrument. J. C. Wilson, Boston, Mass.
426,573. Potential-controlling Device. W. Stanley, Jr., Great Barrington, Mass.
426,574. Regulation for Electric Motors. W. Stanley, Jr., Great Barrington, Mass.
426,576. Dynamo-electric Machine. J. Wenstrom, Orebro, Sweden.
426,583. Switch Apparatus. M. M. Davis, Brooklyn, N. Y.
426,591. Quadruplex Telegraphy. F. W. Jones, New York, N. Y.
426,621. Electrical Signaling Apparatus. J. U. Mackenzie, New York, N. Y.
426,650. Electric Engine. R. W. Thompson, Cleveland, Ohio.
426,657 and 426,658. Electric Motor Car. J. A. Brill, Philadelphia, Pa.
426,688. Electric Fire Alarm. C. H. Schaffer, Rockford, Ill.
426,705. Circuit-closing Hinge for Electric Burglar Alarms. W. M. Bleakley, Verplanck, N. Y.
426,708. Electric-railway Car. J. A. Brill, Philadelphia, Pa.
426,781. Electric Refrigerating Apparatus for Railway Cars. M. W. Dewey, Syracuse, N. Y.
426,819. Duplex and Quadruplex Telegraph. F. W. Jones, New York, N. Y.
426,917. Thermostatic Circuit Closer. W. H. Chambers, Fulton, Ky.
426,941. Telegraph Key. O. Kleber, Allegheny, Pa.
426,989. Apparatus for Electrical Communication. J. L. Cutler, Piketon, Ohio.

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Wireless Outfits for Army Use.

By C. H. Claudy.

In these days "wireless" is an integral part of the navies of all nations, and it is rapidly becoming a part of the army. Outfits are now to be had which weigh but little more than 300 pounds—which pack on mule-back—which can accompany small parties in the field, and be set up and used, and taken down again within the hour, keeping within touch of the larger column, the small scouting party which has hitherto been completely cut off, save by courier or field telegraph, or telephone lines.

The wireless outfit as supplied today to the United States Army by the Signal Corps is very compact and very complete; but it may, and probably will, be different tomorrow from what it is today, inasmuch as experimenting is still going on, and anything new which is demonstrated an improvement is speedily incorporated in the apparatus.

The means which have been used to overcome the difficulties in supplying this sort of an outfit in truly portable form are ingenious. A mast of some sort is an essential in this work, unless the antennæ are carried aloft by kite or balloon. The balloon is impractical, and the kite fails often when wanted on account of lack of wind, so that, for reliability a mast is a necessity.

Sixty feet in height has been adopted as the present standard mast height, more reducing portability by adding weight and less not being sufficient for an adequate radius. This 60 feet is made up by 10 sections of mast, each six feet in length, and jointed with socket and tenon at each end, so that they readily fit together. A continuous strip of metal, forming the electrical conductor, runs up the side of the completed mast. Three sets of guys radiate from the mast at 90-degree intervals, besides a fourth set of wires, spread to poles, guy-supported, forming the ground.

The apparatus itself is packed, permanently, into a trunk, and is of such size and weight that it is easily carried on mule-back, packed on the ordinary aparajo used in mule transportation. One mule carries the trunk with the electrical instruments. Another carries two storage batteries, and a third carries the 10 sections of the mast and a bag containing pins, pegs, ropes, etc. The tent is not an integral part of the apparatus; its use is indicated as a protection from dust and from water, but the apparatus could be used without it.

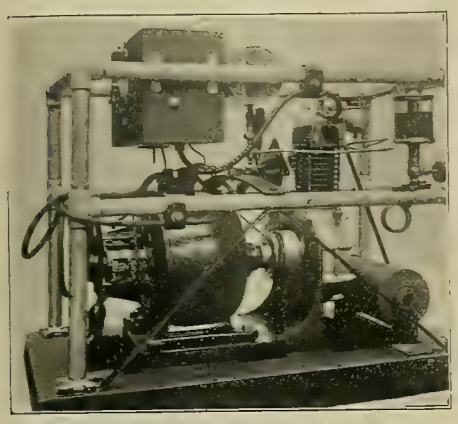
In addition, one or more King kites are supplied with the outfit, they being quick and easy means for sending an antenna up, if there is wind enough.

It is sufficiently obvious that storage batteries, no matter how compact and well made, are not available for constant sending without recharging. For this purpose a portable generating set is supplied, which goes easily in an army wagon, and follows a column, with the rest of the supply train. Any large body of troops must have a supply train, and these supply wagons must have either smooth country or some sort of roads on which to travel. So that wherever large columns can go, there the charging plant can go also.

The batteries are sufficient for 10 hours of continuous sending. They, with the 60-foot height of mast and the type of apparatus used, are sufficiently powerful to send a message which can be picked up at a distance of from 15 to 25 miles by a similar station or at a distance of more than 100 miles by a large station. By the use of such a large station messages can be relayed for long distances. A field party, for instance, out of reach of headquarters, could send a message to any large station within reach and have the message sent on from there, a factor of importance when the large number of big stations all over the country and particularly along the coast is considered.

In setting up the apparatus and particularly in erecting the jointed mast, a drill is necessary if the men are to make time. The writer observed the experiments made with a new rig of guys on the mast at Fort Myer, near Washington, D. C. Here a detail of 10 men, without previous experience, erected the mast inside of half an hour. With practice, each man having a position and specifically understood duties, this time can easily be reduced to 10 minutes and even less.

The guys are first laid out straight with men at the end and the top section is fitted to the next one and raised in the air, men at the ends of the guys steadying the whole. The guys, of course, are broken with double insulators to prevent leaks. The mast is projected skyward wich successive sections fitted in beneath until a section also with guys is reached, which requires more men. Finally, with the eighth section, a third set of guys is brought into play, and the mast, 10 sections high, is held in place with three sets of four guys each. After adjustments for tightness of guys are made so that the mast is straight, pegs are driven and the guys tied. The upper set of guys is partly com-

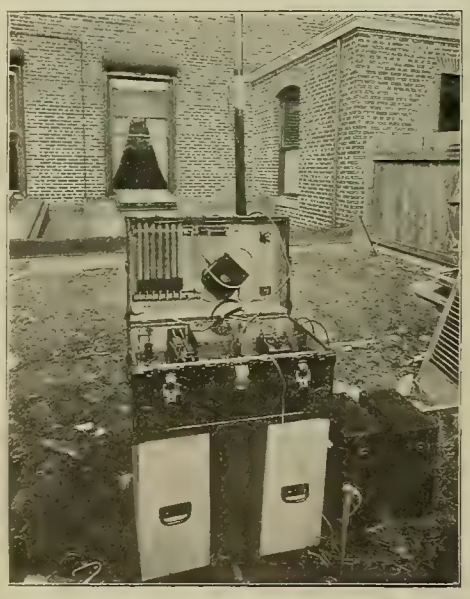


Portable Gasoline Engine and Dynamo in Supply Train for Charging Battery.

Jointed Mast, Guys and Antennae Packed for Transportation.

A Field Station.

Erecting Mast and Antennae in the Field.



Portable Sending and Receiving Instruments. The Set is a Load for One Mule. Batteries (shown at right) are Packed in White Boxes on which Instrument Case is placed. They Form Another Mule Load.

WIRELESS OUTFIT USED BY THE SIGNAL CORPS OF THE UNITED STATES ARMY.

posed of wire which forms an umbrella antenna, giving a large spread without extra weight or apparatus.

The mast in position, nothing remains to do but open the trunk, connect with the batteries and with the mast and ground, and communication is immediately opened. The wave length is in the neighborhood of 200 meters, varying, of course, with different models and different conditions.

If there is wind and a rush is a necessity, the kite is used instead of the mast. These kites, made both eight by eight and six by six feet, are combinations of the Malay flat kite and the box or Hargeave kite, and are the invention of Sergeant King of the Signal Corps. They require no tail, rise quickly in a very light breeze and are very steady. They roll up when not in use and are erected in a moment—one stick stretching the width and two the length. The width stick removes by untying some cords.

The kite is flown to a bridge and rides on a cord of 42 strands of phosphor bronze wire surrounding a hemp center and weighing very little. The wire is wound on a hand reel, and as 500 feet is sufficient elevation for most work the time required

COMBINATION OF MALAY AND BOX KITE USED TO SUPPORT ANTENNA FOR WIRELESS IN UNITED STATES ARMY.

to send up the kite, given only a steady breeze, is a matter of moments. The wire cord acts as the antenna and is connected to the apparatus as are the antennæ from the mast when that is used.

Wireless outfits have not seen much service in the field in this country, although they have been and will be used in army maneuvers, but the practical advantages of keeping one part of a division in continual touch with another set without the trouble, expense and difficulty of maintaining a wire communication are too obvious to need comment. The use of various detectors forms a part of the experiments now being carried on, although the acid detector is the one from which the most favorable results have been obtained. The apparatus, of course, has been simplified as much as possible, and while by no means foolproof is yet easy to operate with a little practical knowledge and is compact and durable in the extreme.

Every nation of any degree of importance as far as its army is concerned is experimenting with some modification of the wireless in portable form, but none has as yet succeeded better than our own Signal Corps in reducing size and weight. Further experiments are going on all the time, and the tests to be made this summer will undoubtedly furnish material for new arrangements and condensations in an apparatus already many times smaller and lighter than would have been deemed possible a few years ago.

Municipal Operation Illegal in Michigan.

Municipal ownership in Michigan has received a "knockout" blow in the State Supreme Court, it having been decided that under the constitution and the law of the state, municipalities cannot engage in any work of internal improvement. Contending that the city of Detroit had power to construct street-railway tracks, the Common Council made an appropriation for the construction of a short piece of track. The attorney-general, at the instigation of a citizen, obtained an injunction restraining the council from proceeding with the work. The injunction is made permanent by the decision of the Supreme Court.

Rehabilitation of Chicago Street Railways.

Charles V. Weston has received the appointment as the representative of the city of Chicago on the Board of Supervising Engineers, which will have charge of reconstructing the street-railway systems.

CHARLES V. WESTON.

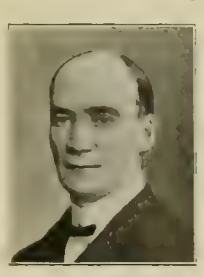
Like the other members of the board, Mr. Weston is thoroughly competent and well equipped for the service he is called upon to perform. He has lived in Chicago since 1888, being at that time with the Chicago and Northwestern Railway. He has been chief engineer of the Northwestern, Lake Street and Union Loop elevated roads and is now chief engineer of the South Side Elevated. Among other engineering work which he performed in Chicago was the building of the Lake View intake crib and the Van Buren Street Tunnel. Mr. Weston is thoroughly familiar with local transportation problems and his engineering training covers a wide field. Before coming to Chicago he did engineering work for railroads in the West and Southwest. He is 50 years old, born at Kalamazoo, Mich., where he received his early education. He is a member of the American Society of Civil Engineers and of the Western Society of Engineers.

Harvey B. Fleming has been selected as the representative of the Chicago City Railway Company on the Board of Supervising Engineers which is to have charge of rehabilitating Chicago's street-railway lines under the traction settlement ordinances. Unless the Union Traction interests also name Mr. Fleming, the board will have four members, each of the company representatives having one-half of a vote. Mr. Fleming, although a young man, is known as a competent engineer of original and progressive ideas. He has for several years been the chief engineer of the Chicago City Railway Company, having been in the company's employment since 1900. His engineering education was obtained at Washington University, St. Louis, where he did post-graduate work after obtaining his degree as a bachelor of science and master of engineering. For a time Mr. Fleming did engineering work in the water department of St. Louis and later for the St. Louis Transit Company and the National Railway Company. He is 34 years old, and a member of the Western Society of Engineers and of the American Street and Interurban Railway Engineering Association, being on the executive committee and standardization committee of the latter association.

HARVEY B. FLEMING.

George Weston, a brother of Charles V. Weston, has been appointed assistant chief engineer of the board.

The Board of Supervising Engineers which will have charge of reconstructing the street-railway systems is now complete and ready to take up its work. It consists of Bion J. Arnold, chairman and chief engineer, named in the settlement ordinances; Charles V. Weston, representing the city, and Harvey B. Fleming, representing the Chicago City Railway Company, while George Weston is assistant to Mr. Arnold. Prof. M. E. Cooley of the University of Michigan, who was strongly considered to represent the city on the board, has been retained as consulting engineer in the preliminary stages of construction. Permanent offices for the board will be fitted up in the Borland Building, where work will be taken up at once.



GEORGE WESTON.

Mr. Arnold and his assistant have already prepared a large amount of the plans which the board will now pass upon. There are many problems to receive attention, trackage and power supply being the first. The work will probably be divided in this order:

Division of trackage and roadbed, to carry out the reconstruction of the tracks under the direction of an assistant engineer; division of electrical power, to work out the problems of the distribution of the power required for the new system under the direction of an electrical engineer; division of power house construction, to supervise the building of new power houses if it is decided to manufacture instead of purchase current; division of cars and operation, to supervise the rehabilitation of all rolling stock and put into effect through routes and other service regulations; division of subways, to have charge of the construction of the underground street-railway system as soon as authorized by the City Council and in the meantime to supervise the rebuilding of the river tunnels in conformity with that plan; division of accounting and auditing, to have charge of all bookkeeping, including the division of receipts between the city and the company.

The Union Traction Company has not yet worked out its internal difficulties, but it is said that the plan for merging the various North and West Side interests into the Chicago Railways Company is making satisfactory progress and will be accomplished by the time the engineers have the plans ready for these lines.

The Chicago Commercial Association is furthering a plan eventually to remove all steam-railroad terminals to the outskirts of the business quarter of the city. A committee of the club held a meeting on May 1st which was attended by a number of traction officials and business men, who discussed the project. The plan is to work out such a comprehensive and adequate transportation system in the downtown district as will induce the railroad companies to move their terminals to the outskirts and still offer quick access to the business quarter.

B. J. Arnold explained a double-deck subway system he has worked out for the Loop district which could be extended north or west of the river to reach whatever railroad stations might be located there. The present traction settlement ordinances include two east-and-west and two north-and-south subways in the Loop district. These have been so planned that if constructed separately they can later be incorporated in the larger double-deck system. Mr. Arnold will urge the city and the companies to construct the smaller system at once.

The opinion was expressed at the meeting that it will be necessary in a few years to have a subway in the entire downtown district, and all construction and reconstruction work of the Board of Supervising Engineers will be done with this ultimate result in view. The steam-railroad men seem to think that in order to furnish passengers quick and easy access to and from outlying stations it will be necessary to tunnel most of the downtown streets and build numerous extensions north and west of the river. This will be the aim of the Commercial Club, and, although a tremendously large project, its officers are convinced that in order to relieve present congestion and properly provide for future growth all street-railway traffic in the congested district must go to subways and the railroad terminals eventually moved further out.

The first move is to be the establishing of a boulevard belt inclosing the central portion of the city, within Twelfth Street on the south, Halsted on the west and Chicago Avenue on the north, the railroad terminals to front on this boulevard. Then the leaders of the movement will co-operate with the city and the traction interests in planning a system of underground rapid transit to be submitted to the railroads as an inducement to retire the terminals to the outskirts of the business section.

A "Getting Together" in La Crosse.

The fierce war in La Crosse, Wis., between the several public-service corporations which has been waged for the last five years, has been brought to a satisfactory close by a uniting of all the interests. The clearing of the situation is brought about by the uniting of the several companies which have operated heretofore and include the Brush Electric Company, the Edison Light and Power Company, the La Crosse Gas and Electric Company, the Central Electric Company and the Wisconsin Light and Power Company. The combined properties furnish gas, electric light and power for private and municipal purposes and hot-water heating and have the following staff of officers: President, D. G. MacMillan; vice-president, C. J. Felber; secretary, P. M. Gelatt; general manager, C. H. Williams.

In order that the question of rates may be settled on a just and equitable basis for both the public and the operating company, the City Council has been invited to investigate the books and affairs of the company and determine the prices which shall be adopted for the future.

Wireless Signaling System for Railroads.

Several forms of radio-telegraph railroad signaling systems have been proposed and a number of tests have been carried out with only partial success. As an improvement in such a system Mr. Frank W. Prentice of Chicago has been granted a United States patent, No. 843,550, on an invention which relates more particularly to cab and block-signal systems employing Hertzian waves for controlling signal devices upon a car or engine to indicate the condition of the right-of-way with respect to the presence or absence of other vehicles or with regard to any of the usual conditions of danger or safety of the track within prescribed limits.

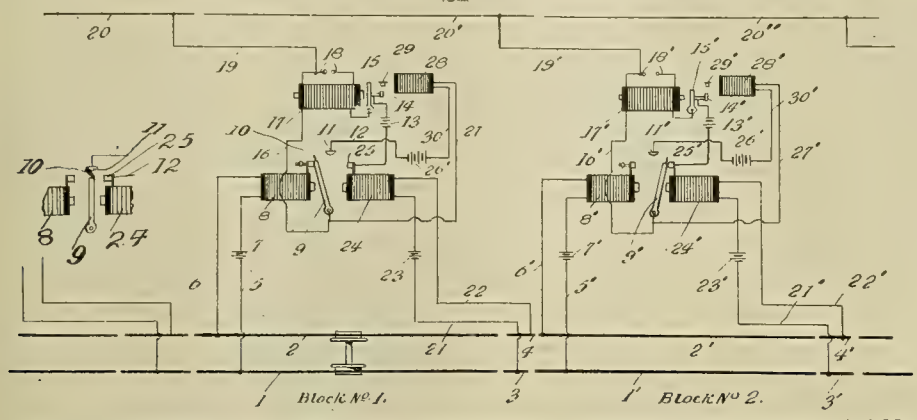


FIG. 1. WIRELESS SIGNALING SYSTEM FOR RAILROADS.—DIAGRAM OF SECTIONAL CAB AND BLOCK SIGNALS.

To this end the invention comprises a generator or transmitter of electrical oscillations for each block or section of the road, which is normally operative when conditions of safety maintain in the block or section to be guarded and is rendered inoperative or inert when conditions of danger exist, and receivers on the cars or engines influenced by the oscillations and adapted to control signal devices which indicate whether the section is "safe" or "blocked."

Generically the invention comprises a cab and block system in which "safety" is indicated in a given block by the generation of oscillations in the transmitter controlling such block and in the car or cab by signal devices controlled by a receiver influenced by such oscillations, and "danger" is indicated by the absence of such oscillations and a consequent non-action of the receiver in the car or cab.

In the accompanying drawings, Fig. 1 is a diagrammatic representation of a sectional rail cab and block signal system embodying the invention upon the east-bound track of a double-track railroad. The small drawing at the left is an enlarged fragmentary detail of the track relays and the contacts controlled thereby.

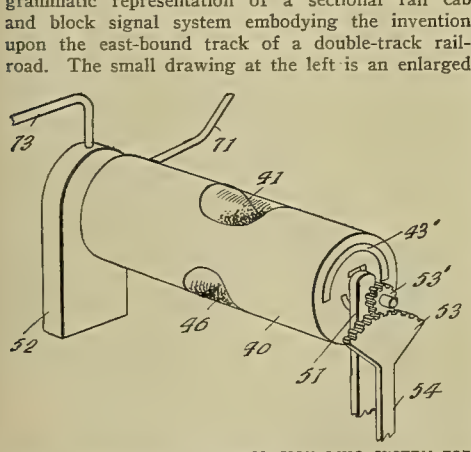


FIG. 2. COHERER OF WIRELESS SIGNALING SYSTEM FOR RAILROADS.

Referring to Fig. 1, (1) (2) and (1′) (2′) indicate the rails of two adjacent blocks or sections into which the track is divided, the sections being designated "Block No. 1" and "Block No. 2," respectively. It will be understood, of course, that the west-bound track is similarly equipped, the apparatus being in reverse position to that shown in Fig. 1. In using a single track or line of road for moving trains in both directions on the one track or line of road, each side of the track is equipped with apparatus, as shown in Fig. 1, one on one side for west-bound and on the other side for east-bound trains. The entire track or road is similarly divided into blocks or sections of any desired or prescribed length, each block defining the limits within which but one train is allowed at one and the same time under proper conditions of operation, as will be understood by those skilled in the art.

Bridging the rails (1) and (2) of block No. 1 is a magnet (8), connected to the respective rails by wires (5) and (6) and including a battery (7). The magnet (8) controls a pivoted armature (9), which normally engages a contact (25), forming one terminal of the circuit of an emitter or generator of Hertzian waves or electrical oscillations (17), which circuit includes a conductor (12), battery (13), back contact (14), and armature (15) of induction coil (17), and wire (16), which leads from the other terminal of the induction coil (17) to armature (9).

When block No. 1 is not occupied by a car or train, armature (9) is attracted from magnet (8), closing the circuit through the induction coil or transmitter (17) and sending a series of electrical oscillations generated at the spark-gap or terminals (18) of the secondary by way of conductor (19) to an overhead wire or conductor (20), paralleling and coextensive with the track section or block in rear of block No. 1. As long as block No. 1 is unoccupied these oscillations are generated and conducted along the wire (20), which serves the same purpose as the ordinary aerial to indicate upon any train or car entering the rear section by apparatus to be hereinafter described that a condition of safety maintains in block No. 1. When a train or car occupies block No. 1 the wheels of the train bridging rails (1) (2) close the circuit of battery (7), which energizes magnet (8), which attracts armature (9), thereby opening the circuit of the induction coil and stops the generation and propagation of electrical oscillations by said induction coil along conductor (20), so that a train entering or occupying the section in rear of block No. 1 receives no oscillations and the operator is apprised of a condition of danger existing in block No. 1.

Block No. 2 is provided with a like installation of electrical apparatus by means of which electrical oscillations are generated and propagated along a conductor (20), paralleling block No. 1 as long as block No. 2 is unoccupied, and the oscillations are discontinued when block No. 2 is occupied to indicate upon a car or train in block No. 1 that the former block is at "danger." Similarly each other block or section is equipped to send oscillations along a wire paralleling the next block in rear to indicate "safety" and to suppress the oscillations to indicate "danger."

It is to be particularly noted that the arrangement of the track and the generators or emitters of electrical oscillations controlled thereby, so that the existence of oscillations shall indicate "safety," and the absence of such oscillations shall indicate "danger," through the agency of any suitable receiver or responsive apparatus upon a car or train, constitutes a complete and effective signaling system.

It is also to be observed that the combination of a track divided into blocks or sections with an emitter or generator of electrical oscillations in each section and receivers or responsive devices on the trains or cars operating on the track is generically within the purview of the invention, provided the presence of oscillations in a given section shall indicate "safety" and the absence thereof shall indicate "danger," even though the control of the oscillations be effected by means other than track or rail circuits—as, for example, when an emitter or generator for a given block or section is controlled by the relative position of a semaphore, a switch-operating mechanism, a drawbridge or any other apparatus or appurtenance of a railroad to generate oscillations when the way is safe and to suppress such oscillations when it is dangerous for an oncoming car or train to proceed beyond the next advance section.

Each car or engine is provided with a suitable receiver or responsive device which operates under the influence of the Hertzian waves or oscillations to effect a predetermined signal or indication on the car or engine. Such receiver and signal may be of any of the usual co-ordinations of Hertzian-wave receiving devices—such, for example, as an ordinary coherer and signal circuit controlled thereby—which operates to close a local circuit to actuate the signal when a Hertzian wave traverses or affects the coherer and to open the circuit and discontinue the signal when the Hertzian waves or oscillations cease or are interrupted, it being understood that the continuance of the signal or indication due to the transmission of the local circuit through the coherer, which latter is rendered operative by the Hertzian waves, signifies a condition of "safety" as to the guarded block or section, and the discontinuance of the signal by the interruption of the current at the coherer indicates a condition of "danger."

Fig. 2 is a fragmentary perspective view of a coherer or wave-responsive device and appurtenant apparatus. The coherer (40) consists of a generally cylindrical body having in two diametrically opposite faces recesses (41) and (46), each covered by a suitable cap or cover of glass or similar material. In (41) is placed suitable metal filings or other material that is responsive to ethereal waves, which cause the filings to cohere and transmit an ordinary voltaic current, but which when subjected to a slight jar or alteration in their relative positions interpose so high a resistance as to fail to transmit such voltaic current. Traversing the cylinder (40) and having their inner terminals imbedded in the filings in recess (41) are two conductors which are connected with contacts on the ends of the cylinder, the contacts being adapted when recess (41) is uppermost to be engaged by brushes, which are connected by wires with a relay. Recess (46) is partially filled with some material that is normally conductive of voltaic currents, such as mercury or the like, and two conductors lead from the lower part thereof to two contacts on the ends of the cylinder (40), which when recess (46) is uppermost are engaged by brushes which connect by wires a magnet through a suitable battery to engage said magnet.

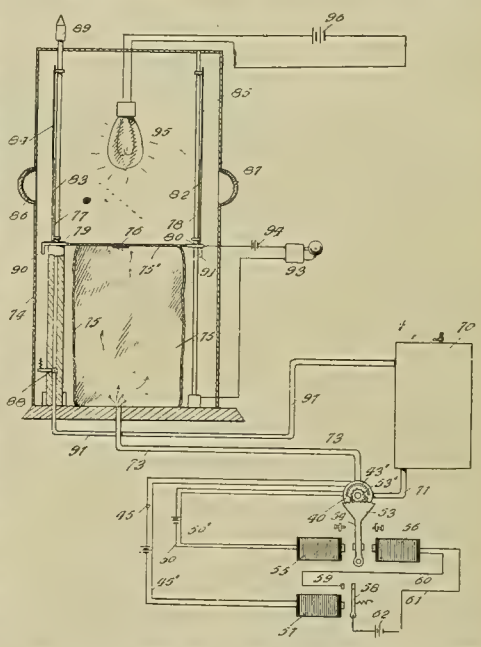


FIG. 3. WIRELESS SIGNALING SYSTEM FOR RAILROADS.—DIAGRAM OF APPARATUS ON LOCOMOTIVE CAB.

The cab signaling device operates as follows, as shown in Fig. 3, which is a diagram of the apparatus on each car or cab: When the car or engine occupies a block—as, for instance, block No. 1—and the adjacent block No. 2 is unoccupied, the Hertzian waves transmitted along wire (20′) (Fig. 1) and radiating from the wire through the air pass through and energize the coherer (40), closing the circuit of relay (57), which closes the circuit of magnet (56), causing the armature (54) to move to the right and rotating the coherer (40) through

180 degrees, thereby disturbing the filings in (41) (Fig. 2), breaking the circuit of relay (57) and de-energizing magnet (56). Recess (46) (Fig. 2) is thereby brought uppermost and the circuit of magnet (55) is momentarily closed, attracting armature (54) and returning the coherer (40) to its original position.

As the coherer cylinder rotates the passage way in the compressed air valve controlled by the coherer is opened and air is admitted from tank (70) to bellows (75). As the coherer is rapidly rotated or oscillated to and fro by the recurrent action of magnets (55) and (56) as the material in (41) is successively cohered and decohered, air pressure quickly accumulates in bellows (75), and the latter is inflated, causing the red or danger glasses to be moved out of registry with lenses (86) and (87) and showing a white or safety light.

This condition will maintain as long as block No. 2 is clear, and the Hertzian waves are sent out by induction coil (17'). Should the operation of induction coil (17') be suspended by the presence of a car or train in block No. 2 and no waves be sent along wire (20'), the coherer (40) would cease to operate, but would assume the position indicated in Fig. 2, and air pressure from tank (70) would be shut off from bellows (75). The air in the latter would escape through valve (75') and the bellows would deflate, causing the red glasses (86) and (87) to cover lenses (86) and (87), showing a red or danger signal. When the bellows are nearly deflated, valve (88) will be opened by detent (90), admitting air to whistle (89), causing the latter to sound a danger signal, and contact (91) engaging contact (92) will close the circuit of bell (93), giving an additional audible danger signal to warn the operator to stop his car or train until the succeeding block is clear, to be evidenced by the coherer again taking up its operation, due to the restored oscillation, and setting the visual signal at "safety" and discontinuing the operation of the whistle and bell.

Copper Takes a Jump in London.

Copper took a sensational rise in price in London on May 1st, according to newspaper dispatches. It opened at £108 a ton, an advance of £4 over the quotations of April 30th and rose rapidly to £114, a record price. A representative of a large American electric company which consumes many millions of pounds of copper a year, is credited with recently having said: "The copper companies are not in as strong a position from the standpoint of production as a year ago. In fact, production has fallen off instead of increasing, and there has been no shrinkage in consumption. The big producers have sold practically their entire output for the next two or three months, and a better idea of the situation can be obtained when consumers begin coming into the market as purchasers for the third and fourth quarters of the year."

Switch-operating Mechanism for High-potential Circuits.

Improvement in the operating mechanism of electric switches, particularly power-driven switches of the oil-break type designed for controlling high-potential circuits of large amperage, is the basis of a recent invention by Theodore E. Button of Schenectady, N. Y. A United States patent, No. 843,070, granted to Mr. Button, has been assigned to the General Electric Company. Following are extracts from the specification:

"In the class of oil switches to which my invention is particularly adapted the circuits are ruptured in oil-pots located in fireproof cells constituting an enclosing structure for the switch, and the operating mechanism therefor is usually located on the top of the cell structure, and the movable switch contacts are vertically reciprocated. It has been the practice heretofore in switches of this character to connect the upper ends of the rods which carry the movable contacts to a single cross-bar or yoke which is bodily reciprocated upon the opening and closing of the switch, some motive mechanism, preferably an electric motor, being employed to produce this motion. With this construction it is found that when the contact-carrying rods are spaced some distance apart it becomes necessary to enlarge the size, and consequently the weight, of the connecting yoke. This necessitates a corresponding increase in the size of the actuating parts and the operating motor.

"The principal object of the present invention is to provide a novel operating mechanism which shall be suitable to the above requirements of service and at the same time light and simple in structure and effective in operation, and one in which any number of contacts spaced any desired distance apart may be employed or new contacts may be added without necessitating a material increase in the weight of the existing parts."

Of the accompanying drawings, Fig. 1 is an end view of the upper portion of an oil-switch structure upon which is mounted an operating mechanism constructed in accordance with the present invention. Fig. 2 is a side elevation of the same structure. Fig. 3 is a plan view of the operating mechanism. Fig. 4 is a partial sectional view illustrating the actuating motor and gearing and the circuit-controlling contact fingers actuated thereby. Fig. 5 is a view illustrating a modification, and Fig. 6 is a diagram of the controlling circuits by which the switch-operating mechanism is actuated.

"The switch to which I have shown my operating mechanism applied is adapted for rupturing current on a high-potential tri-phase alternating-current circuit. The invention, however, although particularly applicable to high-potential switches, may be used in connection with any switches in which a reciprocating switch movement is employed.

"In the present organization the movable switch contacts (7) are secured by yokes to the lower ends of the vertical wooden rods (10), which project through openings in the supporting cap (11) of the cell structure of the switch. The cap (11) is mounted upon brick walls (12), which divide the supporting structure into a plurality of enclosing cells, one for each phase of the switch. The struts (15) are pivotally mounted upon a longitudinally extending shaft (16) carried by suitable bearings (17) secured to the top of the cell structure and to the frame (18) of the motor-actuating mechanism. Mounted upon this same base (18) is a pair of upright brackets (19), which are provided at their upper ends with overhanging portions (20), to which the coiled compression springs (21) are firmly secured. Similar compression springs (22) are located in suitable seats or depressions in the base (18) in line with the springs (21). These springs constitute the actuating mechanism by which the switch contacts are given a quick opening and closing movement.

"If the crank (30) is moved to dead center, or approximately dead center, and held there the springs (21) or (22) will be maintained under strain. If then the holding means be removed, the mechanism will be unlocked, and the compressed springs will be free to throw outward the reciprocating member (24), thereby producing a quick movement of the movable switch contacts. In order to minimize the work required of the springs (21) (22) the weight of the movable contacts and their supporting parts is neutralized by means of counterbalancing torsion springs (33) coiled about the shaft (14) and connected at their opposite ends to said shaft and to the adjacent struts (15), as clearly illustrated in Fig. 2.

"The crank shaft (31) is rotated by means of an electric motor (34), mounted upon the base (18) and adapted to be thrown into engagement with a train of gearing connected to said shaft by the magnetic clutch (35). In operation the ratchet is always rotated in the same direction—that is, in the direction indicated by the arrow in Fig. 4; but the interior member (38) is free to run ahead of the exterior member (37). From this it follows that when the motor is driving the crank-shaft (31) against the opposing pressure of the springs (21) or (22) the members (37) and (38) of the ratchet are in transmitting engagement; but as soon as the crank (30) is moved beyond dead center, so that the springs are free to act, if unrestrained, the crank will be rapidly rotated thereby in advance of the rotation produced by the motor. At such a time the interior member (38) will outrun the exterior member (37), and the teeth of the pawls (43) will slip over the interior surface of the member (37). However, when the exterior member catches up to the interior member the full load will be thrown on the motor, and the pawls (43) will be rotated about their bearings, so as to bite into the interior surface of the member (37) and transmit the motion imparted thereto to the shaft (38), and thence to the crank-shaft (31). In order to hold the crank (30) against rotation when the appropriate set of springs has been compressed, so that the switch may be held in either closed or open position, a movable stop (44) is provided. A magnet is located directly beneath the toggle (47), so that its core (49) when drawn upward by the energization of its magnet coil will deliver a blow sufficient to actuate the toggle, and thereby free the shaft (31).

"In order to cut off the power of the motor at the right instant and to otherwise vary the motor connections, the shaft (31) is provided with three cams (50^a) (50^b) and (50^c), which co-operate with three contact fingers (51^a) (51^b) (51^c) to rock them into and out of engagement with the fixed contacts (52^a) (52^b) and (52^c). The operation of the cams and their co-operating switch contacts will be best understood from the diagram shown in Fig. 6.

"Assuming that the parts are in the position illustrated, which corresponds to the closed position of the switch, and that it is desired to open the switch, the contact (57) of the manual controlling switch, which is usually located some distance from the high-potential switch, is thrown into engage-

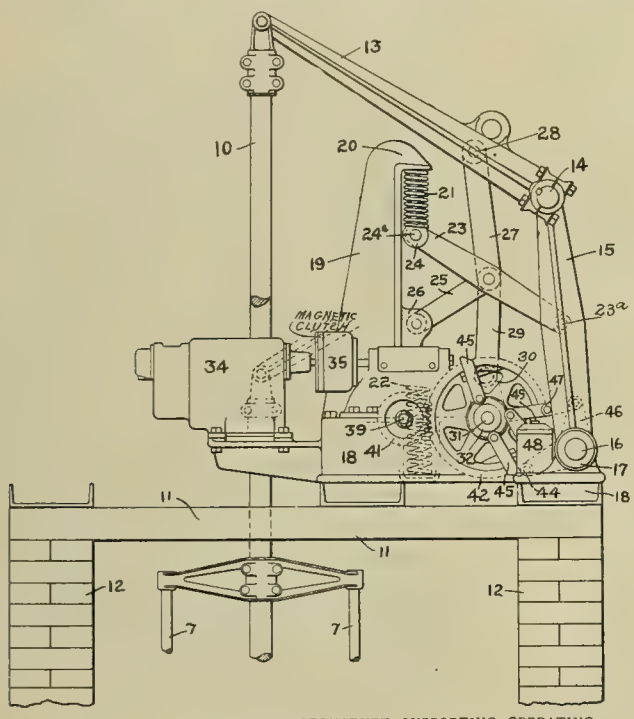


FIG. 1. END VIEW OF OIL-SWITCH STRUCTURE SUPPORTING OPERATING MECHANISM.

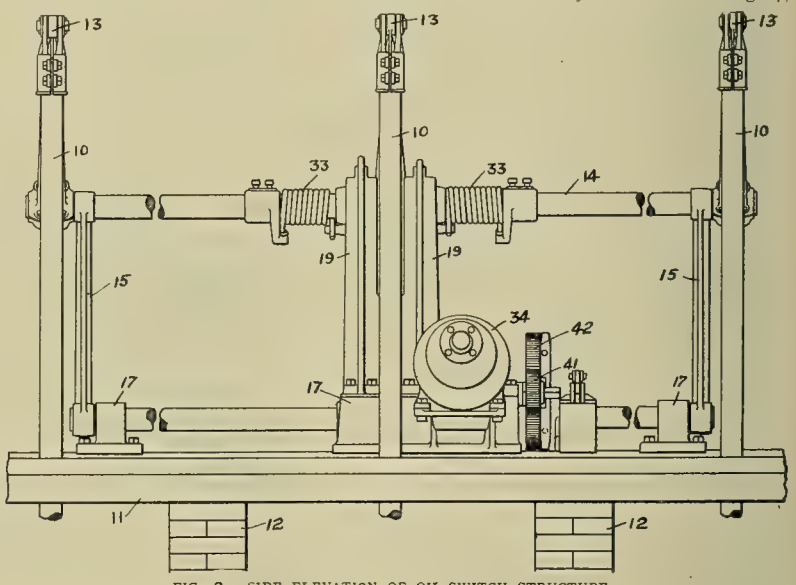


FIG. 2. SIDE ELEVATION OF OIL-SWITCH STRUCTURE.

ment with the contact (56), so as to complete the circuit through the opening finger (51^c), contact (52^c), and trip-coil (48). The coil (48) is thereby energized and by its upward movement actuates the toggle (47), so as to remove the stop (44) from the path of the stop arm (45) and at the same time bridges the contacts (58). Current is then free to flow through the motor by way of the

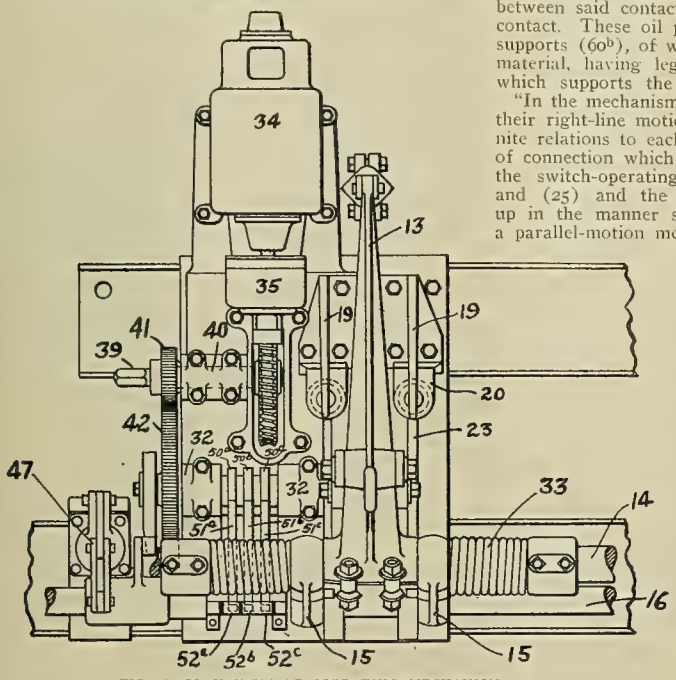


FIG. 3. PLAN VIEW OF OPERATING MECHANISM.

contacts (58) and (52^a). This at the same time starts the motor and energizes the clutch (35).

"As soon as the crank-shaft is freed by the removal of the stop (44), the springs (22), which have been held under strain while the switch remained closed, throw the engaging end of the lever (23) upward, and with it the contacts of the switch. During this operation the interior member (38) of the ratchet moves freely within the exterior member (37) and in advance of the same, as previously pointed out. As soon as the crank-shaft (31) rotates a short distance the master finger (51^a) is moved to its closed position by riding upon the cam (50^a), and as soon as it is closed the closing finger (51^c) passes from its cam projection, and it drops to the open position. The effect of this change is to de-energize the trip-coil (48) and allow the stop (44) to return to its engaging position to catch the shaft (31) when it has made one-half revolution and also to open the circuit at the contacts (58), leaving the motor circuit completed through the master finger (51^a) and its contact (52^a).

"In this operation about the time the spring-engaging member (24) has reached the upper actuating springs (21) the relative speed of the parts will be such that the ratchet will take hold, and the accumulated energy of the motor will be trans-

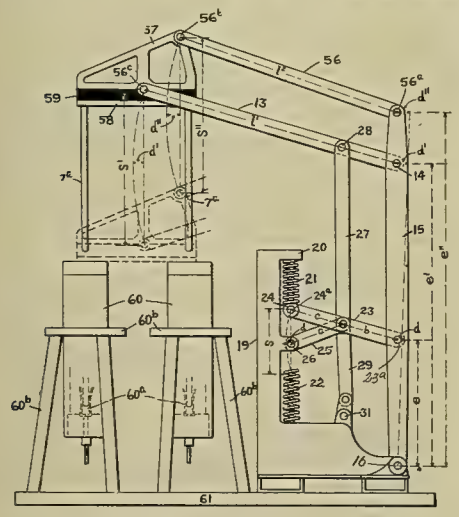


FIG. 5. MODIFICATION OF OPERATING MECHANISM.

mitted to complete the semi-rotation of the crank-shaft (31). When the shaft (31) has rotated far enough to permit the master finger to separate from its contact, the projecting portion of the cam (50^b) will have forced the opening contact finger (51^b) into engagement with its contact (52^b), thus leaving the parts in readiness for the opening of the switch upon movement of the manual controlling switch to complete the circuit through its terminal (55).

"In Fig. 5 is illustrated a modified construction in which the movable switch contacts are positively actuated in a right line and are prevented from movement out of that line without the employment of guiding means. In this diagram is also shown the oil pots (60), which contain the contacts (60^a), with which the moving contacts (7^a) co-operate. In this type of switch the line terminals are connected to the fixed contacts (60^a), and the circuit between said contacts is completed by the bridging contact. These oil pots are suitably mounted upon supports (60^b), of wood or other suitable insulating material, having legs resting upon the base (61) which supports the switch-operating mechanism.

"In the mechanism by which the contacts are given their right-line motions, the parts bear certain definite relations to each other as to length and points of connection which must be observed in designing the switch-operating mechanism. The links (23) and (25) and the rocking strut (15), connected up in the manner shown and described, constitute a parallel-motion mechanism of a well-known type, in which the free end of the link (23) moves in a right line and in which the lengths of the parts and their connections are such that the relation expressed in the proportion $a:b = b:c$ exists, where a, b and c represent the distances indicated in Fig. 5. Preferably, these links are so connected in proportion that a, b and c are equal. Consequently, in the operation of the mechanism these links (23) and (25) swing through equal angular distances.

"Now it is obvious that where two links of different lengths are attached each to a pivot at one end and are given the same angular movement the depths of the arcs formed by their free ends are directly proportional to the lengths of the links. Consequently, in the present instance, since a, b and c are equal, the depths of the arcs struck by a and b as radii are equal, and each is equal to one-half the depth d of the arc struck by the radius $(b + c)$. Due to the relation of the parts, the fulcrum (23^a) is given a lateral movement equal to the sum of the depths of the arcs formed by a and b as radii. This sum, as previously indicated, equals the depth d of the arc struck by $a + b$ as a radius. Since $a + b$ equals the length of the link (23), it will be seen that the arc is entirely removed from the motion of the free end of said link, and the latter is caused to move in a right line.

"In this operation of the parts each stroke of the crank moves the free end of the link (23) through a definite stroke (S), which is the chord of the arc having the depth d. Consequently, the distance d may also be expressed in terms of the radius and chord—that is, in terms of l and s, where l equals $(b + c)$. Obviously, the distance between the points (23^a) and (26), which may be designated m, plus d equals l. Now the distance m equals

$$\sqrt{l^2 - \left(\frac{s}{2}\right)^2}.$$

Therefore

$$d = l - \sqrt{l^2 - \left(\frac{s}{2}\right)^2}.$$

"The principal feature of the present invention resides in the means for causing this one parallel-motion mechanism to affect a plurality of points as it affects the free end of the link (23)—that is, to cause these points to move in right lines parallel to the right line path of the free end of said link. One of the points which is to be moved in such a right-line path is the outer end of the rock-arm (13), and the distance through which it is to be moved equals the length of the stroke required by the moving contacts of the switch. This distance is designated (s′) in Fig. 5. Obviously by locating the point (28), which is the point of connection between the link (27) and the rock-arm (13), at a distance from the shaft (14) equal to b, the arm (13) will be caused to rock through the same angle as the link (23) when the parts are operated. Therefore, since the angular distance through which the link (23) and the rock-arm (13) are to pass is the same, then if l and l′ represent the length of the link (23) and the arm (13), respectively, and s s′ the length of stroke of their free ends, the value of l′ [or the length of the arm (13)] may be determined from the proportion $s:s' = l:l'$, since the values of s, s′ and l are known.

"In a similar manner the depth of the arc which will be struck by the arm (13) may be determined by the proportion $d:d' = l:l'$, where d and d′ represent the depths of the arcs struck by the lengths l and l′, respectively, since d, l and l′ are known. This value d′ is the distance through which the shaft (14) must be moved laterally in order to maintain the movement of the free end of the arm (13) in a right line. To accomplish this the distance between the shafts (14) and (16), [designated (e′)], must be a certain amount. This is obtained by solving for e″, in the proportion $e:e' = d:d'$, where e equals the distance of the fulcrum (23^a) above the shaft (16). Obviously by making the shafts (14) and (16) and the connecting struts (16) sufficiently strong to transmit this same lateral movement to the shaft (14) throughout its entire length any number of rock-arms may be placed on it and a corresponding number of switch contacts operated thereby.

"When it is desired to employ the form of the invention disclosed in Fig. 5, the length of the link (56) may be determined as follows: The additional length of the strut (15) beyond the shaft

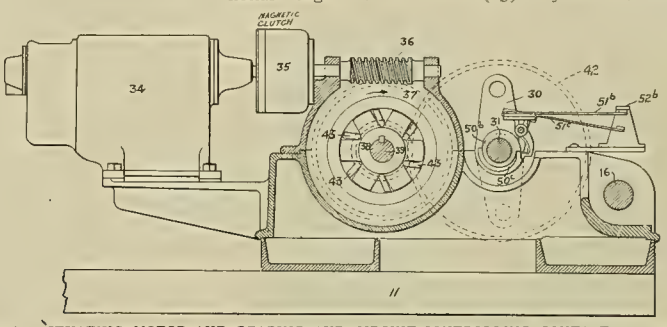


FIG. 4. ACTUATING MOTOR AND GEARING AND CIRCUIT-CONTROLLING CONTACT FINGERS.

(14) may be arbitrarily assumed. If then e″ represents the distance of the pivot point (56^a) above the shaft (16) along the strut (15), then the lateral distance through which the pivot (56^a) will move will be found from the proportion $e:e'' = d:d''$, where d″ indicates this lateral distance. Now in order that the lever (56) may be given a length sufficient to produce an arc having a depth equal to d″ it must satisfy the conditions of the equation:

$$d = l - \sqrt{l^2 - \left(\frac{s}{2}\right)^2}$$

previously given, where d, l and s have the values of d″, l″ and s″. Of these d″ and s″ are known, the

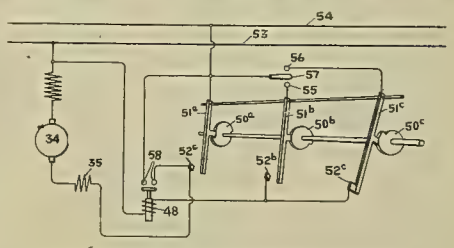


FIG. 6. DIAGRAM OF CONTROLLING CIRCUITS

former being obtained in the manner just described and the latter being the length of the stroke of the movable switch contacts. Solving for l″ (or l) the length of the link (56) is obtained."

Railroads Should Advertise for Freight.

At a recent meeting of the Chicago Trade Press Association J. Newton Nind of the Furniture Journal delivered an address on "Railway Advertising: Its Use and Abuse." Mr. Nind's speech has been printed in pamphlet form at the suggestion of railroad officials who were present at the meeting. It has a direct bearing on the getting of business for the freight department and the extension of the field of the industrial department. Mr. Nind asserts that "half the ingenuity shown by the average press agent in exploiting some comic opera star if applied to the getting of business for a great railroad would result, first, in abundant topic for the advertising man to dwell upon, and eventually a large increase in the freight earnings of the road making liberal but discriminating expenditure for good advertising."

Chicago capitalists are said to be behind the move to develop the waterpower from the falls of the Toutle River, near Spirit Lake, about 60 miles north of Portland, Ore. The falls of the Toutle River are said to be the best power-producing possibilities in the Northwest that yet remain "unharnessed." The new plant may be made to develop 40,000 horsepower. It is said that the new company will make a rate so low that no one need go without electricity, either for lighting or for power. The plant will cost about $1,500,000.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Illinois Independent Telephone Association (annual convention), St. Nicholas Hotel, Springfield, Ill., May 14th and 15th.

Southwestern Electrical and Gas Association (annual convention), San Antonio, Texas, May 14th to 16th.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 15th and 16th.

American Institute of Electrical Engineers (special high-tension meeting), Chicago, May 24th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

THE AMERICAN ELECTROCHEMICAL SOCIETY is to be congratulated on the conspicuous success of its general meeting at Philadelphia last week. The papers and addresses presented were of a high order of excellence, and some of them were of quite unusual interest and importance, such as those on the electric furnace, the Helion lamp and the experimental lecture of Dr. Steinmetz on "Conduction." In this lecture the speaker advanced some new ideas on the theory of the electric arc, which will be sure to command attention. The society is to be congratulated also on its choice of a president, for Professor Burgess is an eminent electrochemist and in every way worthy of the honor bestowed upon him. It is an interesting fact, showing the scientific nature of the work done by the society, that four of the five men elected as presidents are, or were at the time of their election, college professors. A carefully prepared report of the meeting is given in this issue.

SOME REMARKABLE statements are made in a recent circular of the Forest Service, entitled "The Timber Supply of the United States." Thus, every person in the United States is using over six times as much wood as he would use if he were in Europe. The country as a whole consumes every year between three and four times more wood than all of the forests of the United States grow in the meantime. The average acre of forest lays up a store of only 10 cubic feet annually, whereas it ought to be laying up at least 30 cubic feet in order to furnish the products taken out of it. Since 1880 more than 700,000,000,000 feet of timber has been cut for lumber alone. The increase in population since 1880 is barely more than one-half the increase in lumber cut in the same period. The average age of trees felled for lumber is not less than 150 years. To grow a second crop will require at least a hundred years. Thus it is clear that the consumption of forest products in the United States is far too lavish and that the government has taken hold of the matter none too soon unless the future—and the not far-distant future at that—is to witness a timber famine in this country. Steps must be taken to prevent waste in use and to increase the growth rate of every acre of forest in the United States. This work has been undertaken by the Forest Service, but at present but one-fifth of the total forest area of the United States is embraced in national forests. The remaining four-fifths has already passed or is likely to pass into private hands. Therefore it is highly necessary that public sentiment should stand back of the work of the Forest Service and insist that national and state control over woodland areas be extended as widely as possible.

Except for poles and ties, the electrical interests are not conspicuously large users of wood. And to an increasing extent steel or iron poles or towers are taking the place of wooden poles, while steel-concrete ties for railways are more than a possibility. But nevertheless the amount of wooden construction used in electrical industries is large in the aggregate, and electrical men suffer with others, owing to the slow delivery and high price of timber even at the present time. Then, too, the subject of forest preservation has a direct bearing on waterpower development, in which electrical men are greatly interested. So the electrical fraternity should join all other public-spirited citizens in giving hearty support to the movement to check forest waste and to encourage afforestation.

EXPERIMENTS made by Gustave Gin, the electrometallurgical engineer of Paris, show that the reduction of titaniferous iron ores in the electric furnace presents no special difficulties, and that pure iron can be obtained commercially therefrom in regions where the ore is near abundant and cheap waterpower. A brief account of these experiments was given in a paper presented at the Philadelphia convention of the American Electrochemical Society last week, the translation being by Prof. J. W. Richards. One experiment was made on December 12, 1906, at the Technical High School of Aix-la-Chapelle. Sandy iron concentrate from Java was mixed with limestone and carbon in the proper proportions, and submitted in a resistance electric furnace to a direct current of about 500 amperes, at a working pressure of 60 to 65 volts. The charge was easily melted. At the end of an hour's running the temperature of the melted mass was a little over 1,900° C. The slag and metal were then cast, the metal in a previously heated crucible; the slag was very fluid and ran easily from the furnace. The clean ingot of metal weighed 42.62 kilograms and contained 95 per cent. of iron.

The significance of these experiments lies in the fact that titaniferous iron ores are found in many places, at times in such quantities that their utilization in the metallurgy of iron might be very profitable. There exist large deposits of iron minerals containing titanic iron ore concentrated by nature along with magnetite. Such deposits are found in Norway, Sweden, the United States and Canada, in considerable abundance, in the form of black sands. They are likewise found on the coast of the Island of Santiago, among the Cape Verde Islands and on the southern coast of Java. They can be easily enriched by electromagnetic concentration. Such black sands, and the concentrates from them, are but little used in the metallurgy of iron, although their purity and freedom from phosphorus and sulphur ought to make them desirable. It seems that this indifference is based on the opinion that the titaniferous slags resulting from their use are with difficulty fusible in the blast furnace; but Mr. Gin has shown that with the electric furnace these little-used ores may have commercial possibilities.

WHEN an increase of taxes is proposed, men with one accord begin to make excuse. Sometimes the excuses are just and reasonable, sometimes merely pretexts. In the case of the interurban electric-railway men recently before the Indiana Tax Board the protests against increased assessments were ingenious and interesting and no doubt entirely justified by the facts. One gentleman showed that the electric-railway men did not themselves at first foresee the importance of the interurban railways and did not plan and provide for them adequately. "The old construction is not fit for lines carrying long-distance traffic, and the companies are 'up against' the immediate necessity of reconstructing their roadways." Another president of a company pointed out likewise that going through a transition period is an expensive process. The roads were built independently in small systems. "Now, however, they are being taken into combinations and the management conducted more economically. This will be the salvation of the roads and conducive to better facilities for the public." This gentleman also said that there was no money in the freight and express business as now conducted by the interurban roads.

Of particular interest was a statement made by Mr. Arthur W. Brady, representing the Indiana Union Traction Company, who pointed out that the equipment now used by his company and other lines in the state which use the direct-current system is depreciating rapidly since the advent of the more modern electrical machinery, such as that used with the single-phase alternating current and similar systems. At the same time, he said, the prices on the new equipment are so high that it is a serious question with the operating companies to get sufficient capital to install the more modern machinery so as to compete properly with the other electric roads and the steam roads. Mr. Brady did not, however, ask a reduction in the assessment of his company on account of the depreciation in value of the equipment. While he admitted that the gross earnings of his company were greater in 1906 than in 1905, he said that the surplus for that year was much less, due to the expense of taking over additional lines, taxation and other causes. He said that his company is having difficulty in raising funds for improving its lines. "I believe," he added, "that the interurban companies will soon find it necessary to set aside special renewal funds in order to obtain capital with which to renew their equipment."

Another complaint was the high price for coal, due to the tariff fixed by the steam railroads. But in general the interurban companies did not ask for a decrease, merely that there be no increase. They are now building their roads to avoid depreciation, so far as this can be done in the present state of the art, and they face the future with courage and confidence.

AMERICAN ELECTROCHEMICAL SOCIETY.

The eleventh general meeting of the American Electrochemical Society, which was held on May 2d to 4th at Philadelphia, was one of the most successful during the life of this society. The meetings were held in the John Harrison Laboratories of Chemistry at the University of Pennsylvania, in which building the society was organized five years ago.

Doubts which were freely expressed a few years ago as to a real demand for a society in this country devoting itself to electrochemical development have been shown to be unfounded. The attendance and interest in the recent meeting, the excellence of the programme and of the inspection trips and social affairs, made up for the lack of interest in the meeting last fall in New York.

CHARLES F. BURGESS, President American Electrochemical Society.

President's Address.

Mr. Carl Hering of Philadelphia, the retiring president, in his address showed by means of curves and data what the society has accomplished in its five years of existence, and that while fluctuations have occurred in the curves showing membership, receipts, cash balances, papers and publications, the tendency is on the whole toward growth and prosperity. The membership, which was 350 in 1902, has increased to 620, and this in view of the recent application of the policy of dropping delinquent members.

The financial affairs were shown to be in a flourishing condition. A gain in the cash balance was shown in 1906, following a large negative balance in 1905, and the total cash balance in the treasury at the present time is $2,307. What the society has done for its members during the last five years has cost it annually from $6 to $7 per member, while the dues are but $5, and the paradoxical fact that a large surplus has been accumulated in spite of this is attributed to the sales of back numbers of the Transactions and to the initiation fees.

The members of the society receive not only the two volumes of Transactions per year but also the Transactions of the Faraday Society of England, with which a trading agreement exists.

President Hering discussed a proposal made by the American Chemical Society that a joint agreement be entered into between that society and the Electrochemical Society to publish jointly the Transactions of both, thereby securing for the members additional material at little added cost.

In the discussions of this proposal which followed strenuous objections were raised by members, who saw in the plan the possibility of sacrificing the independence and individuality of the society, and the matter is to be submitted to the entire membership in writing and decided by general vote.

The board of directors voted the trial, as an experiment to increase interest in local sections, of the payment of one dollar per year for each member enrolled in local sections, this money being raised to meet the running expenses.

Election of Officers.

The report of the tellers announced the election of the following-named officers for the coming year:

President—C. F. Burgess, Madison, Wis.

Vice-presidents—C. E. Acker, New York; A. H. Cowles, Cleveland; Dr. W. H. Walker, Boston.

Managers—Dr. E. F. Roeber, New York; S. S. Sadtler, Philadelphia; Dr. L. Kahlenberg, Madison, Wis.

Treasurer—P. G. Salom, Philadelphia.

Secretary—Dr. J. W. Richards, Bethlehem, Pa.

Reading of Papers.

At the meeting last fall in New York a scarcity of papers was a marked feature, but the other extreme was characteristic of the Philadelphia meeting, where 33 papers were offered, and even to the most important of these a sufficient time for discussion could not be given, while many were read only by title.

The papers covered a wide range of subjects, and the marked interest shown in them was perhaps due to the large proportion which are of direct interest from the industrial viewpoint. An unfortunate feature was the fact that but few of them were printed in advance, and will not therefore become generally available until the next volume of the Transactions is published.

Electric Furnaces.

Papers dealing with electric furnaces, high-temperature phenomena, high-temperature chemistry and methods of measurement drew attention to the wide interest of this field, and the actual operation of furnaces of various types which were shown at the Lardner's Point Station of the Philadelphia Electric Company was a most interesting feature. These included a Colby furnace of the induction type, employed in the manufacture of special tool steel.

"Carbon for Electrometallurgy," by F. A. J. Fitzgerald of New York and J. Forssell, is a paper which gave a large amount of data useful to the furnace designer. The specific resistances of carbon and graphite of various forms and under various conditions, as used in furnace construction, were given and show values averaging 0.00160 ohm per cubic inch for amorphous carbon and 0.00042 ohm for graphite. Improved methods of making contact to carbon furnace electrodes were described; the resistance of the surface of contact has been reduced to 0.001 ohm per square inch. Various phenomena and peculiar characteristics of furnace working were also described.

Two papers by Dr. S. A. Tucker, entitled, respectively, "Granular Carbon Resistance Furnace" and "Electric Tube Resistance Furnace" described methods of furnace construction for crucible melting and for determination of critical temperatures of various materials.

President Carl Hering, in "The 'Pinch' Phenomenon," described a remarkable peculiarity of resistors of the liquid type. He found that in passing a current of large volume through a channel filled with molten iron a depression of the column occurred at some point and to a depth of several inches, finally causing the complete rupture of the liquid column. He found the same thing to occur in a column of mercury, as well as in other metals in the molten state. The action is as if the liquid metal had been pinched, hence the name.

This peculiar action is a source of difficulty in the operation of certain types of electric smelting furnaces, such as those of the induction type, and in the Gin furnace.

Dr. F. E. Northrup has made a thorough study of this phenomenon, from the physical and mathematical points of view, and it is suggested that it may be due to the fact that currents flowing in like direction attract each other, causing contraction not only of the current lines but of the material carrying the current as well.

An interesting and possibly important application of this property may be made in the construction of electrical instruments of both inducting and recording types, and Dr. Northrup exhibited an instrument which he had made for this purpose. The contraction force on a column of mercury carrying the current causes an upward pressure and upward flow of the upper surface of mercury, and by an ingenious arrangement the force is magnified so that large pressures may be produced.

"The Electrometallurgy of Zinc and Its Relations to the Present Practice" was presented by W. McA. Johnson and read by title. It describes the difficulties which must be encountered in this hitherto unsuccessful but promising line of electrometallurgy.

E. R. Taylor of Penn Yan, N. Y., inventor of the electric furnace by which the carbon bisulphide industry has been revolutionized, described a modification of this furnace intended for the reduction and distillation of metals. His paper is entitled "A Closed Electric Furnace for Reducing and Distilling Metals from Their Ores," and in the discussion which followed interesting facts were brought out, one of which is the assertion that the serious commercial limitation on electric furnaces, due to consumption of carbon electrodes, has been practically eliminated in the carbon bisulphide furnace, and that from electrodes costing $175 over 2,000,000 pounds of carbon bisulphide has been produced. Mr. Taylor says that the minimum interior dimensions of a successful zinc furnace should be about 10 feet.

Dr. O. P. Watts, in a paper entitled "The Action of Carbon on Magnesia at High Temperatures," called attention to certain limitations on the use of magnesite for a furnace material where it comes in contact with carbon. It is generally held that carbon will not reduce magnesium oxide, yet the fact exists that at temperatures which may be considered moderate ones in electric furnace practice reaction does take place, causing the volatilization of both the magnesia and carbon. The reaction is represented as follows:

$$MgO + C = Mg + CO.$$

Both of the products are volatile, and upon cooling the reverse action takes place, depositing the carbon and magnesia in the cooler parts of the furnace.

Dr. Henry Noel Potter of New York, in a paper entitled "Bomb Calorimeter for Measuring the Heat of Combustion of Substances Giving Solid Oxidation Products," described a method which he has developed for the determination of the heat of combustion of silicon, finding for its value 215,692 calories. Prof. J. W. Richards pointed out that this is one of the most important of recent contributions to thermal data.

Another important paper giving new and reliable data in the high-temperature field was entitled "Determination of Fixed Points in Pyrometry," by Dr. G. K. Burgess of the Bureau of Standards, Washington, D. C. Various methods of determining melting points of metals are discussed, and from the melting points found it appears that the generally accepted values differ materially from the true values. The following are the most recent determinations of the approximate melting points of the iron group of metals:

Iron	1500°C.	Nickel	1435°C
Chromium	1482°C.	Manganese	1207°C.
Cobalt	1464°C.		

The discussion brought out the fact that these results may be questioned, especially the figure for chromium, which is considered to be too low.

The Helion Lamp.

"Density, Electrical Conductivity and Viscosity of Certain Fused Salts and Their Mixtures," by H. M. Goodwin of Boston and R. D. Mailey; "The Electric Reduction of Titaniferous Iron Ore," by Gustave Gin of Paris, and "The Titanium Arc," by R. Fleming of Lynn, Mass., dealt with high temperature working, as did also the lecture by Prof. H. J. Parker of New York on the "Helion Lamp."

The marked interest taken in this last-named paper came not only from the remarkable results achieved by this new lamp, giving an efficiency of 0.75 to 1 watt per candlepower, but also from the fact that silicon, an electric-furnace product, is used in making the filament of the incandescent lamps which the lecturer exhibited.

It has been known for some time that the efficiency of an incandescent lamp is increased as the temperature increases. The carbon filament runs at 1,800° to 2,000° C., and has an efficiency of less than 10 per cent., and Prof. Parker pointed out that at the start it appeared hopeless to use silicon, a material credited with a melting point of less than 1,600°, and run it at a temperature of over 2,200° as a filament material, yet this is what has been done, and it is made possible by the fact that silicon has an extremely low vapor tension, far below that of other known elements, and it vaporizes at a temperature far above its melting point.

The silicon is applied to the surface of a carbon filament and under such conditions that the silicon covering possesses greater conductivity than the carbon core.

Mr. Leon Gaster of London and representative of the Faraday Society of Great Britain, in discussing this paper reviewed the present limitation of the common incandescent lamp and pointed out the wonderful possibilities within the reach of a lamp possessing the properties claimed for the helion lamp.

Steinmetz on Conduction.

The most important feature of the entire meeting was the experimental lecture by Dr. C. P. Steinmetz on "Conduction." From the viewpoint of electrochemical theory the lecture was most suggestive, and from that of practice the experiments, data, curves, behavior and properties of materials at high temperature will, when published in full, form an important addition to electrochemical literature.

Dr. Steinmetz began with a classification of materials into four classes, depending upon whether they conduct metallically, electrolytically as an arc or as a vapor. The characteristics of each class of conductivity were described, and then it was shown that no sharp line of demarcation exists in certain material which seems to belong to two or even three of the classes.

Some remarkable properties of metallic silicon were described, including the enormous variation of temperature coefficient at various temperatures. Carbon in the ordinary form has a negative temperature coefficient, while in the "metallic" condition it has a large positive coefficient, thus making impossible to use this property as a means of classifying carbon in the various kinds of conductors.

The principal difference between arc conductance and vapor conductance was shown to be that the former is continuous while the latter is intermittent. It was pointed out that the specific resistance of arcs is of a value very near to that of good electrolytic conductors—between one and four ohms per cubic centimeter.

It is generally supposed that in the direct-current carbon arc, in which the positive carbon is consumed several times as rapidly as is the negative, the carbon vapor which does the conducting is obtained from the positive crater. Dr. Steinmetz holds that this view is erroneous, however, and that the arc material which makes conduction possible comes from the negative carbon.

From this fact is explained the operation of the arc rectifier and also the fact that between certain classes of electrode materials it is impossible to maintain an arc with alternating pressures even as high as 1,000 volts or over, while a much lower continuous pressure suffices to keep the arc going.

Electrolytic Phenomena.

Dealing with electrolytic phenomena were the following mentioned papers:

"Recent Developments in Electrolytic Analysis" was the subject of an address by Dr. E. F. Smith of the University of Pennsylvania. He described in a most interesting manner the work which he and his associates have done in the development of new analytical methods. He showed how determinations which ordinarily take hours and even days may be accomplished with great ease in from 10 to 30 minutes with a high degree of accuracy. These results have been accomplished by suitably designed electrolyzing cells using mercury cathodes and rotat-

ing anodes and by discovery of new anode materials.

Alkaline and alkaline earth compounds can be readily decomposed and analyzed, as can also the various metallic compounds, and even the silicates and fluorides are yielding to the rapid methods. It was pointed out, in fact, that the analytical chemist can profit greatly by "pushing the button" and letting electricity do the laborious tasks which now consume the time and exhaust the patience of the analyst.

Dr. C. F. Chandler of Columbia University paid tribute to the remarkable work done in this line at the University of Pennsylvania, designating the paper one of the most fascinating and enlightening which chemists have had the privilege of listening to. Others who participated in the discussion were Messrs. Bancroft, Doremus, Walker and Patten.

Following the meeting the members were given the privilege of witnessing some of the methods in operation, and copper determinations were "made while you wait."

"Some Efficiency Considerations of an Electrolytic Cell," by W. R. Mott of Decorah, Iowa, defined various factors which influence current efficiency, and curves were given showing how current and energy efficiency varies with variation of each of the factors.

In "Changes of Concentration and Migration Velocities," C. J. Reed of Philadelphia showed the impossibility of the belief that a difference in velocity exists between anion and cathion.

Prof. J. W. Richards determined "The Work Done in Electrolysis" by placing an electrolytic cell in a calorimeter and by carefully measuring the heat energy and subtracting this from the electrical energy delivered to the cell the energy for chemical change was derived. The results obtained are in close accord with measurements made by other methods.

Mr. C. J. Reed, in "Electrolytic Pickling of Steel," advocated a method of removing mill-scale from iron and steel by the dissolving action of sulphuric acid on the cathode. By employing a current density of 70 amperes per square foot of cathode surface the scale can be removed in less than a minute, while hours are required by the ordinary methods. A marked saving of both acid and steel is claimed.

Prof. A. T. Lincoln of the University of Illinois gave a paper on "Electrolytic Corrosion of Brass," containing a mass of data relating to the constitution of zinc-copper alloys.

E. P. Schoch and Alcan Hirsch, in "The Electrolytic Deposition of Nickel-zinc Alloys," showed the possibility of depositing alloys of these two metals, those possessing as high as 10 per cent. nickel having good physical properties.

"Rapid Methods of Determining Electrolyte Resistances," by Prof. C. F. Burgess of the University of Wisconsin, described simple apparatus and methods of determining electrolytic resistances. A special form of electrode tube is employed in connection with a voltmeter. Variations of compositions of solutions in manufacturing processes can be readily detected and measured, such, for example, as in the discharge pipe for the wash water from a filter press. By means of a recording voltmeter a continuous record may be kept.

Cost of Power.

The cost of power for electrochemical industries came up for considerable discussion, following the presentation of two papers, one by John Meyer, which was in reply to the paper by E. A. Sperry of New York a year ago on "Electrochemical Processes as Station Load Equalizers," and the other by Charles E. Lucke on "Relative Cost of Power."

There seems to be some doubt as to what elements constituting the cost of generating electrical energy in central stations should be charged to power delivered by them to electrochemical processes which are able to take the load at such times when not needed for other purposes. In other words, it will require further investigation to determine at what price the central station can offer on power which may serve as a load equalizer. Mr. Sperry, in discussing the matter, called upon the electrochemists to develop processes, preferably electrothermal ones, which may utilize irregular and intermittent sources of energy, for upon this must depend the possibility of the electrochemical man securing cheap power from the central stations and of the central stations securing a uniform load throughout the 24 hours. He favored the appointment of a committee, as suggested by Mr. Meyer, to study and report upon the matter of costs for intermittent power.

Miscellaneous.

Other papers presented were: "The Present Status of the Thermodynamic Scale," by E. Buckingham; "Surface Properties of Metals," by W. J. Hammer of New York; "Polarization Voltages of Silver Nitrate Solutions," by J. A. Wilkinson and H. A. Gillett; "Evolution of Modern Methods of Parting and Refining," by D. K. Tuttle; "Influence of Strain on Corrosion of Iron," by W. H. Walker. There were several additional papers on vacuum evaporators, various forms of carbon, and the artificial diamond, etc., which were read only by title and which will be published in the Transactions.

An extensive programme of excursions and entertainment was carried out, including inspection of the laboratories of the University of Pennsylvania, visit to the ozone plant of the United Water Improvement Company and to a factory for the manufacture of white lead and red lead, a theater party and a visit to the United States Mint. On Friday afternoon the visitors were taken on a Delaware River trip on the fire-boat Ashbridge, tendered by the city of Philadelphia. The Disston Saw Works, Lardner's Point pumping station, Frankford station of the Philadelphia Electric Company, and the Welsbach Light Company's works were visited, while the Navy Yard, Cramp's shipyard, etc., were seen from the boat. This enjoyable trip ended at Washington Park, where the landing of the shad nets was witnessed, followed by an informal planked-shad dinner, which took the place of the usual banquet.

The chairmen of the local committees were: Executive, Dr. E. F. Smith; excursions, Dr. J. W. Richards; entertainment, George Breed; university, Dr. E. F. Smith; ladies, Mrs. George Breed.

The next meeting of the society is to be held in New York city in the fall, the exact time to be announced later.

Mr. C. F. Burgess, the new president of the society, is professor of electrical engineering in the University of Wisconsin at Madison, Wis., and one of the leading electrochemists of the country, being a recognized authority on the high temperature or electric-furnace work which has attracted so much scientific attention of recent years. He is a charter member of the society and was a manager before his election to the presidency.

Spring Meeting of the Mechanical Engineers.

The spring meeting of the American Society of Mechanical Engineers will be held in Indianapolis, Ind., May 28th to 31st. Headquarters will be at the Claypool Hotel.

A number of excursions to points of interest in and around Indianapolis have been arranged.

The opening session will be on Thursday evening, May 28th, at nine o'clock, in the auditorium of the Claypool Hotel. There will be an address of welcome, with response by Frederick Remson Hutton, president of the society.

The sessions following will be devoted to business, committee reports and the discussion of papers.

On Wednesday afternoon there will be visits to various plants and on Wednesday evening five papers on technical automobile design will be presented.

Some of the remaining papers on the programme are: "The Specific Heat of Superheated Steam," A. R. Dodge; "Determination of Entropy Lines for Superheated Steam," A. M. Greene; "The Flow of Superheated Steam in Pipes," E. H. Foster; "Co-relation of Furnace and Superheated Conditions," R. P. Bolton.

On Thursday evening there will be a reception and on Friday an excursion to Purdue University, Lafayette, Ind. A professional session will be held at 10 a. m. in one of the university buildings, when papers will be delivered by W. F. M. Goss, G. H. Barrus, H. H. Vaughan, T. S. L. Kneass and S. A. Reeve.

The University of Illinois extends to the members of the society attending the convention in Indianapolis a cordial invitation to visit the university, where they will be received by Dr. L. P. Breckenridge, professor of mechanical engineering and director of the government research station. Those who take advantage of this invitation will find the trip to Urbana very pleasant and profitable.

Electric-railway Study at Cornell.

The seniors in electrical engineering and in mechanical engineering in Sibley College, Cornell University, are manifesting great interest in electric-railway work. About 110 are taking the general railway lectures, and one-half of this number are in the more highly specialized course.

The interest has been greatly stimulated by means of non-resident lectures by Mr. C. O. Mailloux and by Mr. W. N. Smith of Westinghouse, Church, Kerr & Co. Mr. Mailloux's lectures dealt with velocity-time curves and mechanical integration as applied to their manipulation. The series of six lectures now being delivered by Mr. Smith have the following topics:

1. Preliminary examination to determine the status of the railway project.
2. Topography, train tonnage and time tables.
3. Speed time curves and other methods for power determination.
4. Working conductors, trolley, third rail and transmission lines.
5. Sub-station and power-house location and equipment.
6. Steam versus electricity in operation.

The lectures are intended to embody an exposition of the data needed and results to be secured in the development of the power and equipment required for electric-railway projects. Such courses as this are given only in the latter half of the senior year. Up to that time the students are occupied with routine studies intended to train them for their practical work. It is felt, however, that in the last term the students should be given a general idea of the manner in which mechanical and electrical principles are applied to various phases of engineering work.

QUESTIONS AND ANSWERS.

Demagnetizing a Watch.

E. W. L., Iowa: I have a watch that has become highly magnetized by coming in contact with live line wires. Can someone suggest some way to draw the magnetism out?

Answer.

A demagnetizing coil can be made by winding, say about twenty thousand turns of No. 24 double cotton-covered wire on a drum with an inner diameter of about three inches. Connect this coil to an alternating-current circuit of about 110 volts, and then slowly sink the watch into the coil and draw it out again. Repeat a few times and test results with a compass needle.

Inverse Time-limit Relay.

J. R., Peoria: What is an inverse time-limit relay?

Answer.

An inverse time-limit relay is a relay designed to trip a switch or circuit-breaker after a short-circuit or overload has passed through the switch for a short period. The heavier the current is the quicker will the switch be opened, which gives this relay the name of inverse time; that is, the time of opening varies (roughly) inversely as the amount of the overload. These devices are used where it is desired to prevent the opening of the circuit under overloads of very short duration, as a few seconds.

Law of Inductance.

J. R., Peoria: What simple formula can be applied for finding the induction in henrys of a coil; also of an alternating-current transmission line?

Answer.

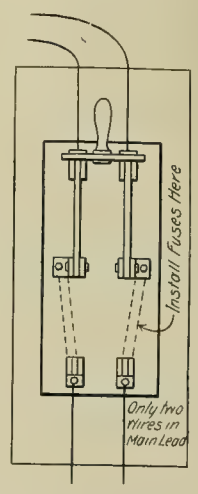
Consult a text book. In Sloane's "Electricians' Handy Book," page 334 (chapter on "The Alternating Current"), this law is stated: "The inductance [not induction] of a circuit is proportional to the square of the number of its turns, if a constant rate of increase of current is maintained in it." The henry is the unit of self-induction or inductance. But the complex phenomena of alternating currents should be studied with the aid of one of the many text-books available.

Motor Connection.

L. N., Chicago: I ask how to connect a motor. I am about to install a ½-horsepower alternating-current motor, and as the wires are already in the place, including a switch, I would like to know how to make the connections, and whether it is proper to have fuse plugs? (See sketch.)

Answer.

The sketch shows a double-throw two-pole switch. Unless there is a special starting device provided,



CONNECTIONS FOR MOTOR CIRCUIT.

which is probably not the case with so small a motor, a single-throw double-pole fuse extension switch should be used. The present switch could be made to do the work if fuses are connected between the middle posts and the lower terminals. The two upper wires should be connected at their other ends to the two terminals of the motor.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XV.—Electrical Measurements.

C. G. S. Units.

Heretofore certain electrical units have been used such as amperes, volts, etc., without any reference as to their absolute physical values. The system of units in universal use today was adopted by the International Electrical Congress of 1893, and is known as the centimeter-gramme-second system, or C. G. S. system. The centimeter is the unit of length, the gramme the unit of mass, and the second the unit of time, and all physical quantities can be expressed in the terms of these three fundamental quantities. The electrical units are derived from the following C. G. S. units:

The square centimeter, the unit of surface.

The cubic centimeter, the unit of volume.

The centimeter per second, the unit of velocity.

The centimeter per second per second, the unit of acceleration.

The dyne, the unit of force.

The erg, the unit of work, or the unit of energy.

The erg per second, the unit of power.

The absolute electrical units, which are defined below, are in some cases so large and in other cases so small that to use them in commercial work would require the use of inconveniently large numerical values, or very small fractions. For this reason a set of practical units has been adopted, all of which are certain multiples of fractions of the absolute units.

The unit of resistance is such a resistance that a unit of electromotive force will cause a current of unit intensity to flow through it. The practical unit of resistance is the ohm, which is equal to one billion absolute units of resistance. The ohm is equal to the resistance of a column of mercury 106.3 centimeters long and 14.4521 grammes in mass at the temperature of melting ice. In commercial work the megohm is commonly used, which is equal to 1,000,000 ohms.

The absolute unit of intensity of current is defined as such a current that when one centimeter length of its circuit is bent into an arc of one centimeter radius it exerts a force of one dyne on a unit magnetic pole placed at its center. The practical unit is the ampere, which is equal to one-tenth of the absolute unit. This is equal to such a uniform current which, if passed through a solution of nitrate of silver, would deposit the silver at the rate of 0.001118 gramme per second.

The absolute unit of electromotive force is such a difference of potential as requires the expenditure of one erg to cause the unit current to flow. The practical unit is the volt, which is equal to 100,000,000 absolute units, and is represented by 1000/1434 of the electromotive force of a Clark standard cell at a temperature of 15° C.

The absolute unit of quantity of electricity is that quantity which is conveyed by a unit of current in one second. The practical unit of quantity is the coulomb, which is one-tenth of the value of the absolute unit. This equals the quantity of electricity conveyed by one ampere in one second. The ampere-hour is more frequently used in commercial work, being the quantity of electricity conveyed by one ampere in one hour.

The absolute unit of capacity is such a capacity that a unit of electricity charges it to the unit of potential difference. The practical unit is the farad, which is the capacity of a condenser charged to one volt potential by one coulomb of electricity. This is one-one-thousand-millionth of the absolute unit. The microfarad, which is frequently used in practical work, is one-millionth of a farad.

The absolute unit of work is the erg, which has already been defined, and the practical unit is the joule, equal to 10,000,000 ergs. This equals the work done in one second by one ampere passing through the resistance of one ohm. As this practical unit is rather small, the watt-hour and kilowatt-hour are more frequently used in commercial work. The watt is equal to the power of a current of one ampere under pressure of one volt, or one joule per second. The kilowatt is equal to 1,000 watts. The watt is the practical unit of power and is equal to 1/1746 of a horsepower. The kilowatt is therefore equal to approximately 1.34 horsepower.

The absolute unit of inductance is that electromotive force induced by the variation of the current at the rate of one unit of current per second. The practical unit is called the henry, which is equal to an induced electromotive force of one volt with an inducing current varying at the rate of one ampere per second. The henry is one billionth of the absolute unit.

The above units comprise the practical electromagnetic units, and the brief definitions given above will serve to give the reader some conception of their physical values.

Ohm's Law.

While it is not intended to introduce any mathematical formulas in these articles, there is a simple relation between current, electromotive force and resistance which should be understood by every one engaged in any line of electrical work. This relation is known as Ohm's law, and is expressed by the equation

$$C = \frac{E}{R}$$

in which C equals the current in amperes, E the electromotive force, and R the resistance in ohms. If, therefore, any two of these values are known in a circuit through which electricity is flowing the other can be readily calculated.

Take, for example, an ordinary 16-candlepower incandescent lamp connected on a 110-volt circuit. A good lamp will require say one-half an ampere of current at 110 volts electromotive force. Applying these values to the above formula we have ½ equals 110 divided by resistance, or resistance equals 220 ohms, when the lamp filament is heated to incandescence. The energy or watts required to run the lamp will be the product of the amperes multiplied by the volts, or ½ multiplied by 110, which equals 55 watts. As a horsepower is equal to 746 watts, the energy required to run one 16-candlepower lamp would be 55 divided by 746, which equals approximately 1-14 of a horsepower; or, in other words, one horsepower would be sufficient to operate 14 such lamps.

Resistance and Conductivity.

The resistance of a conductor of electricity depends upon its length and the area of its cross-section. If the length of a piece of copper wire be doubled, the size remaining the same, the resistance will be doubled. If the area of the cross-section of the wire be doubled the resistance will be halved, so that the resistance varies directly as the length, and inversely as the cross-section of the conductor.

In a divided circuit, as, for example, when two incandescent lamps are connected in multiple, the current will pass through each lamp in inverse proportion to its resistance. If the two lamps have each the same resistance the current will be divided equally between them. If one has a greater resistance than the other, the one having the greater resistance will take the lesser current, and the one having the lesser resistance the greater current.

The specific resistance of any conductor is the resistance of a cube of one centimeter measured between opposite sides. This specific resistance varies very greatly in all different substances, being least in good conductors and greatest in insulators. Thus, substances in which the resistance is least are the best conductors, while those in which the resistance is greatest are insulators.

The specific resistances are measured at the temperature of melting ice, and if the specific resistances of two different substances are known their relative resistance is the ratio of the specific resistances.

From what has been said it will be apparent that the conductivity of substances is the reciprocal of their specific resistances.

If, for example, annealed silver is taken as unity, annealed copper has a relative resistance of 1.063; annealed gold, 1.369; annealed aluminum, 1.935; annealed platinum, 6.022; annealed iron, 6.460. Thus, aluminum has nearly twice and iron nearly 6½ times the resistance of annealed silver.

The above relative resistances are given for chemically pure substances at the temperature of melting ice. Annealing the metals reduces their resistance; and it should be noted that even small traces of foreign substances increase the resistances. In a number of cases a very small portion of foreign material will very greatly increase the resistance of the metal with which it is mixed. For this reason an alloy of several metals always has a considerably higher specific resistance than either of the metals of which it is composed.

The resistances of all metals vary with their temperature, being increased by heat. In other substances, among which is carbon, the resistance decreases with heat. In the case of the incandescent lamp filament mentioned above the resistance was given when the carbon was heated to incandescence. If the resistance had been measured when the filament was cold it would have been found to be about double the resistance when hot.

The increase in resistance with the increase in temperature of most metals is nearly uniform for a considerable range of temperature. In the case of copper, the increase in resistance is about four-tenths of one per cent. for each degree Centigrade of rise in temperature. In the case of alloys, the increase of resistance with temperature is much smaller than with pure metals, and for this reason alloys are always used for standard resistances, as it is necessary that the resistance of standard resistances should vary as little as possible.

This variation in the conductivity or resistance of conductors with the temperature is seen in the performance of all kinds of dynamo-electric machinery. In many cases the ratings of certain classes of motors will be based on the time in which they are to carry the full-load current. In street-railway service, electric crane, hoisting, and other intermittent operations, motors are frequently given what are termed half-hour, one-hour or two-hour ratings. This means that the maximum current for which they are built can only be used for a half, one, or two hours, as the case may be, for the reason that as the resistance of its windings increases, the heating effect is increased to a point which may prove destructive to the machine.

In practice these machines are used intermittently, as, for example, on a down grade of a street railway, where the current should be shut off the motor, and during these intermissions the conductors have time to cool off, to a safe temperature before full current is again applied to them.

[To be continued.]

Note.—This series of articles intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Chicago Lighting Statistics.

The total cost of lighting Chicago's streets for the year 1906 was $957,325.54. Gas, gasoline and electric lights were used. Rented electric lights cost $90 each, while those operated by the city are said to have cost $52.39 each. These figures are taken from the annual volume of statistics published by the Bureau of Statistics and Municipal Library of the city of Chicago. The cost is distributed as follows, the candlepower given being estimated:

Gas, 958,160 candlepower	$382,604.66
Gasoline, 349,920 candlepower	140,454.78
Rented electric lights, 1,492,000 candlepower	65,249.68
Municipal electric lights, 13,384,000 candlepower	350,506.09
Gas (office expenses)	9,419.43
Total, 1906, 16,184,080 candlepower	$957,325.54
Total, 1905, 14,352,434 candlepower	960,048.65

The cost per arc light on the circuits of the municipal lighting plants is given as follows: Operation, $48.52; replacement and betterment, $3.44; per cent. of office expense, 43 cents; total for 1906, $52.39; total for 1905, $52.63. No allowance is made, apparently, for interest, depreciation of plant, taxes, water consumed, etc.

The statistics show that in 1906 there were in the city under the jurisdiction of the Department of Electricity 28 commercial (central station) companies, operating 19,781 arcs and the equivalent of 1,705,534 16-candlepower incandescents; 1,348 isolated plants, with 15,787 arcs and 812,374 incandescents; four municipal plants for street lighting, operating 6,692 arcs and no incandescents, and 12 isolated municipal plants operating 83 arcs and 5,918 incandescents. This makes a total of 1,392 plants under the jurisdiction of the Department of Electricity, operating 42,343 arc lamps and 2,523,826 incandescent lamps. The department made 38,325 inspections, issued 15,787 permits for installation, and among other things inspected electric motors aggregating 41,733 horsepower.

New York Electrical Society.

The New York Electrical Society held its 267th meeting at the power station of the Interborough Rapid Transit Company, Fifty-ninth Street and Eleventh Avenue, New York city, April 24th. Over 500 of the members and friends of the society availed themselves of the opportunity of seeing this wonderful plant. After a short address by Mr. Henry G. Stott, superintendent of motive power, the visitors were escorted by a corps of ushers over the station. A feature of the meeting which was highly appreciated was the presentation to each member by the Interborough company of a pamphlet containing the principal dimensions and data of the plant. This, the first "visiting meeting" this year, was one of the most successful gatherings of the season.

Light from Gaseous Conductors within Glass Tubes—The Moore Light.

By D. McFarlan Moore.

Part II.

The degree of vacuum required in these tubes is about 0.10 of a millimeter, which, comparatively speaking, can be called a high vacuum. This vacuum is maintained within 0.01 of a millimeter of 0.00001 per cent. of an atmosphere either above or below the normal degree of vacuum. The solution of this very difficult problem of maintaining a degree of vacuum so nearly constant was found by taking advantage of the fact that but slight changes in the vacuum cause enormous changes in the electrical resistance of the gaseous conductor. For example, a tube 220 feet long at its lowest vacuum (0.11 millimeters), takes 24 amperes, but at the end of every minute this has crept up to 25 amperes, when a new supply of gas causes the amperes slowly to drop again to 24. Of course it is impossible to detect this slight oscillation either in the steadiness or intensity of the light in the tube. Making use of electricity to govern the vacuum is equivalent to using a multiplier of about 400,000.

These long tubes are built in place by hermetically sealing together 8-foot 6-inch lengths of 1.75-inch glass tubing, with walls 1-16-inch thick, by means of a new blast illuminating gas—fire or double-flamed torch. This work can be done rapidly and cheaply, since in a 100-foot tube about a dozen joints are needed and only about two minutes are required for each one. This has necessitated the development of a new trade, namely, "glass plumbing." The two ends of the tube within the terminal box each contain a graphite cup electrode eight inches long. Immediately in front of one of these electrodes a branched small-bore tube extends to the bottom of the feed valve (see Fig. 3), and the other branch is available to be connected temporarily by a rubber hose to a new small portable oil vacuum pump. The electricity is turned into the tube shortly after the pump is started and the amount of light resulting indicates in a measure the degree of vacuum in the tube. But in investigating a field of this nature a simple, rapid and accurate vacuum gauge was found to be very necessary, and it has proved to be as valuable an instrument as a compass is to a mariner. It can be calibrated to measure to one ten-millionth of an atmosphere.

As soon as the vacuum of the tube is sufficiently high the feed-coil is adjusted to feed at proper intervals the right quantity of air or other gas. When the light automatically and continuously feeds itself from the atmosphere, the supply of which is of course inexhaustible, its life can be said to be indefinitely long. When it is desired to feed the tube on nitrogen only the air is simply made first to pass through a small iron cylinder containing enough phosphorus to last several years. Should a longer life than this without any attention be desired, several cylinders can be used in series, and these can be renewed an indefinite number of times at a negligible cost. Effectually to prevent more than is necessary of the atmosphere from coming into contact with the phosphorus, or being continuously in contact with it when the tube is not in use, it has first to pass through a small mercury trap. To feed the CO_2 tube, a bottle containing a piece of marble and a little hydrochloric acid automatically generates this gas only when the tube requires feeding. Therefore this small gas generator needs only a new piece of marble at the end of several years. Various portable or unit forms of this light have been designed. For example, the one shown in Fig. 12 resembles somewhat an arc lamp. It operates at 220 volts and requires 25 per cent. less watts, yet gives 25 per cent. more useful illumination than an enclosed arc. The automatic feeding valve is of course applicable not only to alternating-current vaccum tubes but also to direct-current vacuum tubes. It can be made invaluable for all kinds of vacuum-tube apparatus, such as X-ray tubes, vacuum oscillographs, wireless telegraphy or telephony, transmitters and receivers, vacuum or vapor rectifiers or lamps.

A careful analysis of this system of illumination in general discloses the large number of advantageous features it possesses. It is the first artificial light than can rightly be called imitation daylight. Natural daylight is the only ideal light that can ever exist and the eye accords with it, therefore the nearer any light source approaches it the better, and vice versa. The absence of the red rays in daylight, for example, would far from improve it. This system is so much nearer natural light imitation that it is in a class by itself. But these tubes furnish a perfect diffusion of light because the light radiates from such extremely large areas as compared with all the old-style spots of light, and therefore if desired a more nearly shadowless light can be produced than by any other known means. The recently appearing types of incandescent lamps having improved efficiencies, such as the osmium, tantalum, zircon, graphitized carbon, tungsten, osmin, osram, titanium and helion lamps are all obtained by causing solids to get overheated, due to electricity passing through them. These new lamps—all based on an old principle—are only of transient interest, an interest of a vastly lower order than the interest that should attach to obtaining illumination by electricity passing through, not solids, but gases. They will not bring about a permanent radical change in the lighting situation. But such a change is now gradually being brought about by the vacuum tube. However, by this it is not meant or claimed that all other forms of light will be abandoned. The candle business is larger today than ever before, and history shows that the electric lamp has interfered very little with gas. But changes must come. Each form of light has its own particular sphere of usefulness, which varies in size in accordance with its intrinsic worth and age. Some are just starting on their campaigns of usefulness and others have reached their prime. Light resulting from gaseous conduction, it can truly be said, is right both theoretically and practically and therefore will probably survive for centuries. It is simply claimed that this new system of electric lighting gives the up-to-date illuminating engineer one more available method for solving some of his problems and that some of its fields, as is the case with all other lights, are exclusively its own.

It should be remembered that the enclosed arc rapidly displaced the open arc, due to better diffusion and lower maintenance cost, notwithstanding a 50 per cent. loss in efficiency, but this new system in turn excels the enclosed arc in all of these factors.

Fig. 12. A small Moorelight unit.

The recent high efficiencies that have been obtained by other forms of illuminants have always been gained at the loss of some other salient factor, for example, such as life or color, but not so with this tube light. It is based throughout on thoroughly well-known engineering principles that are properly applied. The term spherical candlepower manifestly cannot apply any more logically to a long tube than can the law of inverse squares be properly applied to its light emanation. Many of the new forms of spot lights have enormous intrinsic brilliancies, because it is impossible to make them in lower candlepowers. Besides the disadvantages of the high candlepowers of these new point light sources, mechanical difficulties may make the ordinary used voltages impracticable. Since it is possible and practicable to use these tubes graduated from an intensity of light per foot that is almost negligible up to 30 or more hefners per foot, it is impossible to state arbitrarily just what is the intrinsic brilliancy of a Moore tube. The average long tube now in use operates at 12 hefners per foot. The following table compares the tube with some other illuminants on the basis of hefners per square inch:

Moore light	at 6 hefners per foot	0.33
	at 12 hefners per foot	0.66
	at 36 hefners per foot	2
Cooper Hewitt mercury tube		19
Incandescent filaments		250
Nernst glower		600
Arc crater		10,000

Some authorities have stated that an intensity greater than about five hefners per square inch is beyond the theoretically correct limits; therefore this light is the only one that has a low enough brilliancy not to fatigue the eye. This has also been demonstrated by practice. It is remarkable that an intrinsic brilliancy as low as 0.33 per square inch is commercially thoroughly practical. That great progress has been made in tube lighting is clearly proved by calling attention to the fact that the tubes in the "Moore Chapel" at the Madison Square Garden Electrical Show of 1898 operated at only one-quarter of a hefner per foot, while now a hundred times this intensity is easily reached.

The tube lighting accurately resembles cove or concealed lighting, yet there is no necessity for concealing the tube; should it be desired to conceal the source of light the cove itself is not needed, because all that is necessary is to place an opaque reflector on the lower side of the tube so that all of its light would be thrown toward the ceiling and illuminate the room therefore entirely by reflected light.

Stroboscopic tests of the light of the tube reveal an image better than that obtained from enclosed arc lamps, notwithstanding the fact that the heat-constant of the tube as the current wave passes through zero is less than that of any other form of light. Therefore when the supply switch is opened the tube light goes out quicker than all other lights, a fact which should be valuable for signaling but which also in a measure explains the high efficiency of the tube. Tubes of this nature will operate successfully on all frequencies, but at frequencies as low as 25 cycles the images will probably become too pronounced unless two or three-phase currents are available, in which case by the use of multiple tubes the images of moving objects are entirely removed. The highest frequency in use at present for operating these tubes is 480 cycles, and is furnished by a motor-generator on 220 volts direct current. Careful tests on various frequencies up to about 10,000 cycles have shown that the number of alternations of the current used to excite these long tubes has nothing to do with their efficiency.

The term hefner-foot will soon replace the unsatisfactory candlepower, and contracts for lighting any area will be based on specifications calling for a definite intensity in hefner-feet on each square foot or square yard of the area to be lighted. This is far more practical than agreeing to furnish a lamp which is supposed to require no more than a certain number of watts per candlepower at the beginning of its life. There should be used a single commercial quantity or figure that would correctly express the "illuminating efficiency" of each and any system of lighting used to illuminate a given area. The term hefner-foot is preferred because the hefner is the only practical primary standard. Thre is no longer any excuse for using the term candlepower, and it should rapidly be dropped. I believe that the proper way to compare all forms of illuminants would be approximately on the following basis: (1) The area to be lighted should be about 40 by 80 feet and of approximately the shape indicated by these dimensions. (2) The illuminants must not extend below a horizontal plane 10 feet above the floor. (3) The award is to be made entirely upon the results of illuminometer tests in a plane 30 inches above the floor and the stations of which are to be located as follows: Ten equal spaces on the center line of the longer dimension, 10 equal spaces on the center line of the shorter dimension, and 10 equal spaces on the diagonal. The average of these 30 readings is to be divided by the total number of kilowatts used from the street mains by each form of illuminant, and the highest quotient (light units per energy) will determine the placing of the award.

Architects have long considered electric-wiring problems one of their most vexatious burdens. Now a terminal box can be used as a center of distribution from which there radiates a number of long tubes to illuminate portions of the same floor or extend to floors above or below. A tube provided with a reflecting enamel on one side is a far simpler device for lighting show windows than the extremely cumbersome combinations of rows of incandescent lamps with mirrored reflectors in sheet-metal troughs, etc. This tube system has no complicated mechanism like arc lamps, for example, but instead the only moving part is the displacer of the feeder valve, which in its design is about as near being frictionless as is conceivable. Normally, its movement is less than 1-32 of an inch, and some of these valves have required no attention and yet have been in active use over 4,000 hours. They should continue to operate an indefinitely long time.

Discussion (in Part).

Chairman Gano S. Dunn, Ampere, N. J.: I think we should be careful not to make the mistake of estimating the value of the Moore system solely on the basis of efficiency. Its intensity does not vary inversely as the square of a distance, as all lights do. The test of the lamp should not be the test of the efficiency, but rather the test of the light it delivers where we want illumination. A light of high intrinsic brilliancy, of concentrated source, over-illuminates the surface near it, while it under-illuminates the surface away from it. The eye is also inclined to undervalue the illumination of the under-illuminated surface, because it often passes on this surface after having first rested on the bright surface, or possibly upon the lamp itself. Not only this, but the excess of light in the neighborhood of the over-illuminated surface costs money and has to be paid for; besides, that very excess by having fatigued the eye renders of less value the illumination we actually succeed in producing upon the under-illuminated surface. The feature of Mr. Moore's light is its distributing source, the enormously large area over which it illuminates compared with the area of a nutshell in which other lights are generated, or of a short tube in which a Cooper Hewitt mercury-vapor light is generated.

C. P. Steinmetz, Schenectady, N. Y.: The second part of the paper constitutes a very valuable addition to our engineering knowledge of this method of producing light by what may be called an improved Geisler tube, because it is the old Geisler tube now in the form of a commercial illuminant. The paper gives the first actual engineering data of this kind of light, the actual energy, current, and some data on efficiency, etc. Comparative data are given on the illumination produced by the Moore tube and the incandescent lamp, and comparisons are made between the arc lamp and other systems. I do not think much of the com-

parative value, the relative proportions between the two, except that it shows that we can install incandescent lamps and arc lamps in such a manner as to get very little light from very much power. We know that without having had tests made. We know that if you leave the installation of the incandescent lamp to the artistic sense of an architect, or to mere accident, you will get this condition, but the comparison is not fair, because if we replace an unsatisfactory incandescent-light system, unsatisfactory by reason of poor installation, poor size of reflector, etc., with an intelligently installed system, you naturally can always show advantages.

Some illuminating efficiency measurements in hefner-feet are also given. I regret the use of the word hefner. Here in the United States we measure light and illumination in British candles, not in hefner-candles. The hefner-candle is 1.88 times the British candle. These values have to be multiplied by 1.88 to bring them to our American standards of light and illumination. That is an undesirable unit—just as much so as if we should give something in French leagues, measure a distance by some measurement which is not standard in this country. Mr. Moore finds an illuminating efficiency (mean hefner-foot per watt) of 2.15. One British candle has a source of light of one mean spherical candlepower; that means you get a unit of illumination of one candle-foot at one foot distance. One mean spherical candlepower gives you 12.56 candle-feet, or, dividing it by 1.88 to reduce it to hefner-feet, gives you 14.28 hefner-feet per mean spherical candle. Here you get 2.15 mean hefner-feet per watt; that would mean, reduced to mean spherical candlepower that this light consumes in the useful illumination 6.64 watts per mean spherical candle, if you count only that light which reaches the illuminated plane. It means, then, that a very considerable part of the light is thrown away, absorbed by the walls, ceiling, etc. I do not believe it is an unfair estimate for such a class of light, to say that 50 per cent. of the light is wasted; that is, estimating that half of the flux or light radiated by the tube reaches the place of test. That would give you an efficiency of 3.72 watts per candle.

Assuming four watts per mean spherical candlepower, which is a reasonable value, you should get, for all the light which is useful in the illuminated plane, 3.57 hefner-feet per watt, or eight times as much as is given in the table. That means, if these were four-watt incandescent lamps, that they lost seven-eighths of the light before the light reached the illuminated plane. That explains the enormous difference in illumination by these two sources. Coming to the photometric tests, we have, for the most efficient tube, 1.4 watts per hefner-foot. That means at right angles to the tube. The average light in the reading is twice this. The first question is how much light do we get from the source of light? The best efficiency seems to be about 2.5 watts per unit flux of light, that is per lumen, but that flux of light is given by one mean spherical candle. That gives us about the efficiency of the tantalum lamp, or not very far from that of the enclosed arc; better than the incandescent lamp, the carbon incandescent lamp, but inferior to the tungsten lamp. The efficiency of the Moore tube has arrived at that stage where it is now in the range of commercially practical efficiency as an illuminant. It is not any more an inefficient illuminant, although it is not of the same magnitude of efficiency, as, for instance, the mercury lamp.

The efficiency of light production is not the only thing. The essential question is, How can we make use of the distribution of this light? A very great essential is low intrinsic brilliancy to eliminate the dazzling effect and blinding glare, which applies to the new source of light, the tungsten filament, for instance, which is rather bad. We must, however, not attribute too much importance to this feature, because even a point source of light can be diffused by a Holophane or frosted globe. You lose light by it, but if you consider, for instance, say, five hefners per square inch as a proper low intrinsic brilliancy, and take a 32-candlepower tungsten lamp, and enclose it in a frosted globe three to four inches in diameter, you bring the intrinsic brilliancy of the whole globe down to five hefners per square inch, and probably less, from 15 to 20 per cent. of efficiency, and still have an efficiency higher than the Moore light. You can allow in favor of the low intrinsic brilliancy from 15 to 20 per cent. lesser efficiency, but not more, because otherwise you can go to very high intrinsic brilliancy by defraction.

Reference is made in the paper to the blinding brilliancy of the mercury tube. I have not noticed that. I am using the mercury tube almost exclusively as artificial illumination for any work that I may have to do. I would not think of using any other source of light, and find it by far the best. I would challenge the statement made that "the only commercial and proper method of comparing all sources of light is on the basis of their ability to produce useful illumination, and not by any other basis." That is a good way where you have a contract with a customer to light his premises, but that does not help you one step further. The customer wants to find out how he can get good illumination with an economical amount of power, and if the illuminating engineer puts in the lights the important question is, what type of light to employ to use the least amount of power to produce illumination, and for the illuminating engineer the most important question is what source of light gives the maximum flux of light for a given amount of energy—the maximum quantity of light per watt? The next question is, Whether this source of light is suitable for distribution, and how much of the light he may have to waste to get the proper distribution.

The statement is made that photometric tests do not amount to anything. That is an old statement, repeated very often, but I do not think you will make anyone believe that the mean spherical candlepower does not mean anything; yet with a source of this kind you cannot speak of mean spherical candlepower, but you can speak of the total flux of light, and another thing which means something is, how much total flux of light does it give? The important question in the matter of lighting is the total flux of light per watt. We may say how many lumens per watt, since the lumen is the total flux of light and is the amount of light which a candle gives out at one foot distance, and one square foot. I am not here to speak of lumens, but a convenient substitute is mean spherical candlepower. We speak of so many mean spherical candlepower of a source of light, which really does not mean the light is the point and gives so many mean spherical candlepower, but means the total flux of light given from that source is the same as would be given from a combined source of so many mean spherical candlepower. If we say the tube has 1,000 mean spherical candlepower, that means the total flux of light is the same as the flux coming from a point having 1,000 mean spherical candlepower. That is the unit of flux of light, and is the important question. If you would investigate illuminants in a 40 by 80 foot room, I believe you would find in determining the efficiency of illuminants (to find out which illuminant requires the least energy to give a certain illumination in such area) that the mercury lamp is first, then for a long while nothing; then the tungsten, and then for a long while nothing; and then the Moore light, the tantalum and the enclosed arc, and later on the different filaments and incandescent lamps and carbon lamps and Nernst lamps, etc. After all, neither the Moore light nor the incandescent light has the same magnitude of efficiency as the mercury-vapor lamp, and they come next to the tungsten lamp.

Percy H. Thomas, New York: There is one point which a great many people do not realize the value of, which Mr. Moore mentioned casually, and that is, if you can do your lighting in a room from one outlet and do away with the pendants and fixtures and small outlets, you save not only a great deal of expense, but a good deal of fire risk and danger. The elimination of the cost of multiple outlets and many units, fuses, cords, etc., is one of the biggest factors of economy in Mr. Moore's tube over incandescent lamps, and the Cooper Hewitt tubes over incandescent lamps. Mr. Moore made a point of the fact that he considers his tube to give artificial daylight. This statement needs a little challenging. In the first place, daylight gives practically a continuous spectrum. Mr. Moore's light comes from gases and must be a banded spectrum—a few colors well distributed over the spectrum, but which cannot give the same effect as a true continuous spectrum. The tube does not give a strictly perfect diffusion, though at first sight it may seem that this is the fact. The diffusion is perfect in one plane and very imperfect in the other. If you will take your papers and turn them over toward the light, with your pencil parallel, you will get a delicate shadow. You place your pencil crosswise, and you get no shadow at all. In one plane your light is diffused and in the other plane, crosswise, the light is not diffused. It is even possible, with incandescent lamps distributed over the ceiling, to get a more perfect diffusion than with this tube. The short interruptions within the length of the tube are not as important in disturbing uniform distribution as a large cap from one side to the other. You do not need perfect uniformity of light to give substantially uniform distribution. I have seen a good many Moore tubes, under many conditions, but never saw one which looked like daylight.

It is stated by Mr. Moore that "it is not now possible to state definitely what their final life will be, beyond the general statement that some of these tubes have already been in operation over 4,000 hours without change, and that there are good reasons for believing that they should continue to run at least again as long, which is a much longer life than any other form of illuminant yet invented." In a great many places commercial Cooper Hewitt tubes have operated for 10,000 hours. I know of one or two instances where they have operated for 16,000 hours. I am speaking of commercial installations. Mr. Moore has taken a number of stations at different points in a room and determined the intensity of illumination and then averaged the results. These points are well chosen to determine the distribution of light per unit of surface, but if you will notice, it is not fair to average these values as they are taken, because some of them represent a very much smaller area than others. The proper way to plat such a table is to divide the surface into a number of equal units, determine the illumination of each unit and average these.

It is something of a question in my mind whether the mercury valve will not give us trouble if the lamp is left unused for a considerable time. In mercury sealed valves the mercury after a while absorbs a little air on the surface exposed to the atmosphere. If the tube leaks sufficient air, by being out of commission for a month, it might not start up again sufficiently to clear itself. The good points of the Moore tube are its relatively good efficiency (not the best, but relatively good, probably better than most incandescent lamps), its diffusion, and the fact that it has no bright, brilliant spots. The chief difficulty, I imagine, will be found to be its certain tendency to fail at times; any crack or damage done to the tube will put the room in darkness. Furthermore, it is not a matter of taking a spare out of the closet and putting it up, for you are entirely dependent on the manufacturer, and you must go to him and get him to come and pump out the tube and fix it up.

The power factor seems to be a variable question. I originally used a power factor of 50 per cent Now Mr. Moore has it to 60 or 65 per cent. and expects to get it higher still. If the power factor is made very high, it means the elimination, to a certain extent, of the resistance of inductance which absorbs voltage, and will allow more variation in the current. That may become a serious factor. The power factor is in some cases very important. Where you buy your power from a lighting company and pay for the power by meter it is not serious, because the drop in wiring comes in, but if you do your own lighting the capacity of your generator must be considerably greater for a lower power factor to get a given quantity of energy than with the higher power factor, and this would be an added charge against the Moore tube in cases where the load was exclusively for lighting these tubes. With the whole illumination in the room dependent on one or two or three outfits, it is impossible to use a portion at one time.

Dr. C. H. Sharp, New York: Mr. Moore makes a statement that the watts per hefner of the yellow tube vary from 1.3 to 2.5 watts per hefner-candle; or, in other words, from 1.5 to 2.9 watts per candle, measured at right angles to the tube. The white tube, the carbon dioxide tube, has less efficiency. By comparing two of the illumination tables which Mr. Moore gives, we find that the white efficiency bears a ratio to the yellow efficiency of 1.5 to 2.9, or about 1 to 2. In other words, the yellow tube is about twice as efficient as the white tube. I do not think we can lay much weight on these comparisons. However, taking this comparison, we find that the watts per candle of the white tube would range from 3 to 5.8. The yellow tube, according to this, shows an efficiency over the carbon-filament lamp. The efficiency, however, according to this showing, is considerably less than that of the tungsten lamp. Consequently, we can say in a general way that the Moore light does not represent an essential gain as compared with the other illuminants for the present time. Let us consider some of these advantages. It gives a diffused light; it is a light of low intrinsic brilliancy; it has no bright spots to blind the eye; it does away with a certain amount of wiring in the building. What are some of the disadvantages? I think some of us might say that its color is not all that it might be. It has the great disadvantage of not being divisible. We throw a switch and turn on all the light into a room. We cannot have a little light here or there, as we need it. I do not think we consider the tube to be absolutely immune from breakage, and if it breaks we are in the sad position of being obliged to call in the glass plumber. Another serious disadvantage which we have noticed here tonight is the flickering on the alternating current. In any room where the objects are moved rapidly the effect which is produced could be scarcely called anything less than weird, and unless it is possible to overcome this disadvantage in some practical way, and it is hard to see how this is possible, we must mark this down as a serious detriment to this style of lighting.

Let me say one word regarding illuminometer comparisons of various illuminants. This method is undoubtedly excellent for many purposes. If we have a certain room which we wish to illuminate, and if we can carry out illuminometer tests with the various kinds of lighting which are available, we will get in this way eventually the best system for lighting that room, but unfortunately, research of this kind is something which cannot be carried out except under very special conditions. Without wishing to depreciate the value of illumination tests, I do not think we could accept the general validity of results which would be obtained under certain specific conditions, in showing the availability or non-availability of all sources of light. In that connection I wish also to raise my voice in depreciation of the term watts per hefner and hefner-foot. It is bad enough to have the candle-foot, because the candle-foot ought to mean the product of the candlepower by the feet, but it does not mean that. When we bring in an extraneous unit of light which is represented by a most excellent standard of light, namely, the Hefner-Alteneck amyl acetate lamp, but which is not practically recognized as a unit in this country,

we are going far afield and getting badly mixed up in our units of measurements.

[In this week's "Illustrated Electrical Patent Record," page [illegible] patent issued to Mr. Moore on April 30th is illustrated and briefly described. In this case a number of Moore tubes connected in series are shown.—Ed. W. E.]

Deflocculated Graphite.

By Orrin E. Dunlap

Edward G. Acheson of Niagara Falls has invented a process for making a new product which he calls "deflocculated graphite." Mr. Acheson is the discoverer of the process for making artificial or manufactured graphite, and it has long been his ambition to suspend, permanently, graphite in oil or water for lubricating purposes. In the deflocculated condition produced by Mr. Acheson graphite has a condition of fineness that is truly remarkable and which is obtainable by no other means. The truth is that its condition resembles, if not wholly approaches, the molecular state.

The "Acheson effect," for such this new process may be termed, is produced with water and a comparatively small quantity of gallotannic acid. When graphite is treated in this manner by Mr. Acheson it remains suspended in the water, and shows no disposition to settle, the condition being permanent. The black liquid thus formed will pass with ease through the finest filter paper. Very severe tests have been made, demonstrating that it is an admirable lubricant, and there is apparently every reason to believe that deflocculated graphite, with and without oil, will become a popular lubricating agent.

Graphite has been recognized as an excellent lubricant for many years, and it has constantly been growing in popularity. Many persons have devoted considerable effort to invent a process whereby graphite could be suspended in a liquid for use as a lubricant, but up to this time the permanent suspension of graphite has never been accomplished. Scientific men know that plain water has many advantages as a lubricant if it had sufficient body to withstand the pressures brought to bear and to which lubricants are subjected. The high specific heat of water would be of great advantage to keep down the temperatures of bearings, while its low viscosity would reduce friction, but unfortunately it has not sufficient body to withstand the pressure of an ordinary bearing, while it also has the fatal quality of rusting and corroding metals, thus making it absolutely worthless as a lubricant.

The "Acheson effect," however, makes it possible to reduce graphite to practically the molecular state and to cause it to remain suspended in water for an indefinite period of time, and it has the further effect of preventing rust or corrosion while associated with water, thus enabling the taking advantage of water as to its high specific heat and low viscosity, making of Mr. Acheson's latest product the most perfect lubricant known. This is recognized as a very broad claim, but the results warrant it.

It was in 1901 that Mr. Acheson engaged in a series of experiments having as their object the production of crucibles from artificial graphite. This led him to a study of clays, and he learned that American manufacturers of crucibles import from Germany the clay used by them as a binder of graphite entering into the crucibles; also that the German clays are more plastic and have a greater tensile strength than American clays of very similar chemical constitution, while residual clays—those found at or near the point at which the parent feldspathic rock was decomposed—are not in any sense as plastic or as strong as the same clays are when found as sedimentary clays at a distance from their place of origin. Chemical analysis failed to account for these decided differences.

When he became aware of these conditions Mr. Acheson reasoned that the greater plasticity and tensile strength were developed during the period of transportation from the place of their formation to their final bed, thinking possibly it might be due to the presence of extracts from vegetation being in the waters which carried them. He made several experiments on clay with vegetable extracts, tannin being one of them, and found that a moderately plastic, weak clay, when treated with a dilute solution of gallotannic acid or extract of straw, was increased in plasticity. Recalling the record in Holy Writ of the fact that the Egyptians caused the children of Israel to use straw in the making of brick and believing the process was used not for the benefits derivable from the weak fibers, but for the extract he calls clay so treated "Egyptianized" c[illegible]

Having in 1905 discovered a process of producing a fine, pure, unctuous graphite, Mr. Acheson undertook to work out the details of its application as a lubricant. In the dry form, or mixed with grease or oil, it was easy to handle, but he wished it to enter the entire field of lubrication as occupied by oil. In Mr. Acheson's early efforts to suspend it in oil, he met the same troubles encountered by his predecessors in this line of work. It would quickly settle out of the oil. His unctuous graphite was just plain, simple graphite, and obeyed the same laws covering the natural product.

Matters relating to Mr. Acheson's experiments remained in this condition until the latter part of 1906, when the thought occurred to the investigator that tannin might have the same effect on graphite that it did on clay. He tried it, with satisfactory results, and it has been the pleasure of the writer to witness most interesting experiments, extending over several weeks, made with unctuous graphite of Mr. Acheson's manufacture, which might properly be termed disintegrated unctuous graphite.

To one sample of this graphite plain water was added, and after rubbing it in a mortar it was poured into a test tube. To another sample of the graphite and water a little gallotannic acid was added, also a few drops of ammonia, this last, not absolutely necessary, but having been found to improve the result with some waters. This second mixture was rubbed in the mortar as in the first case, and then it was poured into a second test tube. Both tubes and their contents were thoroughly shaken, and simultaneously placed in a rack to settle. When about two minutes had elapsed after the shaking, it was found that the graphite in the plain water had very completely separated from the water, not being miscible therewith, while the mixture of water, graphite, tannin and ammonia remained as black as when originally shaken up. The graphite was thoroughly suspended and showed no disposition to settle or separate.

Then from a bottle containing a quantity of graphite, water, tannin and ammonia, which had been mixed some weeks, a quantity was poured into a glass funnel containing one of the finest filter papers made in America. The deflocculated graphite ran through this fine paper and collected as black as ever in the tube below, apparently unchanged. Its passage through the filter paper was remarkably rapid, leaving no doubt that it was thoroughly mixed. Next, in order to demonstrate that the black liquid was a mixture of water and a solid body—graphite—a few drops of hydrochloric acid were introduced into the test tube containing the mixture. This was slightly warmed over a spirit flame, causing the suspended graphite to flocculate, so that when the liquid was poured into another filter paper, the water ran through clear, the graphite remaining on the paper. A small quantity of this graphite was removed from the filter paper and rubbed on another paper, where it was dried. A brisk rubbing with a finger brought out the familiar and full lustre of the graphite. It may be added that Mr. Acheson has obtained this "effect" with amorphous bodies generally, alumina, lampblack, clay, graphite and siloxicon, the only exception being magnesia, which needs further tests.

Mr. Acheson's success in deflocculating graphite and causing it to remain suspended in water was naturally most gratifying. He, however, realized that people have been educated to the use of oil as a lubricant and that it might be difficult to reeducate them to the use of water and graphite for a similar purpose until they better understand what progress the world has made in this his latest accomplishment. With these thoughts and convictions, he undertook a solution of the problem of replacing the water used as a conveyor of the deflocculated graphite with petroleum.

Naturally, his first experiment, and probably the most rational, as well as the simplest, was to diminish the quantity of water by evaporation, leaving the graphite in a dry state, to be rubbed up later in oil. While this method produced what appeared to be an ideal result, it was soon discovered that in a comparatively short time the graphite had settled out of the oil, having lost its deflocculated condition and returned to its original flocculated state. Consequently, it was not in condition to remain suspended in oil, nor indeed was it possible to again suspend it in water.

These experiments were made during the latter weeks in April, and notwithstanding the decided failure just noted, and the apparently insurmountable difficulty associated with the problem, the desired result was eventually accomplished by Mr. Acheson. The writer has witnessed the suspension of deflocculated graphite in water, has seen the water removed and the deflocculated graphite suspended in oil and passed through the finest filter paper made, remaining suspended thereafter in a most remarkable manner.

Mr. Acheson now feels assured that with his disintegrated unctuous graphite, which is guaranteed to contain less than one per cent. impurity, and can be mixed with oils or grease as may be desired for all specific purposes; with his deflocculated graphite in water for lubrication of steam-engine cylinders and other places and parts where the introduction of oils is objectionable, and with his deflocculated graphite in oil, the quantity carried by the oil to be varied to suit requirements of the most difficult lubrication, he can meet any demand for a lubricant where oil is preferable and evaporation of his water lubricant might be objectionable. It is an impressive fact that the lightest and thinnest of oils, when used in conjunction with deflocculated graphite, can be used in the place of the heavy and expensive lubricating oils of the present day, while the lasting qualities of the graphite lubricants will be greater by far than any oil lubricants the world has known.

It will be realized that the "Acheson effect" is particularly important to the world, not alone because the discoverer has been able to develop surprising new possibilities in the field of lubrication, but because of the fact that he has learned how to deflocculate all amorphous bodies, and by that means he can separate them from crystalline bodies which are impossible of deflocculation.

More About England and the Wireless Conference.

The committee of the House of Commons considering the Berlin wireless telegraph convention of 1906 continues to take evidence, but the end is now in sight. Sir Oliver Lodge in his evidence first claimed to have done much pioneering work before 1896, the date of Marconi's first patent, and that his application for a patent for a tuned system dated 1897 was made long before Mr. Marconi's patent of 1896 was published. It appears that the latter, although dated 1896, was not actually published until late in 1897. Sir Oliver Lodge gave some interesting particulars of the "perfect tuning" which now exists in the Lodge-Muirhead system. On one occasion at their station at Hythe in Kent—which is a regular nest of wireless stations—messages were received from a particular station 60 miles away, while all the neighboring stations were "shouting as hard as they could."

A feature of the system is the exceedingly small power that is used. At Hythe it is only one-sixth horsepower. Again, there is an installation working between Trinidad and Tobago which works across a stretch of water 300 miles, and here the power is only one-half horsepower. During the Prince of Wales' visit to India recently communication was established with H. M. S. Terrible when it was 580 miles away, with only this small power.

Mr. Nevil Maskelyne, technical adviser to the Amalgamated Radio Telegraph Company, stated that his company owned the Poulsen patents and the De Forest patents, with the exception of America. Intercommunication, he said, ought to be made compulsory. With the Poulsen system it would be technically impossible to intercommunicate with spark-telegraphy systems, and therefore until developments took place which decided the system to be universally used—a spark system or a continuous-wave system—it would be necessary for ships fitted with Poulsen apparatus to be also fitted with De Forest apparatus to enable intercommunication to be brought about.

As was to be expected, the Marconi Wireless Telegraph Company is entirely opposed to the ratification by Great Britain of the Berlin radio-telegraph convention of 1906. Giving evidence before the House of Commons committee which is considering the question, Mr. Cuthbert Hall, managing director of the company, charged every other system with having been copied from Marconi's, and in particular he accused Professor Slaby with having come to England with credentials from the German government as a man of science with no commercial interests, and in that way securing information from Mr. Marconi which he utilized to bring out another system.

Marconi's company says that it has organized an international wireless service for the sending of commercial messages, which no other foreign company has done; and that to give—as the convention would—the free use of this organization to all other systems would be grossly unfair. The company feels confident that if Great Britain were to refuse to sign the convention and all other countries signed it, there would be no difficulty in dealing with any

deliberate attempts at interference that might be made by the operators of other systems. In fact, this is what it requests the committee to recommend, in view of the alleged superiority of its system over all others.

Mr. Gavey, the late engineer-in-chief to the Post-office, on the other hand, asserts that no one system of radio-telegraphy, technically, is in advance of another, and he predicts that if Great Britain refuses now to sign the convention such a state of wireless chaos will be brought about that that country would eventually be compelled to ask to be allowed to come in.

Window Lighting.

By J. H. Turner.

Show-window lighting may be divided into two classes: (1) Where the lights themselves are the attraction; (2) where lights are used to illuminate properly the goods displayed. In the first class come saloons and places where no goods are displayed and the lights simply are used for attracting attention. Unfortunately, this method is often used where the result desired is to show the goods, as, for example, where rows of bare incandescent and electric lamps form the border of a display window. Owing to their being in the line of vision they fail lamentably in producing proper results.

A famous French scientist charges Americans

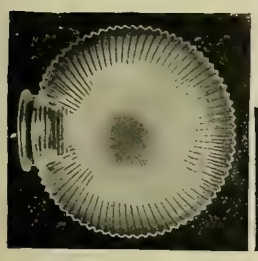


FIG. 1. TOP VIEW.

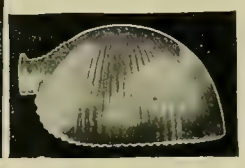


FIG. 1. SIDE VIEW.

with "caring as little for their eyes as they do for their stomachs." That there is a measure of truth in this statement cannot be denied. People looking into the window often make the statement that the light is "hard on the eyes," which simply means that the source of light is too intense to be comfortably or safely looked at; this results in the loss of a large percentage of prospective customers.

The shrewd merchant has an eye for the comfort of every person that looks into his window. For a window where goods are shown, the light should be entirely hidden and at the same time concentrated strongly on the goods displayed. When open-flame illuminants furnished the only means of illuminating show windows, many a merchant said to himself, "How can I set my goods so that the light will fall on them in the right way?" With the advent of electricity there came a change. The question the merchant asks himself now is, "How shall I place my lights so as to display my goods to the best advantage?"

The students of illumination were quick to seize

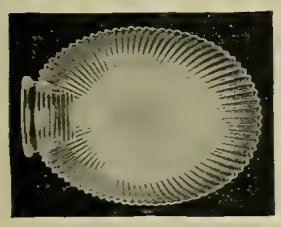
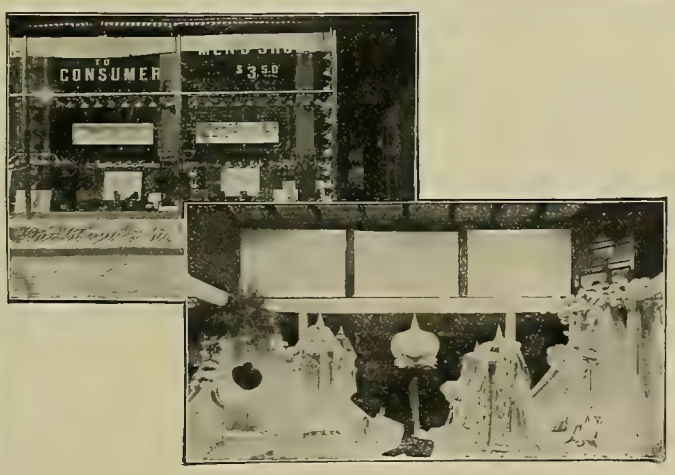


FIG. 2. TOP VIEW.



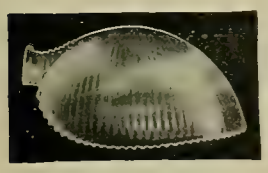


FIG. 2. SIDE VIEW.

EXAMPLES OF MODERN WINDOW LIGHTING.

upon this opportunity to display their ingenuity and have designed a reflector for use especially for window lighting. These are known as Holophane reflectors for window lighting. They can be used advantageously where the lights are placed either horizontally or vertically along the frames of the window. They have the advantage of not only concentrating the light strongly on the goods but also protecting the eyes from the glare of the filament, thus allowing the use of clear lamps, where if used bare, only frosted lamps would be permissible. At the same time, enough light passes through the prisms to make a pleasing appearance and add to the advertising value of the lights. Where it is desired to hide the lights entirely, they should be placed just above the top of the glass of the window. The Holophane reflectors will then concentrate the light and direct it downward, allowing just sufficient illumination for the ceiling. The reflectors can be slanted so as to illuminate a window of any depth or height. In case they are not placed higher than the top glass, a black band should be painted on the glass of sufficient depth to hide the reflectors from observation from the street.

A novel effect may be obtained by forming any desired sign in the black band, the light shining through the Holophane reflectors, making the letters stand out distinctly.

The cuts shown here illustrate two of the most popular forms of Holophane reflectors, designated as Figs 1 and 2. In these days of strenuous competition it is fast becoming evident that the most successful merchants are realizing that a window properly lighted is a strong selling factor that cannot be ignored. Properly constructed reflectors are as essential to an enterprising merchant as a good advertisement in his local paper.

A New Conduit Clamp.

A new device has been placed on the market by Pass & Seymour of Solvay, N. Y., in the shape of a conduit clamp. It is shown in the accompanying cut in connection with iron pipe on steel girder

A NEW CONDUIT CLAMP.

work. In presenting this clamp to the trade the company states that it is unlike the ordinary conduit clamp in that it is not a cumbersome and expensive affair. To the contrary, the new device is neat, compact, of sufficient strength, reasonable in price and easy to put in place. All that is required to install it is a screwdriver.

Model Electric Road for Winnipeg.

When the Winnipeg, Selkirk and Lake Winnipeg Railroad is completed and in operation between Winnipeg and Selkirk, Manitoba, it will be one of the most notable electric railways in Canada. The current will be derived from the Lac du Bonnet power plant and transmitted at 60,000 volts, reduced to 2,300 volts to carry it through the town of Selkirk, after which it is stepped up to 13,000 volts and carried to two sub-stations from which the feeder lines are supplied.

The new line will be 22 miles in length and will have running rights over the Winnipeg tracks. In the building of this line great attention has been paid to every detail. Each car will have four Canadian General Electric motors, complete with multiple-unit control and air brakes. This railway is among the first of the benefits which Winnipeg and the surrounding country are destined to reap by reason of the power development on the Winnipeg River near Lac du Bonnet.

The "Fuel Value" of Ashes.

By T. H. Reardon.

In ordinary parlance, the term "ashes" denotes the solid matter that has fallen through the grate of the furnace without contributing anything in the shape of heat units toward the general fund. Such a residue, while, by common consent, is termed "ashes," should never be spoken of as "ash," which implies something very different.

In the analysis of coal and in the determination of ash, in many technical operations, the sample containing hydrogen, carbon, sulphur, etc., is placed in a tube of hard glass, technically known as a combustion tube, and, with a stream of oxygen passing through it, the tube is maintained at a visible red heat for a time varying from 15 to 45 minutes, according to the facility with which the combustion takes place. The residue remaining in the tube at the end of the operation is "ash," and there is nothing left in it that may be reclaimed by the genius who is negotiating for heat units.

The analysis of coal as reported by the chemist should be understood by the man who is to burn the coal in a practical way, with conditions that make absolutely perfect combustion impossible. It is unfortunate that the combustible in fuel is not burned as completely as it should be, and any efforts that are directed in an intelligent way to reduce this waste to a minimum are worthy of emulation.

The methods that are in vogue at the present time, and that are giving such remarkable results in the hands of the non-technical, according to the reports in the daily papers of the "burning of ashes," seem to be applied in a very inconsistent manner. The object is more completely to burn the combustible in the coal; and many are directing their efforts toward this end with various degrees of success; but the logically correct method is to secure this result before the combustible drops through the grate and goes into the ashpan.

It should be understood that the combustible which drops through the grate before it is burned involves a loss that is twofold in character. In the first place, we may consider the heat units which have not been evolved, owing to the fact that the combustible has not been burned; in the next place, when this residue leaves the grate it has a temperature, approximately, as great as that of the fire from which it has just separated.

The time to apply the remedy is before the residue drops through the grate, as after this has occurred it involves a second handling of the material, together with the fact that this residue, if used as fuel in a second operation, must regain from some source the heat units given up to the surroundings during the time that the residue has been cooling.

The combustion of fuel can be made more perfect by adopting any one or more of several expedients, always bearing in mind, however, that the results secured must be worth more than the money expended for this purpose. The law for the most economical weight of copper to use in a given circuit, enunciated by Lord Kelvin and the analogue of the same law in Trautwine's "Civil Engineering," both state that results must be worth more than the cost of securing the results. That is simply common sense.

The effect of using such agents as free oxygen, oxygen salts, potassium nitrate (KNO_3), potassium chlorate ($KClO_3$), etc., are well understood, and will not receive extended mention here. It may be worth while, however, to consider the probable effect of salt (sodium chloride, NaCl), oxalic acid ($C_2H_2O_4$) and water—the formula which is being

widely circulated by the lay press at the present time.

Salt is not known to exercise any beneficial effect on hydrocarbon combustion; it is known to promote the fusion of silicates at high temperatures, and one result which has been noted already by those who have put the above formula to a rough-and-ready test is the great facility with which clinkers are formed.

This is to be expected, for in the specifications for clay to be used in the manufacture of firebrick it is stipulated that sodium and potassium must be present only in a very small amount, as the presence of these elements promotes the fusion of the brick and destroys the refractory characteristic upon which its value depends.

In regard to the use of oxalic acid, this compound when heated breaks up, disengaging carbon dioxide (CO_2) and carbon monoxide (CO). The carbon monoxide has a fuel value; that is, in burning to CO_2 it takes up another atom of oxygen; but as this gas is derived solely from the decomposition of the oxalic acid, any heat derived from this source cannot be placed to the credit of the ashpile.

Water has no fuel value, but certain kinds of coal when thoroughly wet down will burn and give far better results than could be secured if the water treatment were omitted. The only useful purpose served by the water is found in the fact that it holds finely pulverized coal together until a caking of the mass under the influence of heat takes place, and under the further effect of heat the steam that is formed from the added water, in escaping, leaves the coal in a porous condition and greatly facilitates the passage of the flame through its interior, the advantage gained in this way more than compensating for the loss of heat which the use of the water entails.

In the writer's opinion, the most valuable constituent in the "ash-burning formula" is the water; that can be obtained at the least expense. The use of water in locomotive firing, and in stationary firing also, in the case of finely divided soft coal, has been practiced for a great many years, and the particular benefit which results from its use is fully demonstrated and well understood.

Many manufacturing concerns are using coal of the cheapest kind, and by using grates that are adapted to conditions and employing forced draft are obtaining results which are very satisfactory, regarded from the financial standpoint. An instance has recently come under the writer's notice in which the cheapest kinds of slacks and coal "dirt" are extensively used for burning lime, which requires a very intense heat. The forced draft is obtained by using a steam blast under the grates, and the results seem to be very satisfactory.

The conditions and methods which will give the greatest number of heat units for the money expended will result from care and experience in the selection of fuel, coupled with intelligence in the boiler room, and further assisted by the adoption and use of the most up-to-date appliances for improving combustion.

The man who tries to reclaim something from the ashpile is late, very late, and he is using the pound of cure instead of the ounce of prevention. It is not intended to imply that there is no coal in the ashpile to recover, but rather to lay stress on the fact that the greater wisdom would seem to lie in the effort to keep the unburned coal from going in the ashpile instead of making such strenuous efforts to reclaim it after it has gone there.

Preparations for Electric-light Convention.

Convention circular No. 2 in relation to the Washington meeting of the National Electric Light Association of June 4th to 7th has to do principally with hotel arrangements. A schedule of rates is given and is requested that reservations for hotel accommodations be made through Mr. E. E. Bondy, 55 Duane Street, New York city, vice-chairman of the hotel committee, of which Mr. E. S. Marlow, 213 Fourteenth Street, N. W., Washington, D. C., is chairman. The present intention is to open the convention exhibition on Monday evening, June 3d, and it is hoped that all of the delegates will be present at that time, when there will also be a reception, with dancing and music, at the New Willard Hotel.

An attractive series of souvenir post cards calling attention to the pleasurable features of the convention is being issued by Miss Billings, the assistant secretary.

BOOK TABLE.

THE UNIVERSAL ELECTRICAL DIRECTORY for 1907. London: H. Alabaster, Gatehouse & Co. 1907. Pp. (5¾ by 9½ inches), 1,494. Price, post free in the United States, $4.32.

As usual, the book contains a record, more or less complete, of the industries throughout the world, directly or indirectly connected with electricity and magnetism, and the names and addresses of manufacturers, electrical and scientific men in Great Britain, India, British Colonies, America and the Continent, etc. Lists of all electrical undertakings in the United Kingdom and colonies are given, showing the nature of the supply, system of distribution, capacity of plant, voltage and chief engineer's name, and in the case of alternating current the phase and periodicity. The alphabetical sections include telegraphic addresses, telephone numbers and codes, and many financial particulars regarding British limited liability companies. A thumb index simplifies the turning up of any section desired.

"THE ELECTRICIAN" PRIMERS. By W. R. Cooper, M. A., B. Sc. London: "The Electrician" Printing and Publishing Company, Ltd. (D. Van Nostrand Company, New York). 1906. Price, $5.

The book comprises three volumes of the "Electrician Primers" complete in one. The first volume treats of theory, the second of electric traction, lighting and power, and the third of telegraphy, telephony, electrolysis and some miscellaneous applications of electricity. The object of the Primers is briefly to describe in simple and correct language the present state of electrical knowledge. Each Primer is short and is devoted to the elucidation of some special point or the description of some special application. Theoretical discussion has been avoided as much as possible. The work is suited to readers having little previous acquaintance with the subject, and to artisans in enabling them to obtain clear ideas of the essential principles underlying the apparatus of which they may be called upon to take charge. The author has found it necessary to touch upon some of the more abstruse subjects which are less suitable for primers and which are not easily treated simply and accurately. A glossary has been included in each volume giving explanatory definitions. It is supposed to serve as an index, though its usefulness in this respect is not superlative. The subject of "Wireless Telegraphy" is treated in detail in Primer No. 67, while in Primer No. 80 "Electric Block Signaling on Railways" is given considerable attention. A number of useful tables appear in the work.

GENERAL TELEPHONE NEWS.

The Sullivan and Munsy Company of Beaver Lake, Pa., has been incorporated with a capital of $10,000.

The Central Union Telephone Company has issued a new directory for Springfield, Ill. It contains 1,202 additional subscribers' names and addresses secured since the last issue in November.

The Illinois state convention of the Independent telephone companies will be held at the St. Nicholas Hotel in Springfield on May 14th and 15th. An interesting programme has been arranged and a full representation of the companies is expected.

W. B. Woodbury, general manager of the Home Telephone Company of Detroit, denies that there is any truth in the report that the Home Telephone Company will be absorbed by the Bell interests. Mr. Woodbury has branded as ridiculous the statement that his company and allied companies in other places are to be taken over by the Bell company.

Complete telephone service, it is said, will shortly be in operation over the entire system of the Illinois Central Railroad. The last stretch of 75 miles to New Orleans is now being finished, with 485 pounds of No. 8 copper wire to the mile. The new service is to be used by all departments, and it is expected that the operation of block signals will be especially facilitated.

Mayor Cutler of Rochester, N. Y., has appointed the special executive committee from the bondholders' committee of 25 to investigate and report on a plan of action for the United States Independent Telephone Company. It is composed of Isaac Adler, Harvey B. Graves, Pharcellus V. Crittenden and Edward F. Goltra. All but the last are Rochester business men. Mr. Goltra represents the interests of the western bondholders and stockholders, centered in St. Louis. The mayor is chairman of the committee.

The following telephone companies have recently been incorporated: Citizens' Telephone Company of Driftwood, Okla.; Farmers and Merchants' Mutual Telephone Company of Waubay, S. D.; Rich Valley Telephone Company of Carmen, Okla., capital stock $10,000; Indian Creek Telephone Company of Woodward, Okla.; Magnolia (Ark.) Telephone Company; Everman (Tex.) Telephone Company; Independent Telephone Company of Filley, Neb., capital stock $9,000; Colorado River Telephone and Telegraph Company, Tonkawa, Okla., capital stock $10,000.

Indiana Telephone Items.

The Home Telephone Company of Fort Wayne has just paid a 2½ per cent. semi-annual dividend on its common stock issue of $500,000. The stock, which was started on the market at 40, is now selling at 90 and has been steadily advancing for more than a year.

The disinclination of the Home Telephone Company of Eaton to extend its service into the country influenced farmers in the community to hold a meeting and subscribe $15,000 to build a system on the co-operative plan to furnish rural service.

Telephone subscribers at Greenwood are ordering their telephones taken out. The Bell absorbed the Independent company a year ago on the promise to provide free service to Indianapolis and Franklin. The company is now charging toll-line prices for between-town service, the same as before the Independent company was established.

That no deal has been made or contemplated whereby the Bell Telephone Company has secured control of the Independent systems and business of the state, is the announcement of A. C. Lindermuth of Richmond, president of the Independent Telephone Association of Indiana. President Lindermuth attended a meeting of the executive committee of the Independent Telephone Association this week at Indianapolis. The proposition was hooted at there, especially in view of the fact that the Bell company actually has announced its intention of abandoning certain rich territory in the state, considered an admission that the Independents are in practical control of the field. Indianapolis officials have ridiculed the idea that competition can be maintained in Indianapolis after the Bell company has abandoned other local business over the state. Should an agreement be made whereby the Independents are left in possession of local business it probably will call for the abandonment of Indianapolis as well as Richmond, Marion, South Bend, Fort Wayne and other cities where the Independents have hurt the Bell in the canvass for business. S.

Canadian Telephone Activity.

The Swift Current (Sask.) Board of Trade is considering the advisability of constructing a municipal telephone system. J. G. Maxwell is interested.

The Board of Trade of Napinka, Man., will at once take up the question of installing a telephone system. Mr. H. Quinn can give information.

The Vegreville Telephone Company has asked the Alberta government to take over and operate its system in Vegreville, Alberta.

The municipality of Hamiota, Man., is anxious for the installation of a rural telephone system.

The town of Virden and the municipality of Wallace have decided to install municipal and rural telephone systems. Over 80 per cent. of the farmers in the surrounding country have subscribed.

The first heard of the Alberta government's intention to construct a long-distance telephone line between Frank and MacLeod was a few days ago, when J. H. Grierson arrived in the former town with a construction gang and at once set to work. It is understood the line will be built from Frank to MacLeod and from thence to Calgary. Hon. W. H. Cushing of Calgary has the plans in hand. It is the intention of the Alberta government to lose no time in the construction of long-distance telephone lines all over the province, and at the present time over a dozen gangs are at work. R.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has sought an injunction in the Federal court to prevent the city of Yankton, S. D., from interfering with its proposed improvements and extensions. The city holds that the company has no franchise and that if it desires to extend its system a new franchise must be applied for.

Fox & Jewett of Warroad, Minn., have bought the telephone-exchange system at Spooner, Baudette and Old Baudette, Minn., of Mr. McNamara.

There was a gathering of heads of departments and experts of the Bell system of the states in the Trans-Mississippi country in Minneapolis last week. The purpose of the gathering was for benefiting and improving the long-distance service. Experts from the American Telephone and Telegraph Company from Chicago, New York and Boston were present.

The Dallas Mutual Telephone Company of Dallas, Iowa, has filed articles of incorporation. J. A. Miller heads the list of stockholders.

The Wesley (Iowa) Rural Telephone Company has been incorporated by O. K. Floran and associates; capital, $2,000. R.

Ohio Telephone Notes.

Two hundred people in Middletown, Ohio, are determined to have an Independent telephone service. For that reason they have signed a petition which will go before the council this week.

Ground has been broken in Toledo for a new sub-station for the Central Union Telephone Company on Hicks Street. The new building when

completed will cost about $40,000. This is the third branch exchange to be installed. The intention of the company is have five branches and one central exchange.

The Henry County Mutual Telephone Company of Napoleon was incorporated this week by W. J. Pierpont, H. F. Robes, David Harmon, J. F. Brown and Amos Black. The company will operate lines connecting Napoleon with Toledo, Wauseon, Bryan, Defiance, Findlay and Bowling Green.

The Mutual Telephone Company at New Riegel has placed an order for all necessary equipment to build an exchange. It is hoped to have it in operation some time this fall.

The Central Union Telephone Company in Columbus has completed the North Side exchange building and within a week or 10 days the lines will be cut over from the central exchange. S.

The Telephone on the Pacific Slope.

Telephone trunk lines will be built by private enterprise to Allendale, Cal., from Elmira, Vacaville, Winters and Dixon. Allendale is centrally located so that each of the connecting lines will be of about the same length.

Glenville, Cal., will soon be connected with outside points, via Kernville, by means of a new mountain telephone line. The new line will be built by the Forest Service of the United States in connection with John C. Danner of the White River country and will be primarily a private system, though arrangements will probably be made by which it may be used by the public in time.

The People's Telephone Company was recently organized at Whitmore, Cal., and Joe Covey was elected president and M. Milford secretary. Material has been ordered for the construction of a telephone line extending to Redding.

The City Council of Oakland, Cal., has taken preliminary steps looking to the forfeiting of the telephone franchise which was granted W. A. Beasley in November, 1902. No construction work has been done.

The Pacific Telephone and Telegraph Company has leased a new building on Ramona Street, near University, and will spend in the neighborhood of $60,000 in improving the local plant at Palo Alto, Cal. The outside overhauling of the wiring will cost $40,000, a large part being put in cables. The present switchboard will be replaced with a new one of the latest model at a cost of $15,000 and the company will spend $10,000 in changing the instruments and in wiring buildings to conform with the new plant. A.

Telegraphone System on Canadian Pacific Railroad.

The recently installed telegraphone (telegraph-telephone) system along the lines of the Canadian Pacific Railroad is said to be proving a great success. Two of the telegraph duplex circuits between Montreal and Winnipeg are operated on 210-pound copper wires, with repeaters at Fort William, Ont. These two wires are transposed every half mile and a telephone circuit is being worked between Montreal and North Bay on the same two wires. The telephone circuit was put in operation on December 11th and was found to work exceedingly well, being almost as silent as the regular city telephone circuits. The distance between Montreal and Winnipeg is 1,422 miles, and the voltage for the duplexes at Fort William, Montreal and Winnipeg is 200 volts.

On the same line of poles for the whole distance there is a wire on which is being worked the "phantoplex" between Montreal and North Bay without disturbing the conversation on the telephone circuit. This is said to have been a surprise to the officials and a number of New York experts, as it was thought it would be necessary to abandon the phantoplex in order to obtain a satisfactory telephone circuit. This is said to be the first instance where a telephone circuit is worked on two duplex wires with one of the offices located at a point where there are no telegraph repeaters. W. J. Camp, who has charge of the system, is now making arrangements to install other circuits along the system.

The "Air Line" Electric-railway Project in Court.

Chicago daily newspapers report that a bill has been filed in the Circuit Court of Cook County by Theodore Nemoyer, said to be a former assistant general manager of the company, asking for an injunction to restrain the New York-Chicago Electric Air Line Railroad Company from doing business in the state of Illinois. The petition also asks for an accounting and for the appointment of a receiver in case, in the progress of the trial, it should be determined that the estate of the company can be more economically administered by a representative of the court. Charges of extravagance and mismanagement are made. These are denied, however, by the officers of the company, who say Nemoyer is a "disgruntled employe." The company is one which has made sweeping claims in prominent "ads" in the daily papers, intended to sell stock, and it has been looked upon with doubt by conservative people.

CORRESPONDENCE.

Continental Europe.

Paris, April 22.—An Italian inventor, Bogni, has lately brought out a new method of telegraphy by which he claims to double the speed which is now obtained with the Morse register. This he does by simplifying the alphabet of dots and dashes so as to discard the characters made up of three or more signs, thus shortening up the time of transmission. He does not discard the usual Morse instrument, but modifies it so as to secure two parallel lines of signs and can make up an alphabet accordingly by using single or superposed dots and dashes. There is one electromagnet for each row of signs, and either one can be worked from the distant station by means of a system of polarized relays. On the whole the method is a very simple one and is well worthy of attention.

A new hydraulic plant is soon to be erected upon the Rhone in order to give an increase of current which is needed for the city of Geneva. This will be the third turbine plant to be used for this purpose. The Municipal Council has already applied for bids for the new plant and detailed designs of the outfit. A large company has been formed in Belgium, known as the Asturian Hydraulic Company. Its field of operations is in Spain, and it expects to furnish the industries of the Asturias region with current. For this purpose a hydraulic plant will be erected upon the Nalon River, a stream which will give considerable power. The company is capitalized at $1,300,000.

Fertilizer products containing nitrogen are to be manufactured in Italy by the recently formed Societa Italiana di Elettrochimica. The Franck and Caro cyanamide process is to be used here, and the method is an electrical one in which the air is drawn into the apparatus and the nitrogen separated by a newly invented method. Current is taken from a hydraulic plant which was begun not long since upon the Pescara River. Upon the intake canal leading from the dam will be placed two separate stations which divide the fall into two sections. The first fall at Tre Monte gives 27.60 meters head of water and can furnish 8,500 horsepower, while at Piano d'Orte is located a station which takes a 71.6-meter head of water and will give about 20,000 horsepower. The first of these plants has now been finished and contains four Francis turbines coupled to 6,000-volt alternators. Part of the current is used at Castellanare and other distant points, working upon a 25,000-volt pole line. The rest of the power goes to two large works, the first being the electrolytic factory mentioned above and the second an aluminum works at Bussi.

The municipality of Turin has taken up the question of a tunnel through Mont Blanc. According to the report presented lately by the technical commission a new line is called for, commencing on the Italian side and running through a new tunnel, ending on the Swiss side at Chamonix. With the starting point at Aosta, the railroad line, an electric one, no doubt, will run along the Doire River as far as Pré-Saint-Didier and then pass the mountain by a tunnel about 10 miles long, coming out at a point near Chamonix. At this point it makes connection with the Fayet-St. Gervais electric line and thence to the main railroad lines of Switzerland, bringing Geneva within 160 miles of Turin.

According to recent reports from Roumania it appears that electrical affairs are in a very prosperous condition, and there are a number of new enterprises on foot in the way of central stations for the larger towns. Among these is the project for the lighting of the town of Tecuciu, and bids have been already asked for the construction of a central station. It is to be noted that Diesel petroleum engines are to be used in the plant. Among other projects are electric stations for the towns of Campulung and Botosani and the construction of a standard gauge road in the province of Bacau.

Electric traction is to be used upon the tramways of Groningen, Holland, and the project is approved by the Municipal Council. An electric tramway is soon to be built at Metelin, in Asiatic Turkey, and the details are now being decided upon. In Belgium the municipality of Tongres has advertised for bids for a central plant and a distributing system for the town. A. DE C.

Great Britain.

London, April 26.—The proposals of the new London County Council with regard to its electric power bill—or rather the bill of the late council—are at last about to take shape. It was announced that a meeting of the highways committee, held last week, would have settled matters, which was not so; but I understand that some recommendations have been agreed upon which will be submitted to the council in a few days. The second reading of all the power bills relating to London has been postponed from time to time since the commencement of the session, but the second reading of the County Council bill will be pushed forward with considerable modifications, however. When the bill reaches the committee stage—should it ever do so—a new clause will be recommended giving the council power to purchase within a certain period existing undertakings should the council fail to arrive at an agreement with the companies for the future working of those undertakings or lines to be approved by the council. As the bill now stands the County Council will acquire all existing electricity undertakings in the metropolis willy nilly. Another proposition is to coalesce the existing undertakings for the purpose of uniform working. Under this scheme the companies would provide four generating stations—one north, south, east and west—in return for which the period of their present concession should be extended. Two cents per unit would then be the maximum charge. As things remain at present the concession to the companies expires in 1931, when the undertakings would be purchasable by the respective local authorities. The council's idea is that this period should be extended by 10 or 15 years, but the companies do not appear to be willing to look at anything less than an extension of 42 years. However, a feeling exists that the present strong progressive government will not aid the new party in power at Spring Gardens to pass this scheme, which, by the way, seems to have been based upon an acknowledgment of the rights of the existing authorities. At the same time strong influence will no doubt be brought to bear by the other promoters, i. e., the Administrative County of London and District Electric Power Company, for their bill practically suggests the same arrangement so far as amicable working between council and company is concerned, as that outlined above.

A new and improved signaling system is almost completed upon the Metropolitan Railway, which, it is said, will enable 35 trains per hour to be handled. It is a purely mechanical system, however. A matter of greater importance to traction engineers is the wear of rails—and especially on curves—since the introduction of electric traction. Special investigations have been made on behalf of the Metropolitan company, the result of which is the production of a rail having such a composition that it is confidently hoped that this trouble will now be eradicated. Some further information will shortly be available.

The admitted overproduction in the electrical industry and the inevitable stagnation which follows in such cases, which has been mainly confined to the heavy branches, has led a number of firms to pay greater attention to the smaller goods, in which so far competition has not been so keen. But from influential quarters comes the news that German electrical firms have foreseen this for some time past and have been quietly making arrangements for opening branches in Great Britain with the object of sending over large consignments of such goods. Should this be the case the British firms have had a timely warning which ought to enable them to counteract any such action from the continent. Right through the industry it is easy to perceive that the process of the survival of the fittest is in gradual movement, for the London Gazette weekly contains a notice of some electrical firms which have been forced to go into liquidation. Most of these are the smaller fry, but it does clear the way for those in stronger financial positions.

Serious consideration is being given by the London County Council to the financial position as it is affected by the tramway undertaking. An investigation has been made into a case in which a tramway cost some $400,000 to construct, whereas the estimates were about $150,000. It was proved that a large number of circumstances arose to bring about this result, which throw no discredit upon the staff, but the incident serves to prove that in the past the wishes of the borough councils have been too easily acquiesced in in the matter of adopting the conduit system, for had the overhead system been adopted, as might very well have been done, these exceptional circumstances would never have arisen. Further, the late council voted $100,000 for the construction of a subway station on the underground tramway extension from the Strand to the Embankment. But the distance between the Strand terminus and the junction with the Embankment line is so short that it was obvious no one would care much to use a station between, especially as it involved traversing some 60 steps, and the action of the new council in dispensing with this expenditure is to be commended.

A further instance that the electric supply authorities are either incapable of securing the business or of supplying the needs that are around them is furnished by the completion of a large electric power station at Stratford by the Great Eastern Railway Company. The company erected a station 14 years ago close to its city terminus which had a capacity of some 1,000 kilowatts and supplied just that district. The main works are at Stratford, however (in the West Ham municipal district and which is the electric supply authority), and the decision to erect a larger station there was mainly because of this and for the fact that extensions were impossible at the old station, which had low-tension direct-current equipment. At the new station there are three 1,000-kilowatt 6,600-volt 50-cycle turbo-alternators. Lancashire boilers have been adopted, of which there are nine, measuring 30 feet by eight feet, and there are two short steel chimney shafts arranged for induced draught and fitted with fans supplied by the Buffalo Forge Company. With the one exception of the boiler-feed pumps, all the auxiliaries are electrically driven by three-phase motors. About 40 miles of high-tension cable has been laid, for the old works in the city will be converted into a sub-station. Another

feature, too, is that steel concrete construction has been used in the power house, with the exception of a brick wall to which the switchboard is fixed. Considerable works driving will now be carried out by the company, and it is estimated that of the total supply 50 per cent will be for this purpose.

The last of the electric deep-level tube railways comprised in the scheme of the late C. T. Yerkes will be opened next month. It runs from Charing Cross to Euston and then out to Hampstead and is constructed on identical lines to the others. So severe has the competition of electric tramways and motor omnibuses become that it would not be at all surprising if this line were to prove to be the last of its kind that will be constructed in London, or indeed in Great Britain.

A new company has been formed to take over valuable waterpower rights in North Wales for the manufacture of aluminum. Hitherto the only company carrying on such business here is the British Aluminum Company at Foyers in Scotland. G.

Dominion of Canada.

Winnipeg, Man., May 4.—On May 1st the electrical department of the city of Winnipeg put into force a schedule of fees for the inspection of wiring, inspection of motors, etc. This is the first time the city has collected a fee for doing this class of work. F. E. Cambridge is city electrician. Persons desiring to install electric wiring or apparatus of any kind must make application in writing to the city electrician and obtain permit before doing any work. Prior to introduction of current into premises a final inspection is required at which time all fittings, cutouts, fuses and switches must be installed and completed. The person desiring to use current, having made application for inspection and paid the fees, shall be entitled to a certificate of inspection and permit to use current if the installation is found to comply with the provisions of the by-law.

The city electrician of Vancouver has been having considerable trouble on account of various methods of wiring being followed. To remedy this the following regulation has been issued: "Owing to the trouble arising from time to time through the overloading of circuits and wiring and the tendency of users to increase the candlepower per outlet, we find it necessary to put in force the regulation demanding that a plan be submitted, as well as a copy of specifications, with the application for the permit for rough wiring or the installation of fittings. It is suggested that architects should submit all plans and specifications for electrical work for approval before calling for tenders for buildings, thus avoiding the confusion incident to disapproval after the contract has been let." Another clause demands that after the date noted all applications must show the present load and size of wire used as well as full description of proposed changes. A third section stipulates that hereafter the number of outlets on branch cutoffs is limited as follows: Residences, seven; stores, two; store windows, one. All switches in stores must also be of the double-pole type.

The Edmonton ratepayers will shortly vote on a by-law to raise $120,000 for the erection of an electric-light and power plant, also $41,000 for a fire-alarm system. Address Mayor Griesbach, Edmonton, Alberta.

A system of telephones is to be installed in Pincher Creek, Alberta, a 10-year franchise having been granted to J. E. Wood, C. E. At the end of the 10 years the Town Council has the privilege of purchasing the system at cost or extending the franchise for another 10 years.

The Coquitlam-Burnaby Telephone Company started work on April 20th on a system which will eventually connect Vancouver and Chilliwac, B. C., tapping all the rural settlements en route. Hines & Austin of Coquitlam, B. C., are moving spirits in the new company.

The ratepayers of Indian Head, Sask., will vote on a by-law to provide $10,000 for extensions to the electric-lighting system. Address T. E. Donnell. R.

New England.

Boston, May 1.—The directors of the Edison Electric Illuminating Company of Boston have ordered the sale of 10,902 shares of the company's new stock at auction on May 8th.

The Massachusetts Gas and Electric Light Commission has held a hearing on the Public Franchise League's petition for an inquiry as to the prices charged for electric current by the Edison Electric Illuminating Company of Boston. Everett W. Burdett, the company's attorney, read the company's reply to the league's questions regarding the company's methods of charging. The reply stated that a higher rate is charged for electricity for a short period than for a long period because it is necessary to meet the company's fixed expenses from the charges made for the first hours of use; that consumers of large amounts of electricity received better rates than consumers of small amounts on the general principle of wholesale business and the greater economy in serving the consumers of large amounts; that under the present system of charges each consumer pays what the electricity would cost him if supplied by a private plant or a plant supplying a small number of consumers, minus the economies due to the company's supplying many consumers from a large plant; that the system of charges applied to all consumers is according to the amount of current consumed and the period of use; and that no special bargains were made with special consumers. The members of the commission asked a number of questions, some of which the company's attorney could not answer at once, so the hearing was adjourned to May 22d. The attorney requested the commissioners to submit their questions in writing so that they might be referred to the proper persons for answers.

While at work on the New England Telephone and Telegraph Company's wires in the southern part of Boston, Philip Henry received an electric shock which caused his death before he reached the city hospital.

The Massachusetts Railroad Commission has indorsed the Old Colony and the Union Street Railway Companies' rights to carry freight and express in Lakeville, Freetown and New Bedford, Mass.

Seven Harvard University electrical engineering seniors visited the General Electric Company's works in Schenectady, N. Y., this week, under the guidance of Prof. C. A. Adams of the university's department of electrical engineering.

"Chris" Brady, a starter employed by the Boston Elevated Railway Company, celebrated the completion of 50 years of service for the company and its predecessors last Tuesday. He is 63 years old.

The Boston Elevated Railway Company's stockholders have voted to issue new stock amounting to $8,000,000 and bonds amounting to $5,800,000, the proceeds to be used for subway and elevated construction and equipment for funding the floating debt and for the purchase of necessary real estate. The bonds are to mature in 30 years and the executive committee is to fix the rate of interest.

The Boston aldermen have ordered the corporation counsel to prosecute a bill of equity in the supreme court for the purpose of reviewing the Massachusetts Railroad Commission's order granting a location for an elevated railway through the North and West ends and to restrain the erection and operation of the elevated road by the Boston Elevated Railway Company.

The Uncas Power Company of Norwich, Conn., has made most of the contracts for the construction of a big power plant on the Shetucket River, near Scotland Station. A dam 480 feet long and 32 feet high will be built and the reservoir will be four miles long. The General Electric Company has contracted to furnish the electrical plant by October 15, 1907. The Morgan-Smith Company of Pennsylvania will furnish the waterpower plant before that date. The power company has made a contract to supply electric light and power to the city of Norwich and is negotiating a like contract with the city of Willimantic. B.

New York.

New York City, May 4.—The Long Acre Electric Light and Power Company is busy preparing applications for space in the subways throughout the theater district preliminary to the extension of its service. Walter H. Knight, engineer of the Manhattan Transit Company, which controls the Long Acre company, says the company is on the verge of a new era in electric lighting, particularly in New York city, and that the Long Acre Light and Power Company proposes to take the lead in installing improvements. It is not ready as yet to declare the full extent of its plans. Edgar Van Etten has resigned as vice-president of the New York Central and Hudson River Railroad Company to assume the active management of the Long Acre company, of which company he has been recently elected president. The decision just handed down by the New York Court of Appeals in the Long Acre Electric Light and Power case, which is favorable to that company, has caused Mr. Van Etten to take this course.

At separate meetings of the Atlantic Avenue Improvement Association and the Citizens' Central Committee strong protests were made against the granting of a franchise to the Behr Monorail Company to construct a tunnel under the East River and a line to Coney Island and from South Ferry to Franklin Avenue. The statement was made that the monorail scheme in England and other European cities has been a fizzle. The meetings adjourned without taking any very definite action.

Senator Cassidy has just introduced at Albany a resolution for the appointment of a joint legislative committee of three senators and three assemblymen to investigate the merger of the surface, elevated and subway lines in Manhattan Borough. The resolution was referred to the finance committee.

Articles of incorporation of the Atlantic Engineering and Construction Company have just been filed with the county clerk in Jersey City. The company will build steam and electric railways. The incorporators are H. O. Coughlan, B. S. Frantz, E. C. Baer and others.

The Buffalo, Rochester and Eastern Railroad Company, formed to operate a standard-gauge railroad by steam, electricity or gasoline from Buffalo to Rochester and thence to Troy, a distance of 300 miles, has filed incorporation papers. The capital stock is $3,500,000. The directors are Ralph D. Gillett, Henry W. Ely and Archie D. Robinson of Westfield, Mass., Arthur W. Eaton, Pittsfield, and others.

In a report issued by Comptroller Metz describing the progress which has been made in the construction of Blackwell's Island Bridge, it is stated that while the original estimate of the cost of the bridge was $12,548,500, the indications now are that before it is finished the bridge will cost the city from $18,000,000 to $20,000,000.

The Pennsylvania Railroad has just placed orders for 200 steel passenger cars, the first installment of the designed equipment to be put into use in the Manhattan tunnels. Only steel cars are to be used in the tunnels. For this purpose 1,000 passenger cars and 500 Pullmans will be required. For long-distance travel a car 70 feet long, seating 88 passengers, will be built, and for suburban work a car 50 feet long, seating about 70 passengers, which can be converted into a motor car when necessary.

The electrification of the West Shore between Utica and Syracuse will be completed within three weeks and the electric service inaugurated on June 1st. It is said that the electric service will handle all of the passenger traffic between these two cities. The National express service will be done by electric baggage cars. D. E. P.

Ohio.

Toledo, May 4.—The situation throughout the state of Ohio in the electrical world is generally satisfactory to all lines of the trade. There seems to be no dearth of work and no lack of demand for supplies of every description.

The Columbus fire department has commenced the installation of a complete modern Gamewell switchboard. The outside service is in good shape.

The engine and machinery for the Milloy electric plant has arrived at Bucyrus and is being installed. By June 1st the company expects to put upon the market the Milloy trolley base and the Milloy retriever.

The Ross Hill Company of Columbus has been awarded the contract for enlarging and rebuilding the city electric-light plant at Athens, Ohio.

The first cars operated on the new branch of the Lake Shore electric between Fremont and Sandusky commenced running last week, carrying material for the working gangs. The Lake Shore electric is arranging to install a waterworks, lighting plant and other improvements at Avon Beach Park. Because of its nearness to Cleveland, Lorain and Elyria and its ideal location on the lake it is felt that this park will ultimately make a very beautiful residence section.

Articles of incorporation for the Toledo and Fort Wayne Electric Railway Company were placed on file in Lima last week.

The Heisler Company of St. Marys, Ohio, has been awarded the contract for two of its largest barometric condensers, one to be installed in the power house of the East Liverpool Traction and Light Company at East Liverpool and one for the same company at Steubenville, Ohio.

The new electric block-signal system on the airline branch of the Lake Shore and Michigan Southern Railway is now in operation between Toledo and Wauseon, Ohio.

The William Hall Electric Company of Dayton is having plenty of work in keeping the construction work going on the new Y. M. C. A. Building, the Masonic Temple, the Dayton Hydraulic Machine Company, the Troy Pearl Laundry Building, the Kay & Ess Company's paint mill, the Shonts Building and several residences.

It has been determined to install an electric plant for illuminating and small motor purposes at Columbus Barracks and proposals have been invited for the furnishing of same complete. H. L. S.

Indiana.

Indianapolis, May 4.—On January 12th, 10 years ago, the first electric car was operated in Indiana, and in the same month and year the first electric car was started in operation in Ohio; since that time 1,650 miles of modern electric railroads have been constructed and put in operation in Indiana. In addition to this, there is now building in the state 500 miles of new road, and an equal mileage is being promoted.

The Kokomo, Marion and Western Traction will install in its power station in Kokomo a 2,000-horsepower Parsons steam turbine. Ample power will be secured for running the company's city and interurban lines. Through service between Kokomo, Marion and Bluffton is being arranged.

The General Electric Company is installing a 1,000-kilowatt turbine in the Indianapolis and Cincinnati power house in Rushville. This increased power was necessary to furnish power for the two new divisions of the road just completed, and the Connersville-Hamilton division to be put in operation next.

The new electric-light plant at Carthage has been completed. The little city is now thoroughly lighted, much to the satisfaction of the people.

The Wallace-Lindermuth Company, a California corporation, has established a plant in Fort Wayne to manufacture steam, electric and gasoline hoisting machinery and electrical supplies.

John W. Cravens, secretary of the board of

trustees for the Indiana University at Bloomington, is asking for bids for boilers and stoker engine, generators and electric fixtures for the new college library building. Patton & Miller, 140 Dearborn Street, Chicago, are the architects.

The trustees of the Crawfordsville municipal electric-light plant have adopted an increased schedule of rates.

The municipal electric-light and waterworks plant of Knightstown is threatened with financial disaster unless relief measures are taken at once. In order to settle the question satisfactorily, the City Council has decided to adopt the referendum in the matter and let the taxpayers vote on the proposition of issuing bonds to enlarge and perfect the plant. The report of the superintendent shows that the electric-light plant has been running behind during the fiscal year, and that something must be done to keep it in operation. The business has increased so that there is not now adequate power, and a new engine will have to be put in. The City Council also says that the rates are entirely too low, and that prices must be increased to keep the plant on a self-sustaining basis. S. S.

Northwestern States.

Minneapolis, May 4.—The contract for grading the Omaha-Hastings electric railroad has been let to C. D. Conover of Omaha, and work has been started.

The Minneapolis General Electric Company and the Minneapolis City Council are engaged in adjusting their differences and a compromise now seems probable.

J. F. Johnson of Gibbon, Minn., is preparing plans for the new electric-light plant to be erected at Dawson, Minn., at a cost of $35,000.

The Faribault (Minn.) Gas and Electric Company will discard all of its present dynamos and will replace them with new machinery throughout.

A. K. Adams of New Prague has been appointed electrician of the electric-light plant at New Prague, Minn., to succeed P. O. Nicolas.

It has been proposed to build a large power plant across the Platte River for the purpose of supplying Omaha, Neb., with additional power.

The Electric Light and Power Company of Shenandoah, Iowa, may install an electric-light system at Farragut, Iowa. R.

Pacific Slope.

San Francisco, May 1.—The isolated electric-light and power plant just installed in the basement of the 11-story Kohl Building has been placed in operation. Two 100-kilowatt direct-connected units, each consisting of a Westinghouse direct-current generator and a Ball horizontal cross-compound high-speed engine, are carrying the load on a three-wire system. There is also a 150-kilowatt unit of the same type. By means of a regulating device either 250-volt or 110-volt current can be delivered by each generator. Two Scotch marine oil-fired boilers are in use, and a third one is yet to be installed. One or more adjoining buildings will probably be supplied with current from this plant, which now supplies lights and electric-elevator power to the Kohl Building.

The power plant which is to be installed at the new Hotel Claremont at Berkeley, Cal., will cost $125,000. M. P. Thye, a consulting engineer of Los Angeles, has charge of the work.

The Carlton Lumber Company's new electric-light plant, in connection with its mill at Carlton, Ore., is about completed. A National 2,200-volt alternating generator is driven by a 450-horsepower automatic engine. Arc and incandescent lights will be supplied for lighting both the sawmill and the town. A part of the mill machinery will be motor driven. One 65-horsepower, two 40-horsepower, one 20-horsepower and two five-horsepower motors have been installed.

James H. Brady of Pocatello, Idaho, states that he will build an electric smelter at American Falls, where his power plant is located. He believes that a plant costing $10,000 will be a profitable investment.

The Order of Railroad Telegraphers was dissatisfied with the award recently made by the arbitration board in the controversy between the telegraphers and the Southern Pacific Company concerning wages and hours and decided to bring a suit to prevent the carrying out of the provisions.

John Adams of the Bourbon Mining Company has had a water ditch constructed from Knights Creek to a point near the Contention mine. A small electric generating plant will be installed at the mine, operating under a head of 790 feet of water. A telephone line will be constructed to connect with Columbia, Cal. A sawmill and a quartz mill will be installed.

The application of the Oakland Traction Company for a street-railway franchise in Brooklyn Township has been favorably considered by the franchise committee of the Board of Supervisors of Oakland, Cal.

B. C. Holst has closed a contract at Lovelock, Nev., for the California Electric Company, including the installation of an electric-light plant at Seven Troughs, Nev.

The Redlands Central Railway Company has filed articles of incorporation under the laws of the state of California. The directors are A. G. Hubbard, O. T. Higgins, J. H. Fischer, E. S. Graham and F. E. Sanford. A new electric-railway system is to be built at Redlands, with a branch line extending to Craftonville and Riverside.

H. E. Huntington has been granted an additional electric-railway franchise in the city of Los Angeles. Permission is granted to build a single or double-track line.

The Fremont Power Company, which is under the management of John Thompson of the Red Boy Mine, near Baker City, Ore., will install a hydro-electric power plant this year.

Advices from Albany, Ore., say that Walter Mackay has filed notice of appropriation of water from the North Fork of the Santiam River. It is planned to install an electric power plant with a capacity of 27,250 horsepower. The water will be conveyed through flume for a distance of 10 miles to the power house.

The local street-car system at Klamath Falls, Ore., is to be completed and in operation with horse cars by June 1st. Electric cars will be placed on the road as soon as they can be obtained. The Klamath Falls Light and Water Company will install overhead wires for electric lights in the streets of Klamath Falls, and telephones will also be put in.

Detailed plans have been completed for an electromagnetic separating plant, which is soon to be erected for the Bluestone Mining Company near Yerington, Nev. A.

PERSONAL.

F. M. Lawrence of New York has been appointed superintendent of the Chattanooga (Tenn.) Electric Light Company.

C. W. Stokes, electrical engineer, Montreal, has been appointed superintendent of the lighting and telephone systems at Kenora, Ont.

J. W. Campbell, manager of the contracts and sales departments of the Canadian General Electric and Canada Foundry Company, at Toronto, has been appointed managing director at Calgary, N. W. T., of the Alberta Portland Cement Company.

Thomas W. Peeples, who was chief engineer of the New York elevated railway system for nearly 25 years, died at his home in East Orange, N. J., on April 27th at the age of 77. He was made chief engineer of the elevated roads of New York in 1874.

Edward J. Kenney of Saratoga Springs, N. Y., has assumed charge of the plants and business of the Madison County Gas and Electric Company at Oneida, N. Y. John J. Roohan, who for some months past has been in charge of the concern, has resumed his old position with the Saratoga Gas and Electric Light Company.

Bion J. Arnold sustained a painful accident in Chicago on May 5th. In "cranking" an automobile he was jolted in such a manner that his teeth closed with a snap, biting off the end of his tongue. For a newspaper reporter Mr. Arnold wrote on a pad this laconic account of the accident: "Was with my brother in his new auto. He killed the engine. I got out to crank it. Spark lever was too far advanced. Engine kicked back and pulled my chin down on radiator. It cut my tongue clean off. I drove machine to Mercy Hospital, where Dr. J. M. Lilly sewed it on. I am doing no talking for several days. It happened in Washington Park, just at entrance of Midway, at about 12 o'clock Sunday."

A recent magazine writer, discoursing of George Westinghouse, says: "Possibly it was due to the wearying difficulties which he encountered in gaining a hearing for his own first great invention [the air brake] that Mr. Westinghouse in his subsequent career has ever evinced a tendency to give full consideration to the claims of new inventors seeking an advantageous field for their productions. The consequence of this tendency has been that the thirty companies at present representing the Westinghouse interests have become the repository of a greater number and diversity of inventions than have ever before been brought together in one gigantic combination. Approximately 15,000 patents are thus under the control of Mr. Westinghouse today."

Mr. Allard Smith has been appointed construction engineer of the Chicago Telephone Company, effective May 1st. Mr. Smith's promotion is due to his energetic and efficient work for the company. He entered the employment of the Chicago Telephone Company in 1898 and has held several responsible positions, working his way through the various engineering departments. In his department Mr. Smith will have charge of the engineering work pertaining to extensions and reconstruction of the outside wire plant, including conduits, underground and aerial cables, terminals, pole lines, building conduit, cables, etc., both in Chicago and the suburban territory. Mr. Smith is 30 years old and is married. He was born in Eau Claire, Wis., and is a graduate of the electrical engineering department of the University of Wisconsin, class of '98. He is an associate member of the American Institute of Electrical Engineers.

Professor Alexander Graham Bell received the honorary degree of doctor of science at Oxford University on May 2d, in recognition of his invention of the telephone and for his efforts to teach the deaf and dumb to speak. Professor Bell is reported to have been much impressed by the honor. The ceremony was conducted by the dean of the faculty of science, Prof. A. E. H. Love. Following it, Professor Bell returned to London, where he was the guest of honor at a dinner by the Institution of Electrical Engineers. Accompanied by Mrs. Bell, the inventor planned to leave England on May 8th. It is said that upon his return Professor Bell will go to his Nova Scotia place, where he will conduct experiments with a motor in connection with his aeroplanes.

ALEXANDER GRAHAM BELL.

Mr. Ira A. McCormack, heretofore manager of the Grand Central Station in New York city and general superintendent of the electric division of the New York Central and Hudson River Railroad, has been appointed assistant to the general manager of that road, having charge of matters pertaining to electric operation and performing such duties as may be assigned. Mr. McCormack has had a wide practical experience in steam and electric-railway work. In 1895 he was appointed general superintendent of the Brooklyn Rapid Transit Company and after three years of service resigned to become vice-president and managing director of the Syracuse Rapid Transit Company. After serving in this capacity for seven months he was appointed general manager of the Cleveland Electric Railway. In 1902 he entered the service of the New York Central. It is expected that Mr. McCormack will spend several months abroad studying foreign electric-railway practice.

Frederick P. Fish has resigned the presidency of the American Telephone and Telegraph Company and the Western Telephone and Telegraph Company. He is to be succeeded by Theodore N. Vail, who for years served on the board of directors and who was the first president of the American Telephone and Telegraph Company, nearly 30 years ago. Mr. Fish has been an excellent executive. For some time, however, he has been desirous of resuming his remunerative law practice in preference to corporation management, and this opportunity has presented itself in the availability of Mr. Vail as a competent successor. Mr. Fish has met the arduous duties of his office with energy and skill and his success has been marked by hard work. It is said that for years it has been a common thing to find the president busily engaged at his office in the Telephone Building up to 8 and 9 o'clock in the evening. Theodore N. Vail, the new president, is known as one of the four original telephone men in the United States. About ten years ago he quit the telephone business and thereafter spent much time in Europe and South America, where he built street-railway and electric-lighting plants. He equipped the street railways of Buenos Ayres for electricity and has had large interests in South America. Mr. Vail has always maintained his interest in the telephone company. He now assumes the presidency at the age of 62. It is said on good authority that he takes the executive position independent of any stockholding faction, although in some quarters it has been thought that the change foreshadowed early control by the Mackay interests.

FREDERICK P. FISH.

Mr. W. J. Johnston, well known in the electrical field a few years ago as the principal proprietor and publisher of the Electrical World, died quite suddenly at his home in New York city on April 28th. Mr. Johnston was born in Ballycastle, Ireland, in 1851, and became a telegraph operator. Coming to this country, he, with others, established The Operator in 1874. Mr. Johnston became sole editor and proprietor of the paper, which was the forerunner of the Electrical World, of which the decedent was the principal figure for many years. Mr. Johnston sold the Electrical World in 1899, and after a trip around the world he re-

W. J. JOHNSTON.

entered the publishing business, principally in connection with journals of the mining industry. In 1905 he purchased an interest in the American Exporter, of which he later became sole proprietor, remaining so until the time of his death, which resulted from cerebral hemorrhage. A bland-spoken man of unceasing activity and much force of character—the iron hand in the velvet glove—Mr. Johnston made enemies as well as friends in his business career. Yet his good qualities were numerous and are gratefully remembered. He stood for the honest administration of the important activities of the technical journal—for the integrity and independence of this important medium. The Electrical World, which he formerly owned, gives this estimate: "A sanguine disposition, an extraordinary persistency of purpose and indefatigable industry combined to give special prominence to Mr. Johnston in any field in which he labored. His inflexibility of purpose at times gave rise to friction in his relations to men, but his integrity was above attack, and an innate kindliness and a social disposition endeared him to a large circle in private life, and to all in business life who came to appreciate his sterling qualities." Mr. Johnston was an associate member of the American Institute of Electrical Engineers, a member of the American Institute of Mining Engineers, and a past-president of the American Trade Press Association.

Mr. George H. Daniels, former general passenger agent of the New York Central Railroad and for the last two years at the head of the road's advertising bureau, retired on May 1st. As previously announced, the work of the bureau hereafter will be in charge of Mr. John Craig Hammond, a newspaper man of long experience. Mr. Hammond has been made the official press representative of all the Vanderbilt lines, and all information sought by the press will be given out through him.

ELECTRIC LIGHTING.

The Fred Harvey Company will install an electric-light plant at Francis, I. T.

The town of Vienna, Ga., will spend $15,000 in installing an electric-light and sewerage system.

F. S. Johnson & Co. have been granted a franchise for an electric-light plant at Milford, Neb.

The Sweetwater (Texas) Ice, Light and Water Company has been incorporated with a capital stock of $5,000.

The Wadsworth (Ohio) Light and Water Company has increased its capital stock from $50,000 to $75,000.

The Albuquerque (N. M.) Gas, Electric Light and Power Company has increased its capital stock to $500,000.

Graham Bros. of Stevenson, Ala., have been given a franchise to furnish that town with electricity for lighting purposes.

Forty central-station, gas and electric companies were represented at the recent gas and electrical show, held at Lincoln, Neb.

B. F. Geeslin and associates have been granted a franchise to install an electric-light and power plant at Goldthwaite, Texas.

The Jefferson City (Tenn.) Milling and Electric Company has been incorporated for $20,000 to furnish that city with electric light.

The size and capacity of the power house of the Peekskill (N. Y.) Lighting and Power Company will soon be doubled, it is reported.

The Gunther Electric Company of Chicago has been incorporated, capitalized at $175,000. It is proposed to operate heat, light and power plants. The incorporators are Charles F. Gunther, Burnell Gunther and Donald R. Richberg.

It is reported that an electric-lighting plant will be erected at Racine, Wis., in opposition to the Milwaukee Electric Railway and Light Company. Engineers may be asked to prepare plans and specifications and estimate the cost for equipping a rival system.

On April 29th the Moore Electrical Company of Newark, N. J., sent two men and apparatus for two installations of the Moore light in the largest automobile garage in Europe, located in London. This is especially interesting because it is the first foreign installation of the Moore light.

The Cherokee Light and Power Company proposes to erect an electric power plant in Vinita, I. T., at an estimated cost of $1,000,000. The company proposes to harness the waters of the Grand, Spring, Neosho and Cowskin rivers, thus deriving about 15,000 horsepower; also to furnish all towns adjoining with electric power.

It is reported that a merger has been effected between the People's Gas and Electric Company of Oswego, N. Y., and the Fulton (N. Y.) Light, Heat and Power Company. The People's company had planned some extensive improvements in its power house and gas plant, and at its recent annual meeting had proposed to increase its capital stock $200,000.

Since placing orders for a 500-kilowatt Allis-Chalmers 60-cycle three-phase 2,300-volt steam-turbine unit, the Light, Heat and Power Corporation of Northampton, Mass., has ordered a 375-kilowatt Allis-Chalmers engine-type alternating-current generator and a 17½-kilowatt exciter of the same make for the Northampton Electric Lighting Company. The new units will be used on the lighting and power load.

According to a recently published report there are 1,140 generating stations in Spain. Madrid has a capacity of 15,998 kilowatts in its plants and Barcelona follows with 8,082 kilowatts. The total number of incandescent lamps in Spain for street lighting is 119,105, with 1,427,498 candlepower, and 1,691 arc lamps of 1,214,476 candlepower. For private or domestic use there are 1,593,402 incandescent lamps and 8,051 arc lamps. There are also 3,293 electric motors with a total capacity of 25,382 horsepower.

Of the $5,000,000 five per cent. three-year Chicago Edison notes practically all but $1,000,000 has been disposed of. The sale of this security has been unusually satisfactory, representing as it does a high-class investment. From the proceeds of the sale the floating indebtedness of the company will be cleaned up and provision be made for new construction during the 12 months following the sale. Expenditures for improvements and new construction are expected to be between $3,000,000 and $4,000,000 for the year.

The Alturas Electric Light and Power Company, whose power plant is located seven miles outside the town of Alturas, Cal., has recently undertaken substantial improvements and additions to its present equipment. A contract placed with the Allis-Chalmers Company includes a 300-kilowatt water-wheel-type generator and a nine-kilowatt exciter, also waterwheel driven. The Alturas plant, although built for electric-lighting service, has heretofore been steam driven and made no use of the waterpower, the installation of waterwheels being an addition.

ELECTRIC RAILWAYS.

A franchise has been granted to Henry Schaffer, J. W. Maney and John Maney to build a street railway in El Reno, Okla. A cash deposit has been made to insure work to begin at once.

The interurban electric railway has come into its own at last, for a baseball league has been formed in Central Illinois, the clubs of which will travel by electric roads. More than that, the league blazons to the world the word "Interurban" as a part of its title.

The employes of the Chicago City Railway Company are seeking for higher wages. The motormen and conductors are asking for 33⅓ cents an hour. The company recently offered the men 27 cents an hour, which amounted to an increase of about seven per cent. President Mitten took the petition under advisement.

A sub-committee of the New York Rapid Transit Commission has adopted a resolution recommending that a franchise be granted for a double-track monorail electric road from South Ferry in Brooklyn to Coney Island. Provision was included that the cars be able to make a speed of 80 miles an hour. The application was made by F. B. Behr.

An electric-railway company, organized at McAlester, I. T., has been capitalized for $3,750,000 to build an electric railway from Sallisaw to Lawton, a distance of 225 miles. C. D. Stocker is president, W. R. Douglas vice-president, R. Downing secretary-treasurer, and A. D. Goodnough general manager. Active work is expected to begin soon.

Representatives of the Illinois Traction Company have been looking over Cairo, Ill., and vicinity, with the view of building an interurban line to that section. R. D. Smith, vice-president of the McKinley terminal system, recently said that it was probable that a franchise would be applied for at Cairo in the near future. The distance from St. Louis, Mo., to Cairo is about 150 miles.

Work on the Mackinaw-Lincoln electric railway will be commenced at once. This is the line that the Illinois Traction System will build to give Peoria connection to Springfield and St. Louis. The lines south from Lincoln are now operating, and the Peoria-Bloomington line passes through Mackinaw, leaving only the distance from Mackinaw to Lincoln to be built to give Peoria a through line to St. Louis.

The street-railway system of San Francisco was tied up on May 5th by the strike of 2,000 conductors and motormen. The men quit work after having failed to obtain an eight-hour day and a flat wage of $3. In lieu of street cars the public made use of all sorts of vehicles from express wagons to automobiles. The strikers were joined by the stationary firemen, who demand recognition of their union and an increase of wages from $2.75 to $3.25 a day. President Patrick Calhoun of the United Railroads, said the company would operate its lines independently of the union.

Plans have been announced by the Consolidated Railway Company of New Haven, Conn., providing for a $200,000 improvement to the power house on Grand Avenue, which includes the enlargement of the building and the installation of new machinery. Two 1,500-kilowatt machines will be installed.

Notice has been served on all the elevated-railway companies in Chicago, except the South Side line, that the employes will demand an increase in wages within the next three weeks. The Northwestern, Oak Park and Metropolitan roads had agreements with the union which expired May 1st and the men are working under a tentative arrangement until June 15th. No fears of a strike are entertained, since the agreements in each case provide for arbitration.

The first section of the alternating-current system of the Illinois Traction Company was opened between Peoria and Bloomington on April 21st, as related in the Western Electrician last week. Beyond the usual delays incident to warming up new equipment the single-phase motors and auxiliary apparatus worked well. This road is one of the four single-phase lines in the Middle West which have adopted single-phase alternating-current apparatus made by the General Electric Company.

POWER TRANSMISSION.

It is doubtful whether a longing to view Niagara is infallible evidence of an artistic sense. Those visitors who merely go to see the biggest waterfall on earth might be consoled with a view of the biggest water turbines.—Electrical Times, London.

The Alberta Portland Cement Company of Calgary, Alberta, will develop 5,000 electrical horsepower at Radnor for lighting and power purposes. The company will use 2,000 horsepower itself, selling the other 3,000 to residents of Calgary.

The Sand Mountain Electric Company of Albertville, Ala., has been capitalized at $50,000 to develop the waterpower on Short Creek, obtaining from 500 to 1,000 horsepower for transmission by electricity to Albertville, Boaz and Guntersville. Edgar McCord of Albertville is president of the company.

The Northern California Power Company at Redding, Cal., recently started up its third big power plant. Its capacity is 3,000 horsepower, which, added to the two plants already in operation, gives a total of 15,000 horsepower. The company will proceed with the completion of its fourth plant, which is to generate 10,000 horsepower. The Northern California company is the largest power company in the state.

PUBLICATIONS.

The Northern Electrical Company, Minneapolis, jobber of electrical supplies and machinery, has sent out its May calendar, on which appears an attractive representation of "The Family."

C. W. Leavitt & Co., 220 Broadway, New York city, is sending out a circular dealing with the deoxidation of brass and bronze alloys by means of "Leavitt" magnesium. The circular states that "Of the many alloys in which copper is the chief constituent, brass, bronze and tombac, or the so-called 'yellow metal,' are the most important and most used of all the alloys employed in the industries."

John Ruscoe & Co., Limited, Manchester, England, has issued a booklet describing and illustrating the "Triumph" cable drum carriage. It is asserted that by using the "Triumph" the cost of handling cables is reduced by more than one-half. It will take drums up to 7 feet 4 inches in diameter, and 3 feet 11 inches wide. The booklet also illustrates Ruscoe's patent drill stands for drilling and tapping electric standards, etc.

"Trumbull Cheer" is the name given to Vol. I, No. 1 of a neat little "magazinette" published by the Trumbull Electric Manufacturing Company of Plainville, Conn. The first issue is attractive and contains some cheering as well as business-getting paragraphs. It is thus described by the publisher: "A magazinette published each month (if it's lucky) in Plainville, Conn., with a hunch for Trumbull material and a fond desire to be cheerful."

A recent instruction book issued by Allis-Chalmers Company, Milwaukee, contains information on the installation and operation of the company's direct-current generators and motors, type "K." Paragraphs are devoted to location, alignment, bearings, setting brush-holders, wiring, the motor, the generator, sparking at brushes and the care of the machine. Several diagrams of compound and shunt-wound motors and generators are given in the booklet.

The Beardslee Chandelier Manufacturing Company, 176-180 South Clinton Street, Chicago, has just issued an elaborate catalogue, No. 14, describing and illustrating combination (gas and electric) and gas fixtures of its latest designs in lighting

effects. The catalogue, which contains many new and unique designs, will be sent prepaid to all dealers in chandeliers upon request. The company is now compiling catalogue No. 15, showing electric fixtures only, which will also be sent to dealers on request when issued.

Bulletin No. 8 of the Century Electric Company, 404 North Fourth Street, St. Louis, contains a description of Century single-phase alternating-current motors. The operating characteristics of these motors are given as follows: (1) Self-starting under full load; no clutches, phase coils, starting boxes, etc., being used to accomplish this; (2) capable of developing a heavy starting torque and accelerating quickly; (3) entirely automatic and practically noiseless in operation; (4) develop a high efficiency and power factor making them economical to operate. The motors are said to be adapted to the operation of any kind of machinery.

The Western Electric Company is sending out bulletin No. 4007, describing its 1907 line of fan motors, which include all the points characteristic of the 1906 types and embody new points of construction. The company's Hawthorne Universal 15-inch fan is so designed that it can easily be converted into a desk or bracket type without the use of an adapter or loose part which may easily be lost. The blades are pitched so that a maximum efficiency is reached. The motor is spherical and entirely enclosed and the armature is of the slotted type. Other styles of fan motors listed are 12-inch Zero desk fans, telephone-booth, ceiling, Tuerk alternating-current ceiling fans, ventilating fans and Westinghouse and General Electric makes.

SOCIETIES AND SCHOOLS.

S. M. Kintner of Pittsburg, electrical engineer of the Westinghouse Electric and Manufacturing Company, is president, and Edmund Yardley is secretary of the Engineers' Society of Western Pennsylvania.

A meeting of the Railway Signal Association will be held in the building of the American Society of Civil Engineers, New York city, on May 14th. A paper will be presented on "How to Reclaim Storage Batteries After Having Been Improperly Used." Byron E. Eldred will read a paper on "Copper-clad Steel Wire for Electrical Purposes."

The 1907 catalogue of Purdue University, La Fayette, Ind., contains among other university information the undergraduate courses of study, graduate courses of study, a description of the courses and the material equipment of the institution. Entrance examinations begin on September 10th. Stanley Coulter, Ph. D., is secretary of the faculty, and Alfred Monroe Kenyon, A. M., is registrar.

The National Association of Manufacturers will hold its twelfth annual convention and banquet on May 20th, 21st and 22d, at the Waldorf-Astoria Hotel, New York city. Parts of three days are to be devoted to the business sessions of the convention, during which addresses are to be made on some of the most important topics now before the business world, by government officials, manufacturers and others prominently identified with these subjects.

The New York office of the National Fire Protection Association is now located at Rooms 815, 816, 817, Engineering Societies Building, 29 West Thirty-ninth Street. Mr. Hugh T. Wreaks is in charge. The annual meeting of the association, announced for May 22d, 23d and 24th, at New York, will be held in the Engineering Societies Building. Out-of-town members in New York for the annual meeting, or at any other time, can have mail addressed to them in care of the association.

Proceedings of the eleventh annual convention of the International Association of Municipal Electricians, held at New Haven, Conn., August 15 to 17, 1906, have been published in book form from the office of Secretary Frank P. Foster, Corning, N. Y. The book has 234 pages and a number of illustrations. It is neatly bound and contains considerable valuable information in the shape of papers, reports and discussion on subjects of interest, especially to municipal officers and electricians. The membership of the association represents the electrical departments of American and Canadian cities.

The "Proceedings" of the American Street and Interurban Railway Association, 1906, form a book of nearly 500 pages. They are published by the association, from the office of the secretary, 29 West Thirty-ninth Street, New York. A complete report of the twenty-fifth annual convention, held at Columbus, Ohio, October 17, 18 and 19, 1906, is given. Besides a report of the convention, the book contains considerable data concerning the convention and the association, including a list of delegates, member companies and their officers, etc. The papers, reports and addresses make interesting and instructive reading for the engineer, operator or workman interested in street and interurban railways.

MISCELLANEOUS.

An order instructing the receivers of the National Wire Corporation of New York to ask for, receive and open bids for the sale of the plant was issued a few days ago, it is said, upon application of counsel for the receivers. May 30th was set as the date when the bids should be opened and presented to the court for approval.

The city of Edmonton, N. W. T., has recently contracted with the Allis-Chalmers Company and the Power and Mining Company of Milwaukee for a 1,000-horsepower producer-gas-engine unit for the power plant. This plant is an extension of the present steam plant. It will be installed the coming season under the direction of R. R. Keely, city engineer.

The Canadian minister of finance has introduced a resolution at Ottawa in which he states that it would be expedient to make provision for the payment of bounties on pig-iron and steel manufactured by electrical processes. There is nothing very special about the bounties which the resolution proposes, since they are only an application and extension of time on the iron and steel bounties as now paid.

An innovation in the manufacture of wires for the electrical industries is a process of enameling them which does not interfere with their flexibility. Several attempts have been made to carry out this idea in the past, but the enamels used were found to oxidize on exposure to the elements, being particularly sensitive to alkalies. According to the Electrical Review of London, the new enamel covering is based upon a special treatment of stearin pitch, producing a highly tenacious product.

The newspaper report stating that President Ira Remsen of Johns Hopkins University had received word from London that Sir William Ramsay of Cambridge University had discovered a way to produce copper by the synthetic or combination process from the elements sodium, lithium and potassium, is denied in a later London dispatch. Sir William is quoted as saying that he had never advanced to the point of saying that there is a possibility of making copper synthetically.

Anthony Casale of West Scranton, Pa., has been granted a patent, it is said, on an electrical device which may prove to be a very valuable railroad safety signal. The system which is designed absolutely to prevent collisions of trains is said to afford protection in case an engineer falls asleep at the throttle. The principal object of the invention is to provide means whereby on the approach of two trains within a given danger limit, whether on double or single-track systems, a warning signal will be sounded in the cabs of both trains, and part of the mechanism will automatically shut off the steam, reverse the engine and apply the air brakes.

Mr. S. F. Emmons, in summarizing for the forthcoming "Economic Bulletin" the work of the United States Geological Survey during 1906 in the investigation of metalliferous ores, says: "The increasing exodus of members of the economic force of the Survey in consequence of their employment by large mining organizations at salaries much greater than those they have been receiving from the government seriously impairs the efficiency of the work of this branch of the Survey. It is only by years of practical experience in the field that the geologist, however excellent his preliminary training, becomes competent to carry on independent work in investigating a mining district, and the loss of trained men in this work is, for a time, irreparable."

An unusual activity among the manufacturers of the United States is indicated by the record which they are making in the importation of foreign materials for use in their industries. The figures of the Bureau of Statistics of the Department of Commerce and Labor covering three-quarters of the fiscal year which ends with March show a more rapid growth in importation of manufacturers' materials than that of any other class of imports. These figures indicate that the value of materials imported for manufacturing purposes, whether crude or partially manufactured, will in the fiscal year 1907 exceed by more than $100,000,000 that of any preceding year. This increase occurs in nearly all articles. Cement, for example, shows in the nine months of 1907 an importation of 913,000,000 pounds, against 272,000,000 in the same months of last year. Copper bars, pigs and ingots show importations aggregating 145,000,000 pounds, against 128,000,000 in the corresponding months of the preceding year; rubber imported shows a total of 58,000,000 pounds, against 43,000,000 in the corresponding months of the preceding year. Higher prices are also being paid for the manufacturers' materials.

TRADE NEWS.

The Wadesboro (N. C.) Electrical Manufacturing Company has been incorporated to manufacture telephone and electric wire insulator pins, etc.

The National Electrical Supply Company of Washington, D. C., has secured the contract for supplying the Bureau of Ordnance, Indian Head, with 7,500 feet of weatherproof copper feeder wire, for $1,658.

The Matchless Light Company of Cleveland, Ohio, has been incorporated for $5,000 to make electrical novelties. The incorporators are L. P. Sawyer, Milton Hartman and others.

The C. P. Young Engineering and Supply Company of New Orleans, La., has been incorporated for $100,000 to engage in general mechanical and electrical engineering.

The Gould Storage Battery Company will move on June 1st from its present offices, 1 West Thirty-fourth Street, to 341-347 Fifth Avenue, corner of Thirty-fourth Street, New York city.

The Gunnion Electric Insulation Company of Northport, N. Y., has been chartered with a capital of $250,000. The directors are James Gillin, D. W. Troy and W. L. Morris of Brooklyn.

The Weinsheimer Company of Chicago has been incorporated with a capital of $5,000 to do electrical engineering and construction work. Incorporators are Warren Weinsheimer, E. W. Switser and P. R. Fisher.

The Ray Electric Company is incorporating to take over the specialty agency business of Francis Raymond, who has formed a connection with the Sheldon School to co-operate with the Co-operative Electrical Development Association.

The Westinghouse Electric and Manufacturing Company has offered $5,000,000 worth of stock to stockholders of record on May 4th. The par value is $50 a share and the price at which it is put out is $75. Transfer books will be reopened May 13th. It is explained that it is the policy of the company in issuing new stock to put it out at what is deemed a fair value. The directors also kept in mind that the company's convertible sinking fund bonds are convertible into stock on the basis of par for bonds and $100 for each $50 share of assenting stock. When $15,000,000 of these bonds were offered subscriptions amounted to over $60,000,000, indicating that the privilege of conversion has a substantial value in the minds of investors. It is known that the business of the corporation is increasing at a phenomenal rate and extensive improvements are in progress at the East Pittsburg plant.

F. B. Badt & Co., Chicago, have been appointed western agents for the Excello flaming arc lamp, manufactured by the Excello Arc Lamp Company of New York. These lamps are licensed under 13 "Bremer" United States patents owned by the Westinghouse Electric and Manufacturing Company. Although quite a number of flaming arc lamps are already used in the West, the arrangement just made between the Excello company and F. B. Badt & Co. will doubtless result in a large number of new users of these lamps in the Central and Western states. F. B. Badt & Co., as is well known, represent the Weston Electrical Instrument Company of Newark, N. J., and the Ward Leonard Electric Company of Bronxville, N. Y., and the business of the firm has increased so rapidly that it has been obliged to add to its office space. The company now occupies Suite 1503, 1504 and 1505 in the Monadnock Building.

BUSINESS.

Mr. J. H. Hallberg, consulting engineer, New York, devotes part of his time to the design and manufacture of flaming arc lamps and other electrical specialties. This addition to his regular engineering business necessitated the co-operation of a factory. In view of this fact Mr. Hallberg has moved from 45 Broadway to 30 Greenwich Avenue, New York city, occupying offices with the Beck Flaming Lamp Company and acting as engineer and general manager for the company. In addition, he will retain his old clients and do a general consulting engineering business.

A permanent injunction has been issued by the United States Circuit Court, district of New Jersey, restraining William F. McKeon and Joseph Conning of Newark, N. J., from selling second-hand incandescent lamps unless marked "Used and second-hand." The decision signed by Judge Crose ends a litigation between the General Electric Company and the defendants which has extended over a period of three years. Similar suits were instituted, one against Edward Mills, proprietor of the Newark Electrical Supply Company, and the other against Frederick W. Chase, proprietor of the Lamp Supply Company of New York. Neither of these persons defended and decrees were therefore taken against them by default.

Solvay, N. Y., is where P & S material and electrical specialties are made. For the benefit of those who are under the impression that Solvay is an out-of-the-way place, Pass & Seymour state that the city is located on the New York Central between New York and Buffalo, one mile west of Syracuse. A spur runs into the company's yard, where cars are loaded. The American Express Company's office is 50 yards from the P & S ship-

ping room. All conditions at the plant tend to prompt and correct handling of business.

The Automatic Electric Company, Chicago, is sending out circulars telling of the merits of the automatic telephone switch which "has all the virtues (and more) and none of the faults of 'Central.'" Further, "Independent telephone companies all over the country are adopting our automatic telephone system, the new ones to enable them to start right, the old ones to make up their past losses and take their place among the progressive ones." The company will be glad to furnish information, facts and figures to those who are interested.

The Blake Signal and Manufacturing Company of Boston is receiving commendatory words concerning its tube flux from many quarters. Among them is the following unsolicited letter from Arthur B. Smith of the department of telephone engineering, Purdue University: "We have been using the sample of your tube flux in the telephone laboratory and have found it very convenient. Your idea of placing the compound in this form is certainly to be commended. We are daily doing more or less soldering, and the ordinary stick flux does not last long, due to waste. You have made a decided advance." Before his present position as instructor Mr. Smith was a practical telephone man, having held every position from lineman to manager.

The Wagner Electric Manufacturing Company of St. Louis, Mo., is sending out Bulletin No. 76, dealing with single-phase, variable-speed, ventilating fan outfits. The company asserts, in a circular letter, that the outfit is the only single-phase, variable-speed, ventilating fan with auto-transformer control on the market. The principle employed for speed variation is that of the auto-transformer connected to a regulating head, by means of which the actual voltage applied to the motor is controlled. Wagner single-phase, variable-speed outfits are credited with doing everything that a direct-current outfit will do, having an advantage of operating under full-speed conditions, as an induction motor with no commutator or brush wear resulting. The company believes that they will prove of aid to central-station managers who are seeking new business. A booklet on the subject of these outfits will be sent on request.

Attention is called to the Shawmut pocket test lamp recently put on the market by the Chase-Shawmut Company, Newburyport, Mass. Annoyance experienced in detecting defective indicators of enclosed fuses led the company to design a test lamp to be used for this purpose. It is also very useful to show whether a circuit is alive. A specially designed incandescent lamp is enclosed in a fiber casing. This casing has ferrules and knurled binding posts on either end, while at the middle a hole through both walls of the casing allows the illumination of the lamp to be plainly seen. For the majority of switches and fuses the metal ends of the test lamp will bridge parts of opposite polarity, but for work where the distance is greater than the length of the test lamp the binding posts afford a convenient means of clamping leads of sufficient length. The test lamp lights up, of course, if placed in circuit. It is not designed for continuous service and should be used only for flashing, as the small enclosed casing will soon become too hot if left long in circuit. It is made in two sizes, one for 110 volts, measuring 3⅞ inches over all, with a diameter of 11/16 inch, the other for 220-volt, measuring 4¾ inches over all, with a diameter of 1 1/16 inches.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 30, 1907.

851,654. Four-way Snap Switch. Nathan W. Crandall, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed July 27, 1906.

The contacts are arranged to engage with one another in pairs and a pair of oscillating poles is arranged to be thrown between pairs of stationary contacts.

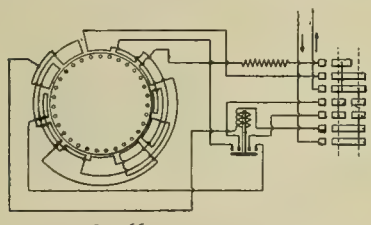
851,655. Electric Horn. Henry Csanyi, Orange, N. J. Application filed June 28, 1906.

An electromagnet causes a diaphragm to vibrate.

851,658. Reactance Coil. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 23, 1906.

Combined with end ring members of magnetizable material are prismatic core members of equal length located between the ring members, coils wound upon the core members and a frame of non-magnetizable material for maintaining a relative lateral position of the several parts, and means for holding the rings in position against the ends of the core members.

851,662. Controlling Apparatus for Electric Motors. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 17, 1905.



NO. 851,662.—MOTOR CONTROL.

In combination with an electric motor having a number of magnetizing windings, are a controller for connecting the windings to the supply circuit in one way for starting and in another for normal operation, and a governing switch that opens the motor circuit if the operating current fails, provided with an actuating coil the circuit of which closes only when the controller is in starting position. (See cut.)

851,663. Electromagnet. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

Two U-shaped, magnetizable core sections have approximately horizontal legs, the upper ones of which are of greater mass than the lower ones. A pivotal support for one of the core sections is located below the center of gravity thereof, and a winding surrounding the upper legs of the core sections is also provided.

851,664. System of Control. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 13, 1905.

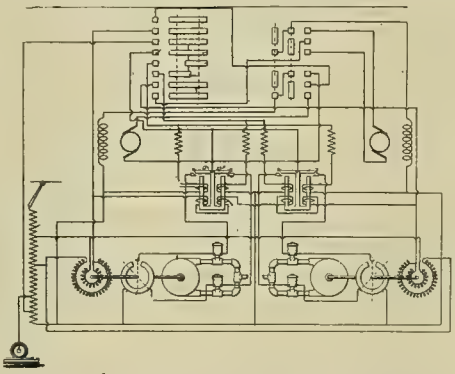
Combined with a number of translating devices are a number of voltage regulators, means for operating the same, means for governing the operating means having windings that are connected between corresponding points in the circuits of the translating devices, and windings that normally control the operation of the governing means. (See cut.)

851,665. Voltage-adjustment Means. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 9, 1906.

In combination with a series of conductors supplied with progressively differing voltages are a number of inductive windings, one terminal of each of which is connected to a distributing circuit, means for connecting the remaining terminals respectively to the supply conductors, and means for disconnecting the same, one at a time, from the corresponding supply conductors reconnecting them to others.

851,666. Voltage Regulator. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 9, 1906.

In the device described are a distributing circuit, a transformer winding having leads extending from several points thereof, two inductive windings, means for connecting the said windings between different transformer leads, a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings and having a point intermediate its terminals connected to the distributing circuit, and means for connecting one terminal of each of the aforesaid windings to the distributing circuit before disconnecting the other terminal thereof from the transformer lead.



NO. 851,664.—SYSTEM OF ELECTRICAL CONTROL.

851,667. Resistance Terminal. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 16, 1906.

Details are described.

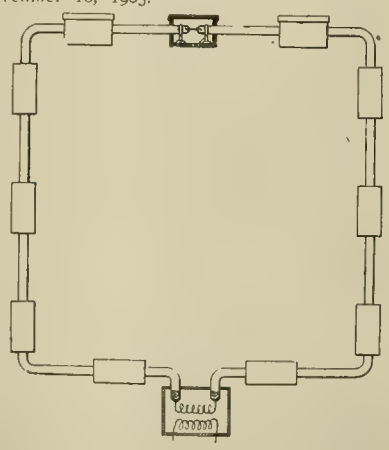
851,671. Supporting Device for Electric Conductors. Budd J. Jones, Chicago, Ill., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 14, 1904.

A line structure for electrical distribution comprises a supporting arm or bracket having an elongated opening, an insulator adjustably supported upon the upper surface of the arm or bracket, and an electric conductor suspended from the insulator.

851,682. Electrically Controlled Elevator. William D. Lutz, Allendale, N. J. Application filed June 22, 1905.

A floor controller has a double set of contacts. Means actuated by the movement of the elevator open one set of contacts and at the same time close the other.

851,685. Vacuum-tube Lighting. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, Newark, N. J. Application filed November 16, 1905.



NO. 851,685.—VACUUM-TUBE LIGHTING.

As shown, the tubes are arranged in series end to end with their leading-in wires connected together. There is an insulated protective enclosure for the contiguous ends of a unit tube of a system, and from this enclosure the glass portion of the tubing alone projects. (See cut.)

851,690. Electric Switch Mechanism. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 11, 1902.

Two main terminals are relatively movable toward and from each other. There is an electromagnetic coil for energizing the terminals and a pilot switch with connections to energize the coils in a manner to produce unlike polarity of the terminals to close the circuit, and to energize the coils in a manner to produce like polarity of the terminals to open the circuit.

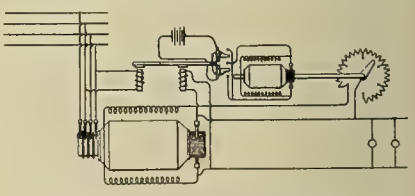
851,691. Electric Switch Mechanism. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed August 2, 1905.

There is a connection whereby the coils are energized to attract when the contact members are separated, and means whereby the contact members are made to engage after the yielding means have been actuated.

851,692. Automatic Block Signal System. Frank P. J. Patenall and George H. Dryden, Baltimore, Md. Application filed December 4, 1906.

Details are described.

851,695. Rotary-converter System. Walter S. Rugg, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 30, 1905.



NO. 851,695.—ROTARY-CONVERTER SYSTEM.

The system comprises a rotary converter and a speed-regulating device therefor, two opposing controlling devices for the speed-regulating device that are respectively energized from the alternating-current circuit and from the direct-current circuit to which the rotary converter is connected. (See cut.)

851,702. Rotary Dressing Device. Vinzenz Spietschka, Cleveland, Ohio. Application filed August 13, 1906.

This invention relations to a dressing tool individually operated by an electric motor.

851,704. Method of Speed Regulation. Norman W. Storer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 24, 1905.

The method consists in connecting a number of large-capacity high-voltage motors in series with a number of small-capacity low-voltage motors, removing the small-capacity motors from the circuit, connecting the large-capacity motors in series with corresponding small-capacity motors and in parallel relation to each other, and again removing the small-capacity motors from the circuit.

851,705. Insulator. Hugo Stotz, Mannheim, Germany. Application filed December 10, 1906.

An insulator on a tubular support for introducing electric wires into a building is described.

851,709. Potential Regulator. Wilbur H. Thompson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 25, 1906.

In a transformer regulator, combined with an electric circuit, are relatively movable coils and means for automatically adjusting their positions to obtain a substantially constant potential in the circuit, and means for producing a relatively rapid change in the position of the coils when a predetermined variation occurs in the potential to be governed.

851,719. Condenser Pump Regulator. Ragnar Wikander, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 24, 1905.

The regulator comprises an electric generator, a steam driving engine therefor, a condenser and supply pump for the engine, an electric driving motor for the pump supplied with energy from the generator, and means for varying the speed of the driving motor as the energy delivered from the generator varies.

851,726. Service Entrance Box. Frederick B. Adam, St. Louis, Mo., assignor to the Frank Adam Electric Company, St. Louis, Mo. Application filed June 25, 1906.

The invention relates to a service box with a hollow projecting portion extending beyond the wall of a building.

851,738. Method of and Apparatus for Transforming Single or Polyphase into Continuous Current. Georges Faget, Paris, France. Application filed October 22, 1904.

Combined with means for creating two distinct rotary fields, and means for varying their angular relation at will, are a stationary secondary winding extending into both of the fields to compound the separate inductive effects of the two rotary fields, and a fixed commutator connected with the stationary winding and having brushes adapted to revolve substantially in coincidence with the resultant inductive effect of the two rotary fields. The method of transformation employed consists in distributing the polyphase currents in the primary circuit so as to generate distinct rotary fields in separate parts of space, to produce separate inductive effects on different parts of the secondary, and rectifying the currents so generated in the secondary.

851,739. Protection of Secondary Circuits. Samuel Ferguson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 9, 1904.

In an electrical distributing system are high-potential mains, transformers having their primaries connected in delta between the mains, a permanent ground connection of high impedance for each corner of the delta, secondaries for the transformers, and means for automatically connecting the secondaries to ground when primary high potential occurs on the secondaries.

851,743. Variable-voltage Transformer. Edward F. Gehrkens, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 9, 1906.

The transformer comprises primary and secondary coils, means for varying the proportion of total primary flux threading the secondary coil, and a third coil in inductive relation to the primary and connected in series with and opposing the secondary coil, the third coil being proportioned to give an induced voltage approximately equal to the minimum induced voltage in the secondary coil.

851,747. Process of Drying Electric Cables. William B. Hale, Mexico City, Mexico, assignor to the Western Electric Company, Chicago, Ill. Application filed March 12, 1906.

A flow of current is used to dry out the insulation.

851,751. Jump-spark Indicator. Otto C. Hoffmann, Buffalo, N. Y., assignor to the Chicago Fuse Wire and Manufacturing Company, Chicago, Ill. Application filed March 21, 1905.

Details are described.

851,761. Telephone Switch-hook. Alfred Larsson, Buffalo, N. Y. Application filed May 22, 1906.

A bridge carrying a set of contacts is provided with upwardly projecting lugs whereby the bridge may be tilted.

851,762. Controlling Means for Automobiles. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 14, 1905.

The means comprise electric driving motors, a generator supplying current thereto, a prime mover driving the generator, a lever controlling the speed of the prime mover, means for returning the lever automatically to its lowest speed position, and means controlled by the generator current for maintaining the lever in other positions.

851,775. Electric Attachment for Tanks. Henry E. Reeve, Brooklyn, N. Y., assignor to the Automatic Fire Alarm Company, New York, N. Y. Application filed February 3, 1906.

The attachment described includes a receptacle for containing a substantial body of oil, a float having a pivot shaft mounted in the receptacle and immersed in the oil therein, an electric switch, operative means of connection between the switch and the float shaft, and a sealing bell inverted over the switch.

851,776. Automatic Train-blocking System. Charles E. Roehl, Brooklyn, N. Y. Application filed December 16, 1903.

In a system for controlling the movements of electrically operated railway vehicles, are combined with a power circuit a controlling circuit on the vehicle the circuit containing a manual controlling switch and being governed by the power circuit, and an automatic controlling device also on the vehicle and governed by the controlling circuit.

851,786. Controlling Switch for Transformers. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1906.

In combination are a supply circuit, a transformer, a translating device, a switch adapted to connect the transformer primary to the supply circuit, a second switch adapted to connect the transformer secondary to the device, a magnet winding adapted to close one switch, and means for energizing the magnet upon the closing of the other switch.

851,792. Telephone-exchange System. Johan A. Avén, Stockholm, Sweden, assignor to the firm of Deutsche Telephonwerke Gesellschaft mit Beschränkter Haftung, Berlin, Germany. Application filed November 1, 1904.

In a call-distributing system means are employed whereby a connecting operator is notified by an annunciator operator to make a connection, and the annunciator operators are apprised of the readiness of a connecting operator to make connections.

851,793. Brush Holder. Ralph E. Barker, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 13, 1903.

A dynamo-electric machine comprises a commutator, a co-operating brush, a holder for the brush, a support for the holder, and means for interchangeably securing the brush holder rigidly to the support in either of two operative positions to give a brush lead in one direction or the other.

851,795. Relay. Elmer F. Bliss, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 17, 1906.

The relay embraces a winding having leads from its terminals and from intermediate points, the number of turns between each pair of adjacent leads being different from that between any other pair, contacts arranged on two intersecting arcs connected to the leads, and two pivoted contacts adapted to move over the two arcs respectively.

851,797. Clutch Mechanism. Tito L. Carbone, Berlin, Germany. Original application filed May 16, 1905. Divided and this application filed November 25, 1905.

In an arc lamp are a revoluble wheel, a flexible member connected to the wheel, an electrode holder suspended by the member, arms rotatably carried by the axle of the wheel, a revoluble axle carried by the arms, three arms fixed on the revoluble axle, an electromagnetic device having its core connected to the third arm and a stationary stop co-operating with one of the arms carrying the revoluble axle.

851,799. Electric Traction System. Alexander Churchward, Schenectady, N. Y., assignor to the General Eletcric Company, Schenectady, N. Y. Application filed June 1, 1906.

In an electric traction system are sources of current supply one external to and the other on the vehicle, a propelling dynamo-electric machine on the vehicle having two armature windings and one set of field windings, and means for energizing the field windings and one armature winding from one source or the field windings and the other armature windings from the other source in order to propel the vehicle.

851,803. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 14, 1902.

Combined with a trunk line adapted to connect with a calling telephone line at its outgoing end and a called telephone with which its incoming end is connected, are a disconnect signal for the incoming end, a relay at the incoming end actuated by current flowing over a portion of the talking circuit when connection is established with the called line to place the signal in condition to operate, and means controlled by the operator at the out-going end for operating the signal to give a disconnect indication when the called subscriber's line is closed at the sub-station.

851,804. Controller for Electric Motors. Charles A. Dresser, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. Application filed June 19, 1902.

The controller comprises a series of resistance contacts to which is connected the resistance in circuit, a solenoid carrying a contact device co-operating with the contacts, a device for stopping the contact devices in an intermediate position and arranged so as to act thereon only when the contact device is in a non-sparking position.

851,808. Automatic Switch for Electric Circuits. Charles H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 22, 1904.

Combined are two pairs of independently operable switches, two independent tripping devices for the pairs, means for moving the devices to an inoperative position, a latch for the moving means, and operative connections between the latch and one of the switches whereby the devices are released when the switch is closed.

851,811. Automatic Motor Starter. Charles D. Knight, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 25, 1906.

In combination are an electric motor, a starting switch therefor arranged to return automatically to off position, a magnet winding adapted to move the switch to running position, a latch adapted automatically to engage and to retain the switch in running position, means for automatically, de-energizing the magnet winding when the switch is in running position, and a magnet winding adapted when energized to disengage the latch.

851,823. System of Motor Control. Wilbur L. Merrill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1906.

In a motor-control system are a number of motors, a series circuit including the motors in series and a source of current, a normally open switch in the circuit, an electromagnet for closing the switch, a control switch at a distant point in circuit with the electromagnet, and means at each motor for cutting the motor out of the series circuit and connecting it to the source independently of the other motors.

851,828. Alternating-current Machinery. Addams S. McAllister, New York, N. Y. Application filed April 2, 1906.

Combined with an alternating-current machine having a rotor provided with a commutator are means for preventing sparking including separate brushes connected through a reactance device and another brush connected to an intermediate point in the reactance device, all of the brushes being arranged to convey the normal current of the machine.

851,829. Electrically Controlled Elevator. Carl Naujoks and Frederick C. Naujoks, San Francisco, Cal., assignors of one-third to others. Application filed April 16, 1906.

The elevator comprises a series of doors, an electric circuit, a motor in the circuit for operating the elevator, a series of resistances arranged to be successively thrown into the circuit by the opening of an elevator door to diminish the current therein and check the speed of the motor.

851,838. Circuit for Coin Collectors. John G. Roberts, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

Combined with a circuit having parallel branches are a magnet in a bridge of the branches, mechanism operated by the magnet when energized, a source of direct and a source of alternating current each adapted to be connected with the circuit, and non-inductive and inductive resistances in adjacent arms respectively of the parallel branches, the dissimilar resistances having equal impedance and unequal resistance.

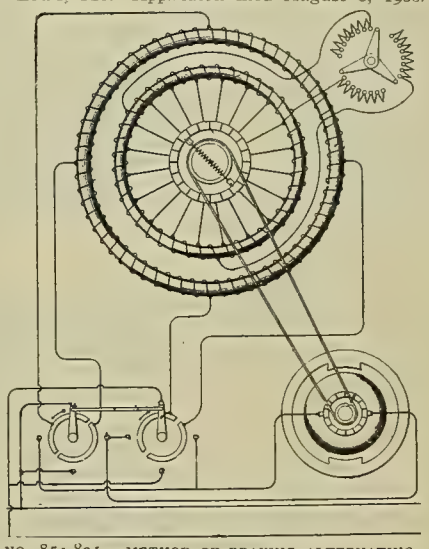
851,856. Means for Nullifying Inductive Interference Between Parallel Circuits. Edward Blakeney, Ossining, N. Y., assignor to the American Telephone and Telegraph Company, a corporation of New York. Application filed January 7, 1907.

In combination with adjacent signaling lines each having a receiving instrument, are a winding located upon a receiving instrument and being connected only with a companion line, and means for causing the current flowing through the winding from the companion line to act momentarily upon the receiving instrument.

851,890. Method of Starting Alternating-current Motors. Waldo A. Layman, St. Louis, Mo. Application filed August 6, 1906.

The method consists in starting the motor on a voltage below normal operating voltage, raising the voltage before normal running speed under load is attained and short-circuiting a member of the motor.

851,891. Method of Electrically Braking Alternating-current Motors. Waldo A. Layman, St. Louis, Mo. Applicaton filed August 6, 1906.



NO. 851,891.—METHOD OF BRAKING ALTERNATING-CURRENT MOTORS.

The method consists in introducing into the motor, after the main driving current has been cut off from the motor, an auxiliary current, and reorganizing the windings to establish thereby a torque opposed to the inertia or momentum torque of the motor. (See cut.)

851,933. Electric Elevator Controller. Howard F. Gurney, Jersey City, N. J. Application filed April 30, 1906.

In combination with a motor are a brake, a starting switch for the motor, an electromagnet arranged to actuate the starting switch and the brake, and an air-cushion arranged to control the movement of the electromagnet in both directions.

851,934. Electric Elevator. Howard F. Gurney, Jersey City, N. J. Application filed April 30, 1906.

In an electric elevator are a motor, a starting switch, a reversing switch, an automatic rheostat and a brake, and an electromagnet arranged to control the starting switch, the reversing switch, the automatic rheostat and the brake.

851,948. Telephone System. Jacob W. Lattig and Charles L. Goodrum, Philadelphia, Pa. Application filed April 4, 1903.

Combined are a multiple-switchboard telephone line, a pair of line conductors, a battery permanently connected between the line conductors, a number of testing terminals connected with one line conductor, the portion of the line conductor between the testing terminals and the battery having an appreciable resistance whereby when a subscriber calls and connects the two line conductors together the testing terminals have their potential raised and the line is placed in condition to test "busy."

851,961. Electric Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Original application filed July 23, 1903. Divided and this application filed July 1, 1905.

In an electric furnace are a conducting resistance constituting a portion of the electric circuit, an auxiliary or supplemental electrode constituting one terminal of a conducting gap inside the furnace body, and means for causing current to flow through the conducting resistance and through the conducting gap

851,075. Incandescent-lamp Support. Edmond Beaudette, Montreal, Quebec, Canada. Application filed April 28, 1906.

The device comprises a canopy provided with recesses, bearings disposed in the recesses, a rotatable spindle carried by the bearings, contact disks carried by the spindle, contacts carried by the canopy and adapted to bear on the contacts and the spindle, a base secured to the canopy, and contacts on the base adapted to bear on the contacts on the canopy.

851,076. Electrical Measuring Instrument. Adelbert O. Benecke, Vailsburg, N. J. Application filed September 19, 1902. Renewed April 1, 1907.

In the instrument are combined a movable part with a retarding device for the movable part, the device embracing an air chamber, a vane or fan operatively connected to the movable part, and a rotatable disk adapted to hold the air contained within the chamber in check when the vane is moved.

851,079. Electromagnetic Separator. William Blackmore, London, England. Application filed September 10, 1904.

The separator comprises in combination, a revolving conical table, a number of separate electromagnets disposed at intervals around the table, windings on the electromagnets, electromagnet pole pieces on each side of the table, the upper pole pieces of the magnets being removable without moving the windings.

851,994. Telephone Switch. Timothy S. Mount, Rhome, Tex. Application filed September 19, 1903.

In a telephone box provided with party-line terminals and suitable connections is mechanism for short-circuiting one end of the party-line connections and for completing a circuit with the other end of the party-line connections at the will of the operator.

851,997. Fuse Holder. John C. Ralls, Los Angeles, Cal., assignor of one-fourth to Edward J. Fleming and one-fourth to Paul Usser, Los Angeles, Cal. Application filed August 8, 1904.

An elongated fuse-holder is provided at each end with means for making connection with a wire, the means at one end of the fuse holder consisting of flanges of malleable metal adapted to co-operate to grip a single wire.

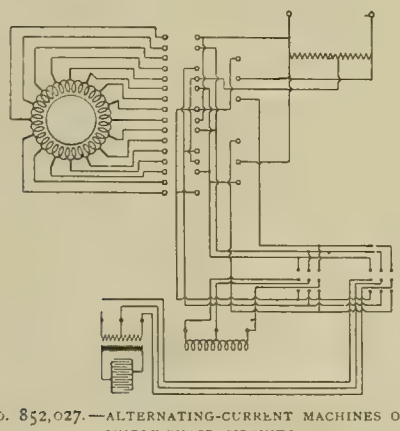
852,004. Automatic Telephone Switch System. John Wicks and Donald D. McKay, Riverside, Cal. Application filed August 30, 1905.

The system comprises a party line including two wires, party signals, each of which is connected to one only of the wires, ringing current generating means, and line-selecting mechanism including wipers connecting the generating means to either of the wires of the party line and constituting part of the ringing current carrying means between the generating means and the signals.

852,026. Protection of Electrical Systems from Lightning and Other Static Disturbances. Ralph D. Mershon, New York, N. Y. Application filed May 8, 1905.

Combined are an aerial line conductor, a portion of the conductor being reduced in size and elevated from the ground higher than the normal distance therefrom, and one or more arrester devices connected to the conductor and to ground, the elevated and reduced portion of the conductor being located between the arrester device or devices and the apparatus.

852,027. Alternating-current Machines on Single-phase Circuits. Ralph D. Mershon, New York, N. Y. Application filed September 29, 1904.



NO. 852,027.—ALTERNATING-CURRENT MACHINES ON SINGLE-PHASE CIRCUITS.

In combination with the primary element of an alternating-current machine are connections therefrom to a single-phase circuit, means for varying the number of poles, a capacity connected to the primary element across one or more common electrical diameters for one number of poles, and means for shifting the connections of the capacity to maintain the relation thereof to the circuit connections for other numbers of poles. (See cut.)

852,028. Electric Motor and Other Apparatus in Which There Is Magnetic Flux. Ralph D. Mershon, New York, N. Y. Application filed March 14, 1904. Renewed January 28, 1907.

In an electrical apparatus are an annular element of polygonal cross section having a ring winding or windings laid in slots therein, of an annular element having a number of faces adjacent the same number of surfaces of the first element and having short-circuited windings laid in slots in the faces.

852,037. Safety-fuse Terminal. Joseph Sachs, Hartford, Conn., assignor to the Sachs Company, Hartford, Conn. Application filed March 9, 1906.

The terminal described comprises an end cap, a contact terminal, both of which members are provided with an aperture for receiving and making electrical connection with a fuse strip or its terminal, and means connected with one of the members and independent of the electrical connection for securing the members together.

852,081. Telephone Holder. Thomas J. Skelley, Collinwood, Ohio, assignor to Skelley & Co., Cleveland, Ohio. Application filed April 17, 1903.

Details are described.

852,092. Electrically Controlled Semaphore Signal. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. Application filed December 7, 1905.

In a semaphore signal are a spectacle case and blade, and a centrifugal friction brake, comprising a casing and brake shoes therein for retarding the motion of the spectacle case and blade and preventing the casing and blade from coming to a sudden stop.

852,094. Railway Semaphore Signal. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. Application filed December 7, 1905.

The signal includes a spectacle case and blade pivoted to a suitable support and electrical means for moving the case and blade to a position to indicate safety.

852,121. Incandescent-light Attachment. William V. D. Kelley, Newark, N. J., assignor of one-half to Howard S. Jones, Brooklyn, N. Y. Application filed January 5, 1907.

A transparency for attachment to a lamp bulb comprises a transparency removably held by jaws carried by a ring, and a second set of jaws carried by the ring and adapted to engage the bulb.

852,133. Electro-therapeutical Instrument. James W. Mollière, Oakland, Cal. Application filed July 18, 1906.

An apparatus for the generation of electrical currents and the production of ozone, includes stationary and revoluble plates, electrical brushes and collectors, an enclosing case therefor, a disk revoluble in unison with the generating disk and carrying radially disposed buckets, a hood having connection with the air outside of the case and open connection between the interior of the hood and the central portion of the buckets.

852,163. Massage Implement. Leonard B. Buchanan, Woburn, Mass. Application filed October 27, 1906.

The device comprises a hand-piece, a pair of massaging electrodes borne by it, which are connected with a source of electric energy, and a rolling medicament carrier independent of the electrodes, but disposed adjacent thereto, which is constructed and arranged to apply a medicament in the path of movement of the electrodes.

852,186. Electrical Current Interrupter. Frederic W. Lord and Frederic W. Erickson, New York, N. Y. Application filed January 28, 1907.

Combined in an arrester device are a number of electrodes separated from each other by air gaps adapted to be arranged in successive series from the line wire to the ground, consisting of a line electrode and a ground electrode, between which are a series of rotatable insulated electrodes separated from each other.

852,188. Dry Battery. Clay D. Manville, Pittsburg, Pa., assignor of one-half to Julius Baer, Pittsburg, Pa. Application filed November 20, 1906.

In combination with a casing and a battery arranged therein, are a spring within the casing below the battery and supporting the latter, and a spring located exteriorly of the casing having one end connected to the latter and its other end connected to the battery.

852,189. Machine for Ornamenting Dials. Edward A. Marsh, Newton, Mass. Application filed January 31, 1907.

The machine described comprises work-holders, graving tools and holders therefor, a number of electromagnets, an armature for each magnet arranged, when attracted to the latter, to move one of the tools into cutting relation with the work, and a stop on each magnet independently adjustable to prevent movement of the armature of that magnet.

852,193. Electric Exercising Apparatus. Archie B. McMillan, Brooklyn, N. Y. Application filed April 4, 1906.

The apparatus includes a field magnet having an adjustable section, the section pivoted on and adapted to be locked in different positions by a suitable screw.

852,226. Burglar-alarm Relay Drop. David D. Friedman, New York, N. Y. Application filed May 17, 1906.

Combined are a base plate, an electromagnet mounted thereon, an armature movably mounted adjacent the electromagnet, a casing secured to the base plate and enclosing the armature and electromagnet, and a longitudinally movable pin carried by the casing and normally engaging with the armature.

852,265. Headlight. Manes E. Fuld, Baltimore, Md. Application filed January 30, 1906.

An electric lamp is adapted to be fastened to the head of the person using it.

852,279. Electric Door Opener. Joseph Loch, Brooklyn, N. Y. Application filed April 17, 1906.

The device embraces a magnet armature, a holding device pivoted to the armature and attracted by the magnet, the holding device being adapted to hold the armature in engagement with the poles of the magnet and a strike engaged by the armature.

852,307. Trolley-pole Catcher. John H. Walker, Lexington, Ky. Application filed June 27, 1906.

In the apparatus described are a carrier comprising a body portion, a rocker, a dog carried by the rocker, a supplemental catch carried by the body portion, and means whereby the rocker when adjusted to position to free the dog may also adjust the supplemental catch to neutral position.

852,326. Apparatus for Repairing Pneumatic Tires. Frederick L. Harley, Quakertown, Pa. Application filed December 22, 1906.

The apparatus comprises a housing having a concave and a flat face and provided with laterally extending perforated lugs or ears and with electrical connections, clamping means engaging the ears or lugs, and electrical heating provisions arranged in the housing and including a thermostatic cut-out for limiting the heat.

852,338. Electric Stove. Albert L. Marsh, Lake Bluff, Ill., assignor to Hoskins Co., Chicago, Ill. Application filed February 18, 1907.

In the stove are a block of refractory material provided about its outer surface with a spiral uncovered groove, a helical electrical resistance wire laid along and confined under exposure to the atmosphere in the groove, and terminals, with which the wire is connected, for coupling it to a supply of current.

852,342. Electric Gas Igniter. Franklin C. Nickel, John E. Martin and Charles E. Blackburn, Jacksonville, Ill. Application filed February 6, 1906.

The igniter comprises a valve, an angular stem movable therewith, a bracket, a clip mounted upon and insulated from the bracket, the clip having oppositely extending tongues, and a coil seated upon one of the tongues.

852,344. Supervisory Signal System. Charles F. Patterson, New York, N. Y. Application filed June 14, 1906.

The system includes transmitters, one for each object supervised comprising alarm-circuit and time-circuit transmitting devices, means operated by one of the transmitting devices for cutting out the other such transmitting device, and controlling means comprising separable members, one connected to the transmitting means and the other adapted for connection to an object to be supervised.

852,381. Wireless-telegraph Receiving System. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Application filed December 4, 1905.

Combined are a loop antenna and a tuned receiving circuit, a transformer having two primary windings serially connected in the loop antenna, a secondary winding placed between the primary windings and forming part of the tuned receiving circuit and means whereby the secondary winding may be moved with respect to the primary windings.

852,386. Hand-operated Electric Circuit Controller. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 18, 1905.

In combination are a contact-carrying drum, means for automatically returning the drum to a predetermined "off" position, after it has been rotated in either direction, comprising a spring and links that severally make operative connection between the drum and the ends of the spring for either direction of rotation.

852,395. Circuit Connector. Charles F. Patterson, New York, N. Y. Original application filed June 14, 1906. Divided and this application filed June 29, 1906.

Each of a series of circuit connectors of the same general type and size comprises relatively separable members and individualizing means for the members, whereby each such member will coact in its own circuit connector and not in other circuit connectors of the series.

852,405. Railway Signaling Apparatus. Edson R. Wolcott, Golden, Colo. Application filed December 27, 1904.

In a railway inductive signaling apparatus are an instrument mounted on the car or train for transmitting inductive electrical impulses, a circuit in which the instrument is located, means mounted on the car or train for automatically and intermittently opening and closing the circuit, and means located at the station and automatically operated by impulses taken inductively from the circuit to indicate the location of trains.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on May 6, 1907:

427,032. Regulator or Rheostat. F. Bain, Chicago, Ill.
427,042. Electrical Train Signal. G. D. Burton, New Ipswich, N. H.
427,087. Multiple Switchboard for Telephone Exchanges. M. G. Kellogg, Chicago, Ill.
427,120. Test Circuit for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
427,121. Multiple Switchboard Testing Apparatus. C. E. Scribner, Chicago, Ill.
427,122. Magneto-electric Machine. C. E. Scribner, Chicago, Ill.
427,123. Electric Loop Switch. C. E. Scribner, Chicago, Ill.
427,151. Method of and Apparatus for Making Rolled Forgings by Electricity. G. D. Burton, Boston, Mass.
427,154. Divided Multiple Switchboard. J. J. Carty, New York, N. Y.
427,155. Multiple Switchboard Apparatus. J. J. Carty, New York, N. Y.
427,156. Telephone Exchange Apparatus. J. J. Carty, New York, N. Y.
427,163. Regulator for Dynamos. W. H. Elkins, Cambridge, Mass.
427,164. Regulator for Dynamos. W. H. Elkins, Cambridge, Mass.
427,208. Apparatus for Testing Electric Lines. B. E. Waters, Brockton, Mass.
427,235. Commutator for Electric Motors. A. A. Ingraham, New York, N. Y.
427,259. Electrical Collecting Device. G. Forbes, Westminster, County of Middlesex, England.
427,294. Dynamo-electric Machine. D. B. Brace, Lincoln, Neb.
427,341. Electric Locking Attachment. H. J. Meyers, Brooklyn, N. Y.
427,405. Iron Core for Dynamo Electric Machines. M. Deprez, Paris, France.
427,429 and 427,430. Electric Signaling System and Apparatus for Railroads. C. H. Koyl and J. W. Lattig, Easton, Pa.
427,459. Device for Unloading, Recharging and Reloading Electric Car Batteries. J. C. Chamberlain, New York, N. Y.
427,489. Alternating-current Electric Meter. G. Westinghouse, Jr., Pittsburg, Pa.
427,515. Electrical Transmission of Power. R. M. Hunter, Philadelphia, Pa.
427,521, 427,522 and 427,523. Electric Switch. O. S. Platt, Bridgeport, Conn.
427,530. Electric-current Regulator. E. P. Warner, Chicago, Ill.

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Electrically Operated Towing Carriage for Testing Ship Models.

By Dr. Alfred Gradenwitz.

The ship-testing institute recently established at Uebigau, near Dresden, Germany, though situated in the center of the country, far from the sea and from large ship-building centers, affords the advantage of having water of excellent quality at its disposal and of being attached to a technical high school and a shipyard. It is the extension of an institution of the same kind installed in 1892 on the model of Messrs. Denny and Brothers' ship-testing plant.

The Uebigau ship-testing plant is subsidized by the state and is intended for the testing of ship resistances and hydrometrical instruments. The building covers an area of 1,243 square meters and comprises six different rooms, of which the testing hall, 101 meters in length and 9.4 meters in width, extending from the east to the west, is by far the greatest. This hall contains a testing tank of rammed concrete, 88 meters in length, 6.5 meters in width and 3.6 meters in depth, the water cross-section being 18.68 square meters. In front of this tank there is provided an additional tank seven meters in length and one meter in width, with walls only 10 centimeters in thickness, which allows the instruments to be readily installed and connected to the ship model. The aggregate length of water surface is thus 95 meters.

The amount of water required for filling these tanks (1,624 cubic meters) is lifted from a pit by means of a pulsometer and is discharged immediately into the River Elbe.

As the walls of the tank project 0.9 meter above the ground, the formation of waves is readily observed, while the work of inspecting and cleaning the rails on which the towing carriage runs is facilitated. Through high windows in the walls and by means of a corridor provided below the tank, observations can be carried out and photographs taken below water, while the whole of the water, whenever required, can be illuminated with electric lamps. Special pegs are fitted to the bottom and walls of the tank for inserting flat bottoms or canal profiles.

The towing track, 112 millimeters in height, is placed without any wooden supports on the top of the longitudinal walls, the rails being planed and fished carefully in order to avoid any oscillations of the towing and measuring truck (Fig. 1) running on the rails. The lower flange is bolted to cast-iron shoes, cement being cast underneath throughout its length.

This measuring carriage or truck (Fig. 1) is of a construction as light as possible so as to insure quick starting and stopping; it is made up of iron framework, its weight being only 5½ tons, inclusive of all apparatus and the staff required for its operation. It is 8.7 meters in length and seven meters in width and consists of two transversal and three longitudinal girders of considerable breadth. The tables on which the measuring instruments are located are free to slide alongside the central longitudinal girder, a platform for the operator being suspended from this girder and the right-hand longitudinal girder. To this platform leads a staircase from a grating placed on the rear transversal girder, access to which is readily obtained on both sides from the bottom of the hall by means of hinging staircases, which are lifted automatically. The apparatus and the ship-model connections are readily arranged in the front tank.

The measuring truck is operated and braked by means of a Siemens-Schuckert shunt electric motor of 20 horsepower and intermittent gear (acting through an intermediary gearing and toothed wheel on the rear running wheel). Both the gears and wheels are provided with ball bearings. Current is supplied through the running rails and three T-shaped irons placed on porcelain insulators, and is collected from the former by the running wheel and from the latter by cast-iron shoes (Fig. 2). The potential of the motor inductors is 110 volts, and the same voltage is used in connection with the five motors of the apparatus installed on the truck. The armature derives a variable tension of up to 440 volts from an accumulator battery through the intermediary of a transformer installed in the rear part of the hall.

In order to reduce as far as possible the starting and braking distances, the operator is placed not on the truck itself, but on an elevated platform in the rear of the hall (Fig. 3). During operation any traveling speed between five centimeters and upward of five meters per second, as well as the braking, is obtained by the aid of a single crank controlling the shunt resistance of the dynamo and of the transformer, and thus supplying the armature of the motor with current at given voltage. While in zero position the truck is braked very sharply. A switch is provided for inverting the direction of travel. A voltmeter, graduated in speeds, allows the operator at any time to check the speed.

Whenever the electric braking fails, a hand brake connected to a cut-out for the truck motor is operated. A buffer jack, sliding on the rails, is installed at the rear of the hall, while rubber buffers in the front part of the hall prevent the truck dropping.

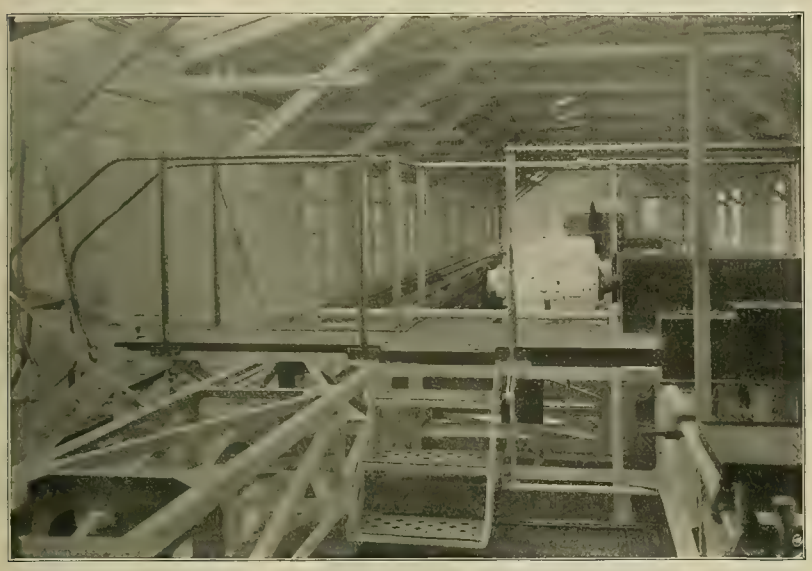


Fig. 1. Rear of Towing and Measuring Carriage, Showing Driving Motor.

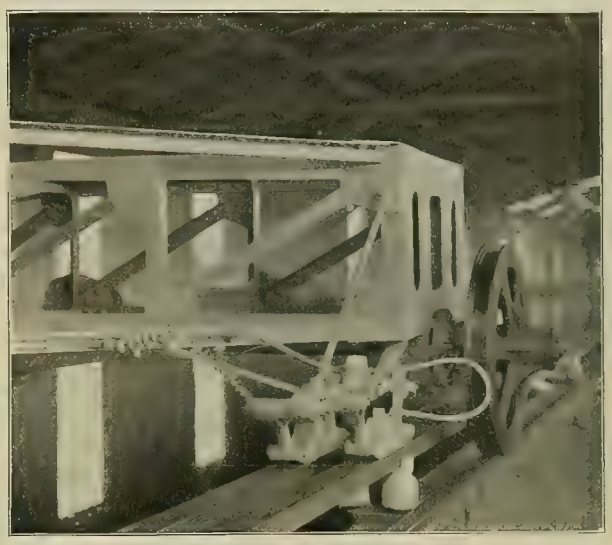


Fig. 2. End of Towing and Measuring Carriage, Showing Contact Shoe.

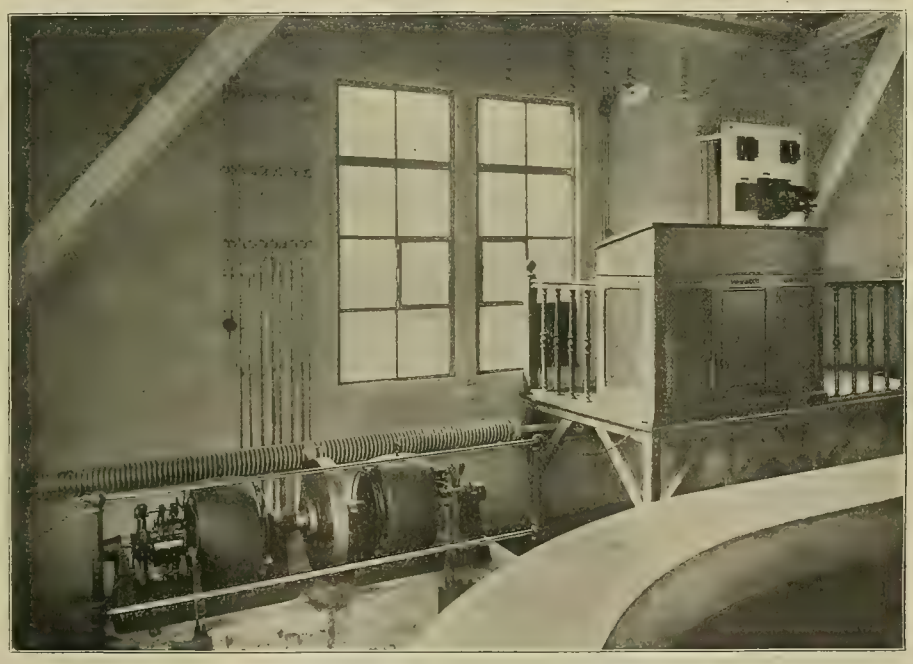


Fig. 3. Motor-generator and Operator's Platform.

ELECTRICALLY OPERATED TOWING AND MEASURING CARRIAGE FOR TESTING SHIP MODELS.

A pontoon floating on the water and provided with an outrigger is used in testing very broad models and in cleaning the tank.

The measuring instruments include the following apparatus: A wave-measuring apparatus, two trim-measuring apparatus, a model dynamometer, a screw dynamometer and an apparatus for the gauging of propellers.

A description of the wave-measuring apparatus will be of some interest. This device (Fig. 4) comprises light glass floats transmitting their reciprocating vertical motion through thin silk strings (running over aluminum wheels) to recording styles constituted by central steel needles that move in a longitudinal direction in front of a drum. The latter is operated by an electric motor, and, like the

FIG. 4. WAVE-MEASURING APPARATUS USED WITH MODELS OF SHIPS.

needles, communicates with induction coils so as to allow sparks to be produced between them, recording the curves of the motion of a float. These spark records were chosen in order to exclude any friction. The recording needles are compelled to follow any upward motion of the float by a small counterweight suspended from the other end of each string. Time (as well as the moment the model passes through the set of floats) is recorded in half-seconds by means of a half-second pendulum traversing a mercury cup and operating an electromagnetic recorder by the current-closure thus produced.

Outside of the Uebigau plant, there are in Germany two other institutions in which the behavior of ship models is tested with a view to ascertaining the most convenient shape to be chosen. The importance of such investigations may be inferred from the fact that the performance of a vessel is greatly dependent on the details of its shape, which can only be ascertained by practical experiment.

Distant Operation by Hertzian Waves.

A French scientist, G. Garet, has invented an improved device for working a distant apparatus, as, for instance, a torpedo, by means of electric waves. It is asserted that the apparatus can be used to solve the difficult problem of distant mechanical operations carried on by aerial waves, and that it is also adapted for use on a wire circuit for the same purpose; likewise for railroad signals and many other devices. With a single wire it can carry out operations which now take as many as 10 or 15 different wires.

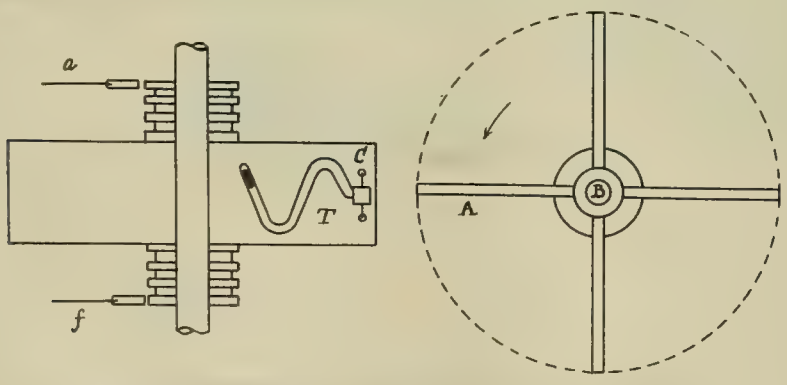
Referring to the diagram, the receiving apparatus is made up of a single wheel (A), movable about a shaft (B), and carrying a set of blades or disks in any number, each corresponding to a separate circuit in the device which is used, such as a torpedo. Each blade makes a contact when it comes to the proper point or brush for carrying the current. Such contacts carry out the propulsion, steering, etc., by means of motors or electromagnets placed in the different work circuits on the torpedo or other device.

The wheel is operated by a ratchet which turns it around. Each tooth of the ratchet is made to advance by a pawl worked by a relay. The relay is in the circuit of a coherer which receives the waves from the sending station (on land, for instance). Each wave signal causes the wheel to advance by one tooth, and in the present case by one blade as well. The operator can thus bring any given blade (corresponding to a work circuit which he wishes to put on) into the contact position by sending a set of short signals like the dots of the Morse alphabet.

What is peculiar to Mr. Garet's device lies in the fact that the blade can be brought into the contact position without having any of the other blades make a contact of any kind by their passage over the same point. Each blade carries a bent glass tube (T) with the air exhausted and containing a drop of mercury. In all the upper blades the mercury lies at the lower or inner end, but in the lower blades the mercury is at the outer end of the tube. There is one special position for each blade where the mercury leaves the center and moves to the periphery, and this is the position of contact, where the blade clears the horizontal position.

Each outer end of the tube carries an ebonite cap (C), with two metallic points placed so that the mercury completes an electric circuit when at this point. When a blade comes into the contact position or angle the mercury does not at once reach the ebonite cap, but is delayed in a manner which can be well adjusted, since it depends on the slant and sinuosities of the tube, and this delay of contact gives the selection of the blade, since the operator can send signals which are spaced close enough together so that the drops have not time to reach the cap during the instant when the other blades pass by this special angle. When he ceases to send the signals the right blade has now come into place, and after a short time the mercury makes the contact desired. A properly placed commutator on the shaft gives the electric contact at (a) and (f).

This retarding principle allows of controlling the working device (steering, etc.). A control or check signal shows the operator the exact moment when the right blade has come into the contact angle. In wireless operations this signal can be given from the torpedo, etc., by a transmitter lodged within it, or else a luminous signal can be used, which the operator sees. Since the speed of propagation is almost instantaneous, he is warned in advance that a certain circuit is about to be closed on the torpedo. If he desires to annul the operation which has been commenced, he sends an extra set of signals which cause the wheel to turn before the mercury arrives at the end of the tube, and the contact cannot therefore be made. Foreign wave signals which are not syntonized are obliged to use a certain time t of some length, in order to charge the coherer. It is known, in fact, that the coherer charge is equal to the product C V t, V being the potential, C the capacity, and t the time in seconds. As C and V are small, owing to the lack of syntonization, the factor t increases, and in practice it always has a value greater than the duration of the delay in the contact.



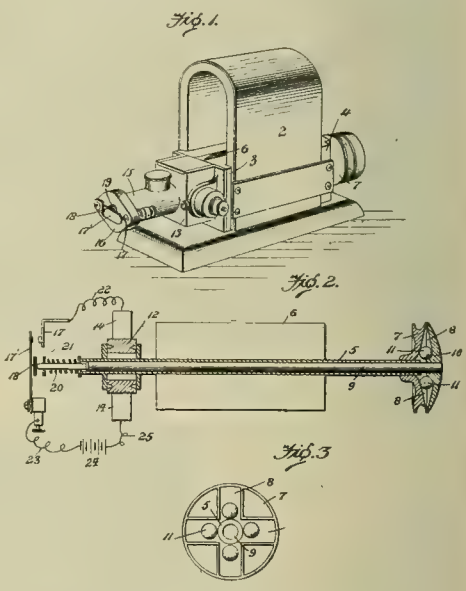
DISTANT OPERATION BY HERTZIAN WAVES.—RECEIVING DEVICE

Automatic Speed Control for Magneto.

An ingenious mechanism which will permit a magneto generator to maintain automatically the electric charge of a storage battery, particularly a battery used for the igniting apparatus of an internal-combustion motor, has been invented by Charles E. Dawson of Indianapolis, Ind., and a United States patent has been granted covering the invention. The invention is also applicable for charging any secondary battery in which the motive power used to operate the generator is irregular.

In the group of drawings Fig. 1 is a perspective view of the invention, Fig. 2 a horizontal section in a plane through the armature shaft, showing the circuit to the storage batteries, and Fig. 3 a detail view of the governor.

The shaft (5) of the armature (6) is hollow, and upon one end of it is mounted a peripherally grooved pulley or disk (7), which is connected by a belt or other transmission device to an internal-combustion motor or irregular motive power. Extending through the hollow shaft is a spindle (9), the end adjacent the pulley (7) being provided with a disk (10). The face of the disk opposed to the grooved face of the pulley is provided with a number of radial grooves (8), the opposed grooves forming tapering radial raceways between the two parts. In these raceways are located balls (11), which when the armature shaft is driven at a cer-



AUTOMATIC SPEED CONTROL FOR MAGNETO.

tain predetermined speed fly by centrifugal force toward the peripheries of the pulley and the disk and cause the disk to move axially away from the pulley. As the disk is rigidly secured to the spindle (9) the spindle also moves axially.

The commutator (12) is on the end of the armature shaft opposite from the governor just described. To a disk (16) at the end of the commutator housing are attached contacts (17) and (17′), the latter being a spring tending to move toward the former.

The under face of the contact (17′) is provided with insulation (18), which lies directly in front of an opening (19) in disk (16) and which is adapted to be engaged by the end of the spindle (9) projecting through the opening. To hold the end of the spindle against the insulation there is a helical spring.

The contact (17) is connected directly with one of the brushes (14), while the contact (17′) is connected with storage batteries (24), which are in turn connected with the other brush.

It will be noted that the spindle is normally held by the spring (20) in such a position as to provide an open circuit through the storage batteries. When the speed of the generator increases to such an extent that the voltage has reached a predetermined point the centrifugal governor draws the spindle away from the circuit-closer (17′), permitting the latter to move to contact (17) and to make a circuit from the generator through the storage batteries, and when the voltage falls below the predetermined point the governor will permit the spindle to move and break the circuit.

Thus it will be seen that when the irregular power is running at high speed the storage batteries are charged, and when the power is running at low speed the generator does not charge the batteries. By this means it is impossible for the batteries to discharge through the generator, as at no time when the circuit is closed does the electromotive force of the generator fall below that of the batteries.

Industrial Plant Illumination.[1]

By George C. Keech.

The artificial illumination of industrial plants is of the greatest importance, as it must be depended upon for from 10 to 20 per cent. of the working hours of average plants not running nights or overtime.

There are few plants which make a practice of cleaning and renewing incandescent lamps, and the attention given to arc lamps would be less if regular trimming were not necessary.

Dull tools are not tolerated in manufacturing institutions. Why should dull lights be?

I have a very positive statement of a foreman to the effect that the product of his department, operating during night hours, was increased about 15 per cent. by a thorough overhauling of his shop lighting.

It is common practice, together with some large units for general illumination, to furnish each workman with a single 16-candlepower incandescent lamp which, when new and at the average height from his work, usually gives him a fair amount of light. Dirt, oil, sawdust, etc., soon reduces his illumination one-half, but it is not expected that the quality or quantity of his work should be reduced in the same proportion.

A lamp at a drill press in a certain shop hangs one foot one inch above the face plate and seven inches from the center, at which point it gave 3.7 foot-candles. (The amount of light entering the eye of the workman was not measured.)

A new, clean lamp was placed in the same socket and gave 5.6 foot-candles at the same spot. Again the dirtiest lamp in the shop was substituted and measured only 1.55 foot-candles.

These lamps with even the cheapest shades or reflectors would produce better results and catch less dirt.

The illuminometer with which the foregoing tests were made is a Weber type, shown in Fig. 1. The standard is a low candlepower tantalum battery lamp carefully calibrated before each test and operated at the proper voltage during the test. The disk (A) receives the illumination which enters the screen through the tube (B). The standard at (C) is moved back and forth with respect to the screen (D) until the spots merge as observed through the eye-piece (I) and the graduated scale (E) reads directly in foot-candles as indicated by the pointer (F).

Fig. 2 shows a layout of woodworking machinery in a Chicago factory with four different systems of lighting, as indicated by the key. The floor is 75 feet by 97 feet, and the net area, after deducting stairways, etc., is 7,044 square feet. This floor was originally lighted by five five-ampere arc lamps and 45 16-candlepower individual incandescents. No test of this system was made, and it was fairly satisfactory, although the energy was high.

One step toward reducing the energy and still attempting to give sufficient general and detailed illumination was to install 70 50-watt metallized-filament lamps in two and four-light clusters, with 15-inch porcelain-lined reflectors. A still further reduction in power with greater intensity was effected by the installation of 16 mercury-vapor lamps with 21-inch tubes and regulation reflectors. In order to have every possible system represented a set of 16 three-ampere arc lamps was installed, each within a few feet of a vapor lamp.

Each system was measured separately, and readings taken at a distance of three feet four inches from the floor which corresponded with the height of most of the machines and benches. The test stations were located at the center of each of 26 bays, each bay containing approximately 250 square feet.

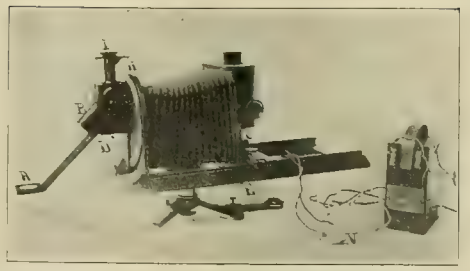


FIG. 1. WEBER ILLUMINOMETER.

This test may be considered of value, as it was made under actual working conditions.

The results of the foot-candle readings of the different systems are given in Table I., with some data on the original installation.

At the foot of the table are the figures of the firm conducting the test on the maintenance of each system per year, based on their costs and experience, and including interest on investment, cost of current and renewals for the number of lamp-hours burned in this department.

The yearly cost as shown in the first row is for the illumination as tested and in the second row for an intensity of three foot-candles, which is deemed necessary for this class of work.

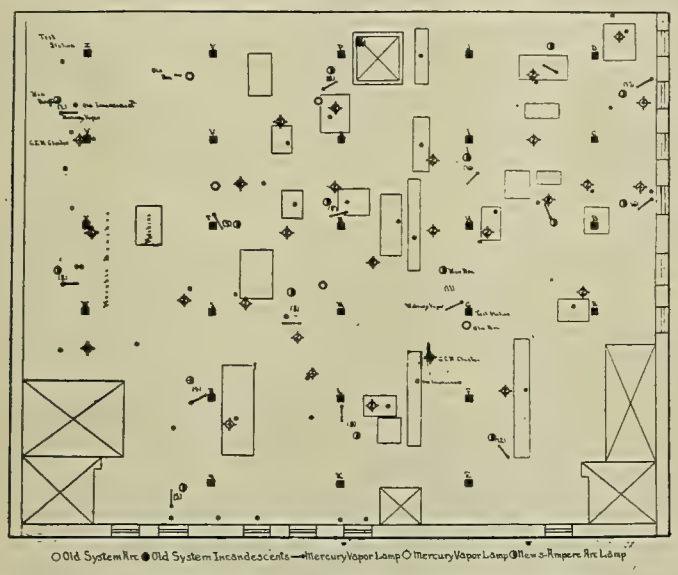


FIG. 2. FOUR SYSTEMS OF LIGHTING IN A WOODWORKING SHOP.

Table I. Data on Lighting in Woodworking Shop.

	Mercury-Vapor Lamps.	Metallized-Filament Clusters.	New Arcs.	5 Old Arcs, 45 Incand.
Total watts	3080	3500	5280	5558
Square feet illuminated	7044	7044	7044	7044
Number of lamps	16	70*	16	.....
Watts per sq. ft.	.431	.497	.749	.787
Average foot-candles	2.91	1.56	2.28	.....
Foot-candles per watt per sq. ft.	6.66	3.14	3.04	.....
Annual cost as installed	$220.48	$212.68	$278.34	.....
Annual cost for 3 ft.-candles	226.96	409.06	366.24	.....

*Grouped into 21 two-light and 7 four-light clusters.

An illumination test was made in the linotype room of the Chicago Daily Tribune when arcs were used and another test a short time later under the vapor lamps which suceeded them, and which were hung in the same locations. Readings in both tests were taken at the same stations (Fig. 3) and at a plane four feet from the floor, at which average height, it was observed, reading of copy was done as operators passed about the room. Each machine has of necessity its individual incandescent lamp. These were not considered in the test, which refers to general illumination only.

It is interesting to note that the readings of the two systems at each of the stations were very close together, and the illumination curves in Fig. 4 show the situation graphically.

The vapor lamps were of 21-inch tube length, provided with reflectors and hung 13 feet from the floor, and the arc lamps had dense opal outer globes, which accounts for the good diffusion. These lamps were hung so that the height of the arc averaged 10 feet from the floor.

The results of the test are given in Table II.

The walls and ceiling were dark terracotta and probably added nothing in reflection.

Table II. Comparison in Linotype Room.

	Arc Lamps.	Vapor Lamps.
Total watts	2310	1155
Square feet illuminated	4095	4095
Average sq. ft. per lamp	682.5	682.5
Watts per sq. ft.	.56	.28
Average foot-candles	1.485	1.6-9
Foot-candles per watt per sq. ft.	2.65	5.90

A certain machine shop is illuminated by six 21-inch mercury-vapor lamps. Another shop of nearly the same dimensions and area is illuminated by six arc lamps. In both shops are a few scattered incandescent lamps used for special purposes, but are not taken into account in these tests.

The character of work in the two shops is the same and the plane of illumination is taken at 35 inches from the floor at the average working level.

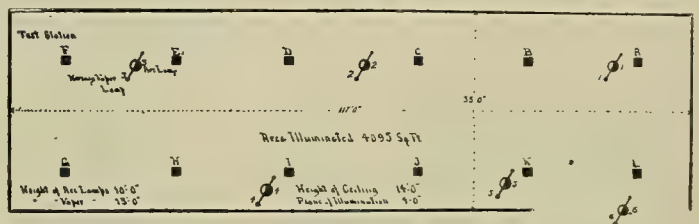


FIG. 3. VAPOR LAMPS IN LINOTYPE ROOM.

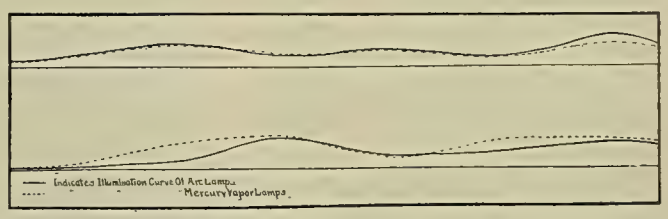


FIG. 4. ILLUMINATING CURVES OF ARC AND VAPOR LAMPS IN LINOTYPE ROOM.

The comparative results of a test are given in Table III.

Table III. Comparative Results in Two Machine Shops.

	Vapor Lamps.	Arc Lamps.
Total watts	1155	3300
Total square feet illuminated	2647	2744
Number of lamps	6	6
Average watts per lamp	192.5	550
Average square feet per lamp	441	457
Watts per square foot	.436	1.2
Average foot-candles	2.66	2.00
Foot-candles per watt per sq. ft.	6.12	1.66

Fig. 5 is a photograph of the drafting room of the Illinois Steel Company at the North Works on Wabansia Avenue, Chicago. This picture was taken at dusk with the shades drawn. Another picture was taken by daylight, and a comparison between daylight and artificial illumination shows practically no difference in the photographs.

The lighting of this room was laid out by the writer in the spring of 1906, with the intention of giving an average intensity of 11 foot-candles and as even a distribution as possible. Also to give the draftsmen as nearly as possible the same direction of light as they would receive from the windows.

This was accomplished by hanging type K vapor lamps of 45-inch tube length in front of each window at a distance of one foot. The four lamps down the center finish the distribution.

The plan of the room with locations of lamps and test stations and the arrangement of drawing tables is shown in Fig. 6.

The plane of illumination was taken at 42 inches from the floor, which is the height of the table tops, and the stations are located in each case directly over a drawing.

The foot-candles average 9.7, or 13 per cent. less than proposed, which is easily accounted for in the accumulation of dust on the tubes and reflectors which were not cleaned for the occasion; in fact, they had not been touched since they were installed nine months before. The building is not far distant from the many smoking chimneys of the plant.

It may seem strange that this accumulation of dust would have such an effect on the illumination from the lamps, but a test made directly underneath a lamp in a machine shop at a distance of

FIG. 5. DRAFTING ROOM IN CHICAGO LIGHTED BY VAPOR LAMPS.

1. Abstract of a paper presented before the Chicago Section of the Illuminating Engineering Society (of which Mr. Keech is chairman), May 9, 1907.

five feet nine inches showed six foot-candles, and after the tube and reflector had been wiped off the reading was 6.7 foot-candles, or an increase of nearly 12 per cent.

As I could find no drafting room in the city of as high intensity with any other system of lighting, I have compared the Illinois Steel drafting room with the Duane Street drafting room of the New York Edison Company, lighted by arc lamps with concentric diffusers, and referred to in Mr. Edward A. Norman's paper read at the March meetings of the New York and Chicago sections of the Illuminating Engineering Society.

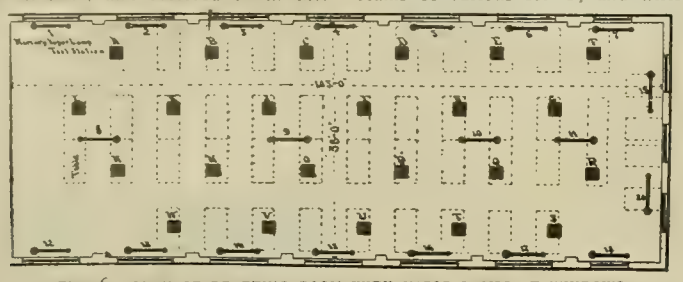


FIG. 6. PLAN OF DRAFTING ROOM WITH VAPOR LAMPS AT WINDOWS.

In Table IV. the results of the two tests are compared.

TABLE IV. COMPARISON OF ILLUMINATION IN DRAFTING ROOMS.

	Illinois Steel.	N. Y. Edison.
Total watts	7700	12173
Total square feet illuminated	7014	1516
Number of lamps	20	17
Average watts per lamp	385	715
Average sq. ft. per lamp	1051.7	89.3
Watts per square foot	1.07	8.07
Average foot candles	9.7	13.5
Foot candles per watt per sq. ft.	4.92	1.68

The above tests were made entirely on what may be termed low-ceiling installation. It was impossible to include in this paper a very important class of lighting such as is used in large erecting shops and foundries equipped with 30 to 75-foot span cranes running the entire length.

DISCUSSION.

The discussion which followed the presentation of Mr. Keech's paper dealt mainly with the use of mercury-vapor lamps.

O. C. Spurling of the Western Electric Company said that in that company's woodworking shops some of the mechanics objected to the color of the mercury-vapor lamps as compared with that of incandescents and arcs, giving preference to the incandescents, though the total illumination might not be as great. Mr. Spurling thought that the softness in color of the mercury-vapor lamp was not an advantage in cases where the men needed definite lines and shadows on their work. The speaker referred to the fact that insurance companies, when investigating an accident, frequently want to know whether the machines are illuminated with individual lights, believing that with such illumination the possibilities of accidents occurring are less than with a system of general illumination.

J. R. Cravath discussed plant illumination in general, the use of bare lamps and those provided with shades. He believed that if general illumination could be employed at an equal cost per square foot, much better results would be obtained than with a system of individual lighting, for, in the former case, the lights would maintain their brilliancy longer, not coming in contact with dust, oil, etc.

N. R. Stansel said that 15 out of 20 mercury-vapor lamps used in the driveway of the Federal Building, had burned continuously for 7,000 hours without the renewal of tubes. Mr. Stansel favored individual illumination for tool lighting in industrial establishments.

Ed. Bauer of the Railway Appliance Company said that in the spring shop of the company 36 arc lamps had been displaced by 18 type K mercury-vapor lamps. Better results were obtained, lack of shadows, in comparison with arcs, facilitating the work of the employes. He asserted that the men could temper the tools just as readily under the mercury-vapor lamps as under arcs.

C. R. Gilman of the Chicago, Milwaukee and St. Paul shops at Milwaukee said that the railroad shops at West Milwaukee were lighted by arc lamps for general illumination, incandescents being used for individual work. The power consumption, however, was great and they were figuring on installing a different system.

W. P. Bear of Kohler Bros., said that they were using six mercury-vapor lamps in their switchboard shop. Two of these lamps had burned for 10 hours a day for two years without a renewal of the tubes. Illumination tests, the speaker said, showed a difference of only five per cent. in foot-candles between one of these lamps and a new lamp burned 10 hours a day for three months. The tests were made at the same distance below the lamp.

Others who took part in the discussion were Messrs. S. M. Rushnell of the Chicago Edison Company, W. E. Ballantine of the La Salle Street railroad station and Albert Scheible, who presided at the meeting.

Edison's Electrical Welding Apparatus.

In designing an apparatus to be used in welding certain seams in the manufacture of his new storage battery, Thomas A. Edison produced an improved electric welding device of the type in which the welding is performed by the heat of an electric arc. The improved apparatus is adapted for use in welding together the contiguous surfaces of seams of various forms; and where the seams to be welded are reproduced in the successive articles to be operated upon the apparatus is capable of a substantially automatic operation, the only manual attention, in fact, being the proper regulation of the arc.

Specifically, Mr. Edison says, the apparatus has been designed for the purpose of welding the seam formed between the flange of the cover and the upper edge of the sheet-metal can employed by him for holding the supports, active materials and the electrolyte of his improved storage batteries. The invention is especially suited for this purpose, because it has been found very difficult to make a solder that is absolutely unaffected by electrolysis in an alkaline solution. By welding the seam between the cover and the can an absolutely perfect joint is secured, doing away completely with the necessity for solder, and since the weld is practically superficial and extends below the surface only a fraction of an inch, the cover can be removed, if necessary, by merely filing off the top edges, thus removing the welded portions.

The depth of the flange presented by the covers of the Edison batteries is sufficient to enable five or six successive welding operations to be effected, which would be much more than would ever be necessary in the life of any cell. Since the seams to be welded in the improved batteries are the same in form for the different-size cans, it is possible to perform the welding operation thereon substantially automatically, and to facilitate the operation the inventor found it possible to perform a welding operation on two cans simultaneously. There is, of course, no electrolytic action between the cover and the can, since they are both formed of the same metal, and consequently the joint obtained by welding is entirely permanent.

The objects of the invention are, first, to provide an apparatus for the purpose in which a perfect and uniform welding operation may be effected, so that the resulting joint will not only be entirely gas-tight and liquid-tight, but the appearance of the joint will be entirely satisfactory; second, to provide an apparatus wherein the arc will be automatically caused to follow the seam regardless of the form of the latter; third, to provide an apparatus in which a number of welding operations may be performed simultaneously on the seams of separate articles, and, finally, to provide an apparatus in which the adjustment of the carbon or carbons may be readily effected without interfering in any way with the operation of the device.

For simultaneously welding two cans the two carbons are carried by a frame and are guided to follow two seams by means of a pattern corresponding with the form and size of the seam somewhat like a pantograph. By such an arrangement the two ends of the bridge at which the carbons are carried will be caused to transcribe corresponding paths. The bridge carrying the carbons is caused to be properly moved, so that the carbons will follow the lines of the seams by means of a pattern of the proper form to represent the seam under process of welding. Mr. Edison has secured a patent on this welding apparatus.

Some Modern Gas Engines and Producer Plants.

BY FRANK C. PERKINS.

The modern gas engine, as is well known, is now recognized as a formidable competitor of the steam engine, particularly where cheap gas is available, or the waste gases from coke ovens for blast furnaces are to be had, as at the coal-mine and iron and steel plants. A few instances of recent important installations of this character may be of interest.

There is a 600-horsepower Deutz double-acting twin engine installed at the power house of the Stahlwerk Hoersch in Dortmund, Germany. A 600-horsepower double-cylinder, double-acting engine of the same type is in operation at the power plant of the Iron Works Company, at Morgenrath. At Karwin, Germany, a 600-kilowatt three-phase generator constructed by Ganz & Co. of Budapest, shown in Fig. 1, is driven by a four-cylinder high-power gas engine of modern construction, operated by coke-oven gases. As shown by the picture, the method of construction is unusual.

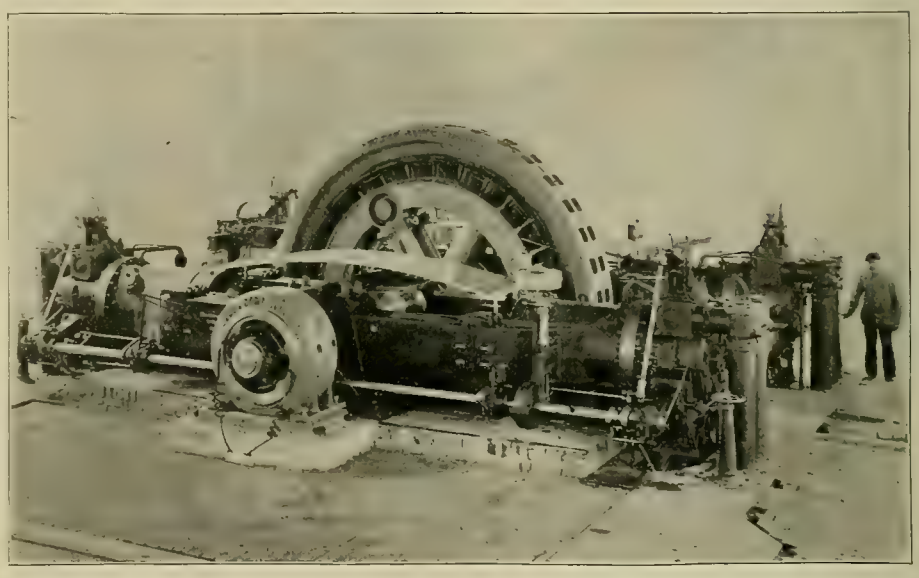


FIG. 1. 600-KILOWATT THREE-PHASE GENERATOR DRIVEN BY FOUR-CYLINDER COKE-OVEN GAS ENGINE IN KARWIN, GERMANY.

Gas-engine electric power is now extensively used not only in all of the recently constructed iron and steel plants, but also in the power houses of the largest chemical works. The high-power gas engine is being introduced in the largest plants in England as well as in Germany, Austria and other continental countries for power purposes as well as for generating electric-lighting current, and current for chemical purposes.

There are two 250-horsepower Deutz double-acting single-cylinder engines direct-connected to direct-current electric generators in operation at the chemical works at Kalk, near Cologne, Germany. In large chemical works, gas producers are frequently employed for supplying the fuel for high-power gas engines in the electric power stations, the economy of the entire installation being equal to or better, it is said by prominent engineers, than the best steam-engine power-house equipment.

A gas producer plant of 10,000-horsepower capacity was erected at the Castner-Kellner Alkali Company's plant at Runcorn. This installation was furnished by the Power Gas Corporation of London and is used for furnace work as well as for supplying gas for a number of Koerting engines, each having a capacity of 700 brake horsepower.

Another large gas producer plant, noted in Fig. 2, has recently been installed by the same company at the steel works of Messrs. William Beardmore & Co. of Glasgow, Scotland. The ultimate capacity of this installation will be 200 tons of coal per day, but at the present only five producers are in

operation. The gas is used for the steel furnaces as well as to drive Koerting and Oechelhauser gas engines of 1,000 and 500 horsepower each.

Gas producers are necessary at iron and steel works for supplying fuel to gas engines when the waste blast-furnace gases are not adequate for providing sufficient power, but at present high-power gas engines utilize these waste gases extensively and with the greatest of economy.

The suction gas producer is being largely employed, having, it is said by prominent engineers, the advantages that no boiler or gas holder is necessary and that it can be erected without danger in any convenient place, while it is easy to start and operate and the economy of the gas engine is high, so that this combination is particularly desirable. With the suction gas producer plant only a small floor space is required, and there is no soot, smoke or odor, and economical utilization of the fuel is obtained, there being automatic generation of the gases by the engine. As is well known, a highly advantageous utilization of fuel results from employing gas engines taking their supply from producer-gas power plants conducted for generating out of a suitable fuel a proper mixture of hydrogen and carbon monoxide. Some of the gas producer plants of the pressure type have boilers for providing steam which is mixed with air, and by means of a fan or steam jet blower it is forced through the glowing fuel, the coal being burned to carbon monoxide, while the steam is decomposed to hydrogen. The gas engine receives these combustible gases from a gas holder, to which they are conducted after passing through the scrubbers.

The other forms of gas producers, known as suction type, are said to be cheaper and simpler, requiring no gas holder or boiler. In these plants an evaporator takes the place of the boiler, being constructed on the top of the producer in some cases and in the form of a tubular evaporator in large installations. The steam is generated in the evaporator by taking advantage of the heat of the producer and the gases, the firing of an independent boiler being avoided. It is said by engineers favoring this type of producer that it utilizes 80 per cent. of the fuel and the grate is kept cool by passing the steam under it. It is also declared that the suction gas producer can start quickly from part load to excessive load as the carbon monoxide is formed, and the steam provides the hydrogen very rapidly. The gas producer is said to work well with either coke, charcoal or anthracite coal, supplying the gas engines with an abundance of fuel at high economy.

Fig. 3 shows a Spanish central station having a combined capacity of 12,000 horsepower, operated from pressure gas producers. In this power house (it is that of the Societa de Gasificacion Industrial at Madrid) there are six gas engines, each directly coupled to a three-phase revolving-field alternator. The engines were installed by a concern in Nuremberg, Germany, and it is maintained that there has been great economy in the operation of this plant.

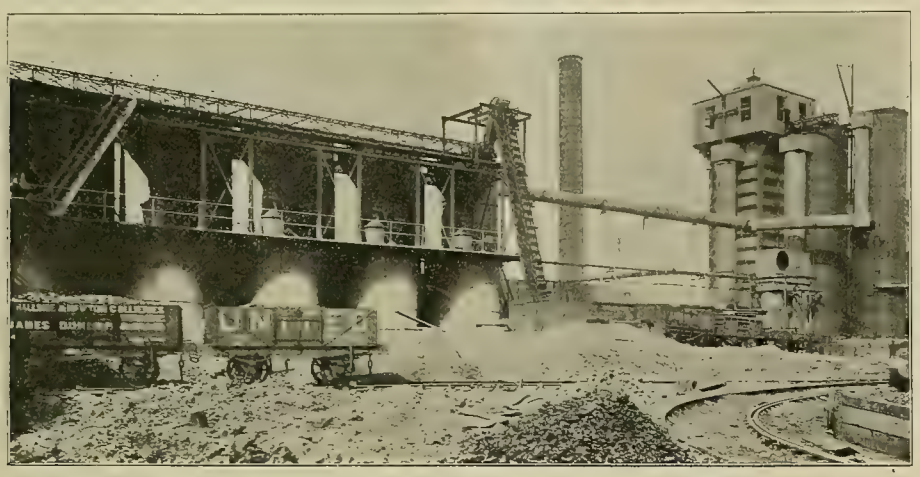


FIG. 2. GAS PRODUCER PLANT AT STEEL WORKS IN GLASGOW, SCOTLAND.

National Electrical Code.

It is expected that a new edition of the National Electrical Code will be published in July of this year. The changes and additions since the 1905 edition of the code was printed are given in the Supplement printed with the October, 1906, "List of Electrical Fittings." This list, giving fittings approved by the Underwriters' National Electrical Association is revised semi-annually, and the latest edition, dated April, 1907, has just been published. Inquiries in relation to the Code may be addressed to the Underwriters' Laboratories, 382 Ohio Street, Chicago.

Helion Lamp Exhibited in Boston.

A contribution to the discussion of the properties of the new helion incandescent lamp was made at a recent meeting of the Boston Scientific Society at the Massachusetts Institute of Technology. It was the first exhibition of the helion lamp in Boston and was made by the inventors, Prof. Herschel C. Parker and Walker G. Clark of Columbia University, and about 200 electricians, engineers, scientists and heads of lighting corporations were present.

As is known, the helion lamp is a return to the carbon base with a plating of silicon. Of the new European forms the tungsten lamp is the most efficient, but it has two defects, the cost of production is high and the rate of production necessarily slow.

Throughout the lecture Prof. Parker spoke of the tungsten lamp as ideal in quality of light and in economy of current, stating that in these respects it is on the same plane as his own, but he laid claim for the helion lamp of the commercial advantages of production with the same apparatus and the same rapidity as the present carbon lamp and at a low cost.

Taking for his text the increased light with higher temperatures of the filament, Professor Parker spoke of the relation of the light produced to the temperature. The carbon lamp burns practically at red heat, while the new filaments are at a white heat. He showed by various diagrams that the amount of light emitted increases in a very high ratio.

With the dull heats a large portion of the radiation from the filament is in the form of heat waves, while with the higher temperatures more and more of the energy in proportion to the whole energy consumed comes in the form of light, so that the high-temperature lamps may be described as very brilliant but yet very cool lamps. At the temperature of the carbon filament, about 1,700° C., five or six per cent. of the energy becomes light, the rest being heat, but at the temperature of the helion lamp, from 2,100° to 2,300°, about 10 per cent. of the energy becomes light. There is therefore a great advantage in favor of the new filaments in point of economy of current.

It is true that the flame arc is a wonder in the way of economy of power, since it turns into light fully 50 per cent. of the energy that it receives, but it has two disadvantages when considered with reference to consumers. The first is that smaller lamps are in demand. It is easy enough to mass together a number of small lights to make a large one, but it is not practicable to split up a large light into smaller ones. The other objection is cost, the imported lamps in which these carbons are burned being of foreign manufacture and protected by a duty. The incandescent bulb when once installed costs nothing for maintenance.

The speaker then outlined the improvements in the filament, speaking of the tantalum lamp, which was an enormous advance over the old carbon filament, being nearly twice as efficient. Then came the tungsten filament, again nearly twice as efficient as the tantalum, and now the helion lamp, which is declared to be quite as efficient as the tungsten and more practical.

Mr. Clark contributed a discussion of what light is, showing its relation in wave lengths of the different kinds of manifestations of energy to which we are accustomed. This was followed by the explanation of a number of diagrams relative to the new light, and for the finale there were a number of experiments and illustrations with the lamp, being in continuation of those by Professor Parker in the earlier part of the evening. The diagrams showed the comparison of the helion with the carbon lamp. The elements of consumption of energy, the production of light, the deterioration of the filament and the conductivity at different temperatures were shown. In all of these elements the diagrams showed important advantages to the credit of the new lamp.

It was Mr. Clark who suggested the idea of a silicon filament, and very interesting was the story of the efforts of the inventor to produce one that would be satisfactory. One scheme of his was to fuse together iron and silicon and from the cooled mass the iron was eaten away by acids. The resultant crystals were beautiful, but the process was not possibly a commercial one. A striking experiment was the exhibition of colored cloths under the ordinary carbon light and the helion. The latter, according to Professor Parker, is the same as that of the sun spectroscopically, and consequently it is a daylight illumination in which the colors stand in their true relations.

Southwestern Electrical and Gas Association.

As the Western Electrician goes to press the third annual convention of the Southwestern Electrical and Gas Association is in session in San Antonio, Tex. This association is composed of electric-light, gas, electric-railway and telephone companies of the Southwest. The retiring president is H. S. Cooper of Galveston, and the retiring secretary R. B. Stichter of Dallas. An attractive programme was prepared for the convention, including these papers: "Labor-saving Tools and Devices," V. W. Berry; "The Best Car for Urban Use," David Daly; "Education of Legislators with Reference to Public-service Corporations," H. M. Moore; "The Value of Scientific Tests," Arthur C. Scott; "Forms," F. C. Randall. The Western Electrician expects to present a report of the convention in next week's issue.

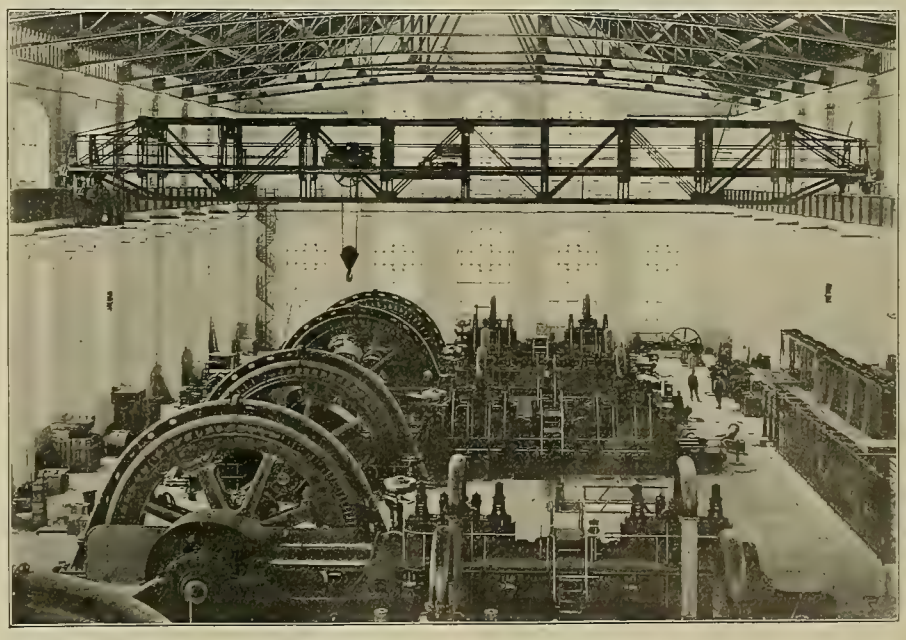


FIG. 3. 2000-HORSEPOWER GAS ENGINES IN MADRID CENTRAL STATION.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Institute of Electrical Engineers (special high-tension meeting), Chicago, May 24th.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 4th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Gas Engine Light Association (annual convention), Toronto, August 20th to 22d.

American Street and Interurban Railway Association and allied societies (annual convention), Atlantic City, N. J., October 14th to 18th.

THE ANNUAL REPORTS of the General Electric Company usually contain engineering information of much interest, and that for the year ended January 31, 1907 (dated April 27, 1907), which is published elsewhere in this issue, is no exception to the rule. We may point out a few statements which show, in a rather striking manner, the advance in the art.

The length and voltage of long-distance transmission continue to increase. Transformers of 7,500 kilowatts capacity, for operation at 104,000 volts, are now building. These transformers will have an overload capacity of no less than 11,250 kilowatts. In general, the size of apparatus continues to increase, and the present maximum ratings of units (overload capacity) are now listed as follows: Turbo-alternators, 13,500 kilowatts; water-wheel generators, 11,250 kilowatts; direct-current generators, 4,000 kilowatts; induction motors, 9,000 kilowatts. High-tension switching apparatus has been further developed during the year; a switching device for operation at 100,000 volts has been successfully tested.

Four turbo-generators of 8,000 kilowatts normal rating are now in operation at the Fisk Street station in Chicago. One was unofficially tested on February 25th under regular operating conditions. It showed a steam economy of less than 13 pounds of steam per kilowatt-hour. From 5,000 to 14,000 kilowatts output the steam consumption varied less than one pound per kilowatt output.

It is reported that the operation of the single-phase railway has been entirely satisfactory. On April 1st the New York Central Railroad had 110 multiple-unit electric trains and 30 electric locomotives (direct-current) in daily service. This service is satisfactory in all respects. The delays are less than with steam and the number of "dead" movements is greatly reduced as compared with steam. All the suburban service of the New York Central and the majority of the long-distance trains are today operated in and out of the Grand Central Station by electric power.

An important application of electricity is found in the reduction of metals. During the year ended January 31st last the company sold to one customer for this purpose 28 machines of a total capacity of 74,000 kilowatts. These units, the largest direct-current generators in existence, were especially designed for the purpose, and those already completed have proved to be entirely successful.

Another interesting announcement is that the vertical-shaft design has been applied to the building of motor-generators and rotary converters. This vertical arrangement effects a considerable saving of space and money, and is particularly recommended for use in sub-stations in large cities. A number of such vertical sets have been sold for operation in Chicago and other places.

Electric motors in industrial establishments continue to increase both in numbers and in variety of applications. An unusual case involving the use of very large motors of special design is that of driving rolling mills in the manufacture of steel. The company has several contracts in which the motors for driving the mills average about 10,000-horsepower capacity each. Over 40,000 stationary motors were sold during the year.

Difficulty has been experienced in supplying the demand for incandescent lamps. The production of metal-filament and "metallized" carbon-filament lamps is rapidly increasing. The report makes no reference to arc lamps nor, rather strangely, to electric heating devices.

The company has 28,000 employes and its total sales for the year were over $60,000,000, showing an increase in shipments of about 40 per cent. The sales billed for the first two months of the present fiscal year are more than 50 per cent. greater than for the corresponding period of 1906. The "patents, franchises and good-will" account has been written off as an asset, and, after paying $4,344,342 in dividends, the total surplus is now over $15,000,000. The company's showing is a fine one and demonstrates not only the importance of the industry but the effects of excellent management.

The company does not fail to record its keen sorrow at the death of General Eugene Griffin, first vice-president, who passed away on April 11th. A resolution expressing the deep regret of the directors is conspicuously printed in the annual report.

COPPER may be distilled by the aid of the electric furnace, according to an account in a foreign contemporary. Small pieces of the metal are placed in the crucible of the furnace and are subjected to the intense heat of the electric arc. An aperture is provided in the top of the furnace and a still, with a flow of cold water, is arranged after the usual manner with some modifications. It has been found, it is said, that the fumes of the metal condense in small quantities in the form of copper threads. This product has been found to consist of 99.7 per cent. of pure copper, with traces of chalk and graphite. After removal of the chalk by treatment with acetic acid, the distilled copper has a density of 8.16, which is lower than that of fused copper and points to the possible occlusion of a small quantity of gas.

GAS TURBINES, to combine the economy of the gas engine and the advantages of the steam turbine, are interesting possibilities, although still far removed from the domain of practical use in the power station. Indeed, some engineers who have studied the subject are doubtful whether this proposed form of prime mover will ever become practicable. Nevertheless, the experiments continue, and our correspondent in Paris reports that Messrs Armengaud and Lemale have met with encouraging results, although, to be sure, the work has not advanced beyond the first stages. These gentlemen are experimenting with a gas turbine operated by the combustion of oil in a strong chamber, to which is supplied, at the same time, compressed air or steam. The resulting hot gases are directed against the vanes of a disk which closely resembles the rotating part of a steam turbine.

THERE SEEMS TO BE a widespread impression that the character of the steel rails furnished to the railroad companies by the steel makers during the last few years, during the great "boom" in the steel business, has not been up to the mark, and that this fact may account for the large number of railroad accidents that has shocked the public of late. The matter has been taken up by the American Railway Association, which has appointed a committee to consult with the manufacturers on the subject. One reform proposed is the abandonment of the Bessemer process and the substitution of the open-hearth or some other process in connection with the present available ores, so as to permit of the keeping down of the phosphorus to acceptable limits that will permit, in connection therewith, the use of a proper proportion of carbon. It is said that the great steel-making concerns have become arrogant during the period of apparently unlimited prosperity and will neither roll rails to the specifications of the railroad companies nor give a five-year guaranty with their own specifications, as was formerly customary. The railroads are not satisfied with the rails they are receiving, and no wonder, if it is true, as reported, that in the single month of February 449 rails on the Union Pacific were found broken, of which 179 were new 90-pound rails that had been laid within the last five or six months. The steel people say that what the railroads need, with their greater traffic, is heavier rails, while the railroad men retort that what they want is better rails. But the railroad companies appear to accept rails, perhaps, under the stress of necessity, which they suspect may prove defective, and the responsibility seems to be theirs. It is no light responsibility, and it is one which is also thrust upon the electric-railway companies with the growing importance of electric railroading. To put it plainly, it is "up to" the railroad companies to use rails which they honestly believe will stand up under the heaviest traffic that can be put upon them, with a large margin of safety. If the steel companies refuse to furnish such rails (although they will not very long if the price is attractive), let the railroad companies build their own rolling mills. This would be an undesirable alternative, but it ought not to be beyond the bounds of possibility.

Programme for Electric-light Convention.

The preliminary programme for the Washington convention of the National Electric Light Association (June 4th to 7th, inclusive) has been issued, and it shows that a wealth of good, practical material has been provided for all who attend the convention sessions. In addition entertainment for the ladies has been provided. There will be a reception, with dancing, a ball, automobile and car rides, a theater party and excursions to Mount Vernon and other places of interest. In a later issue the business programme will be given in full. Herewith are given some of the principal features:

Tuesday morning—Report on "Progress," T. C. Martin; "Accidents," Paul Lüpke; "Frosting Lamps," E. P. Hyde; discussion on metering of polyphase service, led by L. A. Ferguson.

Tuesday afternoon—"Differential Rates," G. W. Betts, Jr.; various committee reports.

Wednesday morning—"Lightning Protection," Alex Dow; "Protective Apparatus," D. B. Rushmore; "Arc Lamps," G. M. Little; "Electric Cooking and Heating," J. I. Ayer; "Electric Heating," C. D. Wood; "Gas Engines," Lewis Nixon; "Producer Gas Engines," R. T. Lozier; "Flicker in Illumination," Dr. A. E. Kennelly and S. E. Whiting; "Efficiency of Illumination," E. A. Norman; "Specifications for Street Lighting," Dudley Farrand.

Wednesday evening—Lecture by Dr. Steinmetz on "Lightning and Lightning Protection."

Thursday morning—"Recent Turbine Developments," W. L. R. Emmet; "Electric Automobile," H. H. Rice; "Municipal Ownership," A. H. Grant; same subject, Glenn Marston; "Italian Methods of Charging for Electric Current," Guido Semenza; various committee reports by E. H. Davis, H. L. Doherty, J. Robert Crouse, S. R. Bradley, Jr., and W. H. Blood, Jr.

Thursday evening—Executive session—Reports on rates and public policy by R. S. Hale and E. W. Burdett, respectively. It is expected that Mr. Edgar of Boston, Mr. Insull of Chicago, Mr. Dow of Detroit, Mr. Doherty of New York, Mr. McCall of Philadelphia, Mr. Lieb of New York and Mr. Scovil of Cleveland will take part in the discussion.

Friday—This is Commercial or New-business Day. There will be morning and afternoon sessions. The programme, arranged by Mr. Crouse, is remarkable for its extent and diversity. There are no less than 33 short papers and reports on the list. The topics discussed are "The Commercial Field," "Questions of Policy," "Wiring" and "The Solicitor" in the morning and "Advertising," "Light," "Power," "Heating" and "Review of Advertising" in the afternoon. There is to be discussion of each group of papers except the "Review." After an introductory explanation by W. W. Freeman, Mr. Freeman, J. R. Crouse, H. L. Doherty, F. M. Tait and J. E. Montague will present papers on "The Commercial Field." "Policy" will be the subject of papers by F. A. Willard, R. V. Scudder and F. W. Loomis; "Wiring," F. H. Golding, J. S. Cartwright, J. R. Strong; "Solicitor," George Williams, F. W. Frueauff, L. H. Scherck, J. D. Kenyon, R. S. Hale; "Advertising," Ralph Richardson, E. S. Marlow, A. D. Mackie, M. S. Seelman, Jr., Lawrence Manning, E. R. Davenport, L. D. Mathes; "Light," C. F. Oehlmann, R. W. Hemphill, H. J. Gille, Homer Honeywell; "Power," G. N. Tidd, R. W. Rollins, F. H. Plaice; "Heating," T. K. Jackson; "Review of Advertising," C. W. Lee. Papers on this day are limited to 10 minutes in presentation and discussions to three minutes.

The convention will be closed on Friday afternoon by the reading of the "Memorial" by T. C Martin, and the election of officers.

President Roosevelt will give the association a special reception on the afternoon of Tuesday, June 4th.

Illuminating Engineers to Hold Convention in Boston.

At a meeting of the New York Section of the Illuminating Engineering Society held in the Edison Auditorium, New York city, on the evening of May 10th, announcement was made by Secretary Millar of the fact that at a meeting of the Council of the society held in the afternoon of the same day, it was decided to accept an invitation extended to the society to hold its convention in the city of Boston during Old Home week, the latter part of July or the early part of August. The invitation was extended by the mayor of Boston and the Boston Section of the society.

The meeting was called to order by L. B. Marks, in the absence of the chairman. G. H. Stickney, electrical engineer with the General Electric Company, delivered a lecture on "Color Values of Artificial Illuminants." W. D'A. Ryan was to have delivered the lecture, but owing to a pressing engagement could not be present. Mr. Stickney's lecture was largely made up of demonstrations on the screen, showing the effect of interruptions of light waves, the effects produced by various classes of diffusers, and also the effects produced upon exactly the same materials by various mediums.

Referring to the subject of color blindness as touched on by Mr. Stickney, Mr. Marks called the attention of the members to an article on the subject in the current number of The Century, by Dr. Ayers, which, he said, was worthy of perusal.

An account of the discussion which followed Mr. Stickney's lecture is given elsewhere in this issue.

Ontario to Get Electric Power at $10 Per Horsepower.

With the authority of the Ontario government the Ontario Power Commission has decided to enter into a contract with the Ontario Power Company to furnish electric power at a rate of $10.40 per horsepower per year at the transformer station at Niagara. This will be subject to the acceptance of the formal contracts by the municipalities.

The current to be contracted for is alternating three-phase 25-cycle 60,000-volt. An agreed amount of power, with a minimum of 10,000 horsepower, is to be kept available for the commission by the company at all times. The power will be measured by standard instruments, sealed and inspected by the contracting parties. With the minimum of 10,000 horsepower the commission will have the right to increase that amount at any time by giving 30 days' notice up to 30,000 horsepower. The contract will have a duration of 10 years with an option of renewal for 40 years.

The price for the power up to 25,000 horsepower is to be $10.40 per horsepower per annum for 24 hours' use a day. When the amount of power taken exceeds 25,000 the price is to be $10 a horsepower. As 40,000 horsepower has already been applied for by the western municipalities it may be taken that the price will be fixed at $10.

The commission reserves the right to purchase power from other sources, such a provision being considered necessary to guarantee a continuous supply in case of accident. The amount of the extra power and the territory to be supplied are among the points not yet agreed upon.

It is probable that some of the other companies will avail themselves of the privilege to supply part of the power required. Penalties are provided for in case of non-continuity of service. The Ontario Power Company has the right to generate 180,000 horsepower at Niagara, one-third of which may be exported, so 120,000 horsepower will be left for distribution in Ontario. The company already has five generators installed, producing 55,000 horsepower.

Electromagnet Employed in an Astronomical Experiment.

In order to disprove Kepler's theory that the orbits of comets are elliptical and uniform, and to prove on the contrary that the orbits are originally elliptical but that they become circular through the influence of the sun's attraction, Frank L. Goodwin, a university student, recently performed an experiment in Chicago in which he employed a 230-foot pendulum and an electromagnet.

The enclosed court of the Chamber of Commerce Building was the place selected for the test. The pendulum was suspended from the roof of the building to the second floor. A ball of iron was attached to the cord of the pendulum and was swung in an ellipse about the electromagnet. After a few oscillations the attraction of the magnet caused the ball to swing in a circle.

Mr. Goodwin asserts that the sun's gravity tends to condense anything within its reach, and that the nearer the planets are to the sun the denser they become. Mr. Goodwin has been conducting researches in various laboratories on ether, radioactivity and electrons.

Important Consolidation in Toledo.

There has just been closed in Toledo, Ohio, an important electrical "deal" in the shape of the merging of the Toledo Railways and Light Company with the Toledo Gas, Heat and Electric Company, the latter being itself known as the gas merger. Under the new combination the Everett-Moore people have a monopoly in Toledo for street railways, electric light and power, artificial gas and heating by water and steam. In addition to that they own and control all but three of the interurban lines entering the city. Those they control are the Lake Shore electric, the Detroit, Monroe and Toledo, the Toledo and Point Place, the Toledo and Western, the Maumee Valley and the Toledo, Ottawa Beach and Southern. In addition to this they also have the property of the Detroit United in Detroit. In the neighborhood of $29,000,000 worth of stocks, bonds and property changed hands, and the Toledo Railways and Light Company is now in control of all merger properties. There will be extensive remodeling of the plants which are variously located about the city.

Electric Traction for the Detroit River Tunnel.

As has been previously stated in the Western Electrician, a tunnel is being built under the Detroit River for the transference of both freight and passenger trains by electric locomotives between the United States and Canada on the Michigan Central Railroad. The tunnel will replace the present ferry service between Detroit on the American shore and Windsor on the Canadian side of the river. Two tracks will be laid in separate iron tubes 65 feet beneath the surface of the river. These iron tubes will rest on beds of concrete and will be flanked by concrete walls. The electrified zone will be 4.6 miles in length and will comprise with the yards some 15 miles of single track.

The electric locomotives to be used in drawing the trains will not only permit greater celerity in handling traffic but also afford a complete solution of the ventilation problem. Six 100-ton direct-current locomotives of the swivel-truck type, with geared motors, will comprise the initial equipment for hauling both freight and passenger trains. Each locomotive will be capable of hauling a 900-ton train up a two per cent. grade at a speed of 10 miles an hour. Four 280-horsepower motors will be mounted on each locomotive, two motors being placed on each of the two swivel trucks. The Sprague-General Electric multiple-unit control system will be furnished, enabling the locomotives to be operated singly or in train. Current for operating the motors will be taken from the third rail by means of contact shoes. Automatic high-speed air brakes will form a necessary part of the equipment. The electrical equipment for the locomotives as well as for the tunnel in general will be furnished by the General Electric Company.

Power for operating the system will be purchased from the Detroit Edison Company and will be delivered to a sub-station at Detroit at a potential of 4,400 volts and at a frequency of 60 cycles. At the sub-station two 1,000-kilowatt synchronous motor-generator sets will be installed for supplying direct current to the third rail. Each of these sets will consist of a 1,000-kilowatt 4,400-volt three-phase synchronous motor direct-connected on a common base to a 1,000-kilowatt 650-volt compound-wound direct-current generator. A 15-kilowatt 125-volt exciter for the synchronous motor will be mounted on a shaft extension of each of the motor-generator sets.

A very complete electric-lighting and electric-pumping equipment forms a part of the project. The yards and approaches to the tunnel will be lighted by arc lamps, while the tunnel itself will be illuminated by incandescent lamps arranged on duplicate circuits. Alternating current from the main power supply at a frequency of 60 cycles will be used on the lighting circuits. To insure an uninterrupted lighting service the lighting circuits in the tunnels are so arranged that half the lamps in both tunnels will burn, if by chance either of the lighting circuits in the tunnels should be broken. A single three-phase distributing circuit will run through each tunnel, and from these circuits suitable connections will be made to step-down transformers. The secondaries of the step-down transformers will be interconnected with duplicate circuits for half the lamps in each of the tunnels.

No less interesting will be the equipment for keeping the tunnel dry. Five sumps will be provided in the tunnel, each sump drained by induction-motor centrifugal pumps arranged in duplicate. The motors on the pumps will operate directly at 4,400 volts and the controlling circuits with compensators will be centralized in the sub-station. For indicating the amount of water in each sump a float system will be provided having both visible and audible indicating devices in the sub-station.

At the sub-station a regulating storage battery will be provided to carry the fluctuations of the load. If the main power supply from the Detroit Edison mains should be interrupted this storage battery will have sufficient capacity to operate the entire system for half an hour. In such an emergency the lighting and pumping alternating-current equipment will be energized by 60-cycle alternating current from a 50-kilowatt motor-generator set, the driving motor being supplied with current from the storage battery. Flexible switching arrangements will be installed to enable this interchange of power supply to be made easily and quickly.

Annual Report of the General Electric Company.

The fifteenth annual report of the General Electric Company covering the business done in the year ended January 31, 1907, is out. Besides covering details of sales and finances the report contains some interesting statements as to manufacturing and engineering developments. The net amount of sales billed to customers during the year was $60,071,882.99. Following are details taken from the report:

PRESIDENT C. A. COFFIN TO THE STOCKHOLDERS.

The profits of your company for the year ended January 31, 1907 (including $329,702.55 from securities sold, $675,000 increased value of security holding companies, and $417,586.19 from royalties, dividends, sundry profits, etc.), after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and writing off $2,834,123.80 from factory plants—this being substantially 74 per cent. of all expenditures thereon during the year—

were	$ 8,427,842.68
Paid in dividends during the year	4,344,342.00
	$ 4,083,500.68
Written off patents, franchises and good-will account, which on January 31, 1897, stood on the books of the company at $8,000,000, to reduce it to the nominal sum of $1	999,999.00
Carried to surplus account	$3,083,501.68
Amount of surplus at the end of last fiscal year was	12,027,295.09
Total surplus January 31, 1907	$15,110,796.77

The sales billed by your company to its customers for the last year were nearly $17,000,000 more than for the previous year, showing an increase in shipments of about 40 per cent.

The sales billed for the first two months of the present fiscal year are more than 50 per cent. greater than last year. Should this growth in business continue, additional capital will be required.

SALES AND ORDERS—FIRST VICE-PRESIDENT EUGENE GRIFFIN.[1]

Total sales (amount billed to customers) during the year was $60,071,883; total orders received amounted to $60,483,650. A comparison with previous years is as follows:

Year ending Jan. 31.	Amount Billed.	Orders Received.
1902	$32,338,036	$34,350,840
1903	36,685,598	39,944,454
1904	41,699,617	39,060,038
1905	39,231,328	35,094,807
1906	43,146,902	50,044,272
1907	60,071,883	60,483,659

"Orders received" include only apparatus manufactured by the General Electric Company and do not include such items as services of experts, labor of installation, freight and transportation, supply material, boilers, engines, etc., of outside manufacture, and bare copper wire. All these items are included in "amount billed."

In the last 10 years the amounts billed have increased from $12,540,994 in 1896 to 60,071,883 in 1906, an average increase of 17 per cent. per year. The very large increase in the business of the company during the last year, together with the difficulty and delay in obtaining raw materials, has made it very difficult to meet the requirements of our customers as to deliveries.

Curtis Steam Turbines.—During the last year turbo-generators of an aggregate capacity of more than 350,000 horsepower have been sold. Thirty-seven Curtis turbines have been installed in Japan. We have also sold Curtis turbines for installation in England, Ireland, France, Germany, South Africa, Cuba, Mexico, Canada, Brazil, New Zealand, Siam, Peru, Algeria and Spain.

On January 29, 1907, an official test was made by the engineers of the Boston Edison Company of one of the 5,000-kilowatt turbines in its station. Under the normal operating conditions the test showed a steam economy of 13.586 pounds of steam per kilowatt-hour.

On February 25, 1907, one of four 8,000-kilowatt turbines in operation at the Fisk Street Station of the Chicago Edison Company was unofficially tested under the regular operating conditions and showed a steam economy of less than 13 pounds of steam per kilowatt-hour. This test proves beyond question the pre-eminence of the Curtis turbine in respect of steam economy. This test, moreover, showed the remarkable result that from 5,000-kilowatt output to 14,000-kilowatt output the steam consumption varied less than one pound per kilowatt output.

Electrical Equipment of the New York Central and Hudson River Railroad.—The New York Central and Hudson River Railroad commenced the regular operation of many of its trains by electric power on December 11, 1906. To-day (April 1, 1907) there are 110 multiple-unit electric trains and 30 electric locomotives in daily service. The total daily multiple-unit train mileage is 1,250 miles. Sixty trains are handled each day by electric locomotives, the daily train mileage being 692 miles.

The electric service is satisfactory in all respects. The delays in service are less than with steam, and the number of "dead" movements is greatly reduced as compared with steam. All of the suburban service of the New York Central and the majority of the long-distance trains are today operated in and out of the Grand Central Station by electric power.

Electrical Equipment of the West Jersey and Sea Shore Railroad (Pennsylvania System).—This steam road from Camden to Atlantic City—a branch line of the Pennsylvania Railroad—was equipped electrically with General Electric Company apparatus in the autumn of 1906. This apparatus has operated with complete success. On March 31 of this year the 58 motor cars (every car in each train being a motor car) carried 17,000 people, without delay of accident.

The land area of all three plants is now about 445 acres. The total book value of all the land and buildings (excluding machinery, etc.) of the Schenectady, Lynn and Harrison factory plants is $5,363,812.88, or about $1.12 per square foot of manufacturing floor space of the buildings.

Schenectady Works.—A building of 237,000 square feet of floor area which will be used for the manufacture of large apparatus, and release space in other parts of the plant for switchboard and kindred work is now nearing completion. There are also under construction a blacksmith and boiler shop aggregating 39,000 square feet of floor space, an extension to the power house of 18,000 square feet, buildings for a wood-working plant aggregating 80,000 square feet, and an addition of 26,000 square feet for the manufacture of wire and cable. Additional important extensions aggregating 370,000 square feet have been authorized.

The brass foundry and other additions mentioned in my last report as under construction were completed during the year.

Lynn Works.—The completion of the buildings for the manufacture of railway and stationary motors, etc., of 170,000 square feet of floor area, mentioned in my last report, has been delayed by the recent difficulties attending building operations, but these buildings will be finished and occupied at an early date. The extension to the turbine building of 45,000 square feet has been completed. Buildings of 168,000 square feet to provide increased facilities for the production of meters, instruments and other work will be erected this year.

Expenses		Earnings		
Cost of Sales including depreciation of Plants, $2,834,123.80)	$53,106,594 04	Sales		$60,071,882 99
		Royalties, Dividends and Interest on Stocks and Bonds, and Sundry Profits	$ 417,586.19	
		Interest and Discount	114,660.00	
				532,246 19
Interest on Debentures	74,395 01	Profit on Sales of Stocks and Bonds		329,702 55
		Increase in surplus of Security Holding Companies, representing their net profits for the year		675,000 00
Profit for the current year	8,427,842 68			
	$61,608,831 73			$61,608,831 73
Patents written off	$999,999 00	Surplus brought over from last year		$12,027,295 09
Dividends paid in Cash	4,344,342 00			
Surplus at January 31, 1907, carried forward to next year	15,110,796 77	Profit for the year ending January 31, 1907		8,427,842 68
	$20,455,137 77			$20,455,137 77

CONSOLIDATED PROFIT-AND-LOSS ACCOUNT OF JANUARY 31, 1907.

Assets.			Liabilities.	
Patents, Franchises and Good-will		$ 1 00	3½% Gold Coupon Debentures	2,047,000 00
			5% " " " "	55,000 00
			Accrued Interest on Debentures	458 34
			Accounts Payable	4,010,410 58
			Unclaimed Dividends	1,465 86
Cash		3,910,708 85		$6,114,334 78
Stocks and Bonds	20,086,790 08			
Real Estate (other than factory Plants)	347,488 93			
Notes & Accounts Receivable	22,863,788 76			
Advances to Affiliated Companies	2,022,675 57			
	25,786,464 33			
Work in Progress	8,863,321 23			
	50,074,064 57			
Merchandise Inventories: At Factories	19,680,342 89		Capital Stock issued	63,572,800 00
At General and Local Offices	2,672,152 60		Subscriptions on account of Capital Stock, an equal amount being payable April, 1907	780,750 00
Consignments	241,511 64			
	22,593,007 13			
		72,667,971 70		
Discounted Paper		666,607 65	Endorsements	666,607 65
Factory Plants (including all lands, buildings and machinery)		9,000,000 00	Surplus	15,110,796 77
		$86,245,289 20		$86,245,289 20

CONSOLIDATED BALANCE SHEET OF JANUARY 31, 1907.

SALES AND ORDERS—FIRST VICE-PRESIDENT EUGENE GRIFFIN.[1]

Supplies.—Sales of supplies and small apparatus, such as meters, transformers, direct and alternating motors, arc and incandescent lights, wiring devices, etc., have increased 35 per cent. over the previous year; 40,365 stationary motors, aggregating 565,000 horsepower, were sold during the year.

Apparatus.—Sales of large apparatus have also increased and show the same tendency as heretofore toward larger-sized units. The maximum sizes in various lines are:

Units.	Nominal Rating.	Overload Capacity.
Turbo-alternators	9,000 KW	13,500 KW
Waterwheel generators	7,500 KW	11,250 KW
Direct-current generators	2,700 KW	4,000 KW
Induction motors	6,000 KW	9,000 KW
Transformers	7,500 KW	11,250 KW

Incandescent Lamps.—The consumption of incandescent lamps has been very large and great difficulty has been experienced in supplying the demand. The situation is being met by large increases in factory facilities which will provide for a greatly increased output of incandescent lamps during the next winter season when the maximum demand occurs. The production of metal and metallized carbon filaments is rapidly increasing.

Foreign Business.—The business of the foreign department has shown a gratifying increase over the previous year. This business is well distributed throughout the world.

Daily Supply Orders.—During the year we have received about 235,028 supply orders (not including contracts), an average of 783 per working day. The record in 1906 was 694; in 1900, 473.

Organization.—The growth of the business of the company has made it necessary to expand our organization. Mr. J. R. Lovejoy has been appointed general sales manager; Mr. J. G. Barry, manager of the railway department; Mr. C. D. Haskins, manager of the lighting department, and Mr. D. R. Bullen, manager of the supply department. I desire to express my appreciation of the loyal, efficient and hearty co-operation of all department and local office managers and salesmen in the conduct of the selling business during the last year.

MANUFACTURING AND ENGINEERING—THIRD VICE-PRESIDENT E. W. RICE, JR.

Manufacturing.—Expenditures aggregating $3,834,123.80 have been made during the year for real estate, erection of new factories, extensions to existing buildings, additional machinery, patterns, special tools, fixtures, etc. The following table shows approximately the floor space and the number of factory employes during the last five years:

	Floor Space.	Employes.
1903	3,000,000	18,000
1904	3,700,000	17,000
1905	4,100,000	18,000
1906	4,350,000	22,500
1907	4,770,000	28,000

Harrison Works.—A building of 60,000 square feet has just been completed for the manufacture of high-efficiency metal-filament lamps. A four-story building of 120,000 square feet, to be located on land recently purchased at Fort Wayne, Ind., and to be devoted to the production of incandescent lamps, has just been started.

Pittsfield Works.—The plant of the Stanley-G. I. Electrical Manufacturing Company at Pittsfield, Mass., has been used to a large extent for the manufacture of General Electric Company apparatus during the last year. It is now used wholly for this purpose, and will be operated hereafter as one of the General Electric Company's plants. The floor space at present available is 370,000 square feet, with about 1,700 employes. There are now under construction extensions to this plant aggregating 178,000 square feet, which will be used for the manufacture of transformers, lightning arresters, switches and other apparatus.

Engineering.—Engineering effort has continued to be largely devoted to the extension and improvement of our existing lines of apparatus, although a large amount of special apparatus has been designed to meet novel conditions.

Long-distance transmission of electricity is now thoroughly established in practice, and orders have been received for the equipment of a number of new and important installations of this kind during the year. The increase in the distance covered by such systems has involved the successful solution of many difficult problems connected with the generating, distributing and controlling apparatus. The size and voltage of transformers for use in long-distance transmission work continues to increase. We are now building on order a number of transformers of 7,500-kilowatt capacity for operation at 104,000 volts.

Our high-tension switching apparatus has been still further developed during the year; one notable instance has been the design and successful testing of a switching device for 100,000-volt operation.

Our line of steam-turbine generators has been enlarged and improved. The first of our 8,000-kilowatt turbine machines was started at the station of the Chicago Edison Company in September, 1906, and has been in daily operation with loads at times reaching 14,000 kilowatts. Five of these great machines have since been placed in operation in Chicago and New York. The steam economies which have been realized in these and other of our large turbines are unprecedented. Such high economy, added to the simplicity, reliability and compactness already realized in our turbine units places us in a position to furnish our customers a prime mover whose value is unequaled.

The operation of the single-phase alternating-current railway equipments which we have installed

1. Died April 11, 1907.

has been entirely satisfactory, and we have received orders for a number of such equipments during the year.

Our engineers have completed the design of a line of direct-current railway motors containing important novel features. Practical tests have shown these new motors to be superior to existing standards in economy, commutation and ability to operate at higher and more economical voltages.

An interesting and important application of electricity is found in the reduction of metals. During the present year we have sold to one customer for use therein 28 machines of a total capacity of 74,000 kilowatts. These machines are the largest direct-current generators in existence, were especially designed by us for the purpose, and those already completed have proved to be entirely successful.

The vertical-shaft design which has proved so successful in our large turbines has been applied to the design of motor-generators and rotary converters. This vertical arrangement effects a considerable saving of space and money, and is particularly desirable for use in sub-stations in large cities. We have sold a number of such vertical sets for operation in Chicago and other places.

Electric motors in industrial establishments continue to increase both in numbers and in variety of applications. An interesting case involving the use of very large motors of special design is that of driving rolling mills in the manufacture of steel. We have several contracts in which the motors for driving the mills average about 10,000-horsepower capacity each.

Our research laboratory has developed a new process for making a metal-filament lamp of great efficiency. The commercial introduction of such lamps will mark a great step in the advance of the electric-lighting industry.

A large number of letters patent covering new and important designs and devices have been applied for during the past year.

It is a pleasure to testify to the successful and original character of the work of our engineers and to the effective and economical work of our factory managers.

Financial Report—Treasurer Henry W. Darling.

The report of Treasurer Darling and General Auditor Edward Clark goes thoroughly into the financial condition of the company. For convenience of bookkeeping the assets and liabilities and profit and loss accounts of the Edison General Electric and Thomson-Houston electric companies are included with those of the General Electric Company. The principal items in the financial report and a reduced reproduction of the balance sheet and profit-and-loss account are given on the opposite page.

During the year there was expended in acquiring sundry patents, for licenses under patents, and in patent litigation $785,594.17, which has been treated as ordinary expenses of the year. In addition, the amount of $999,999 has been charged to profit and loss, leaving the company's patents, franchises and good-will standing at a nominal valuation of $1.

The factory plants representing the real estate, machinery, patterns and sundries of the manufacturing plants at Schenectady, N. Y., Lynn, Mass., and Harrison, N. J., cost $27,205,024.87, but there has been written off during 14 years a total allowance for depreciation and replacement of $18,205,024.87, leaving their book value January 31, 1907, $9,000,000.

Real estate, other than factory plants, represents the investment in the Edison Building, 44 Broad Street, New York city, and sundry parcels of land in various places, mostly improved and rented, which have been acquired at various times, chiefly in payment of debts. All are free from mortgages.

The total book value of all stocks and bonds of the company is $20,086,790.08, including miscellaneous securities carried at $1 for each lot, $89; stocks of affiliated companies, $6,385,071; stocks and bonds of security holding companies, $6,417,160.28; stocks and bonds of local lighting and railway companies, $3,786,471.46; miscellaneous stocks and bonds, $730,815.72; stocks and sundry foreign companies, $2,767,182.62.

Considerable profits have been made by the affiliated companies and by the local lighting and railway companies, most of which profits have been added to the surplus of such companies. The General Electric Company has not increased the book value of the shares owned by it in the above-mentioned companies. Pursuant to the established policy of selling securities which there is no special reason for holding permanently, various stocks and bonds have been sold at a profit of $329,702.55.

The net amount of sales billed to customers during the year was $60,071,882.99. Of some 19,700 regular customers on the accounts receivable ledgers, an increase for the year of 2,700, there were debit balances against 8,900 at the close of the fiscal year.

Finished apparatus for novel uses has been delivered to various concerns subject to purchase if its operation is successful. The greater part of consignment account represents such contingent sales, and the remainder represents apparatus on exhibition or loaned to regular customers for temporary use by them.

Illuminating Engineers Discuss Color Values of Artificial Illuminants.

The New York section of the Illuminating Engineering Society, at its meeting on May 10th, was treated to a lecture on "Color Values of Artificial Illuminants," by G. H. Stickney, electrical engineer, with the General Electric Company. Following was the discussion, in part:

Leon Gaster, London England: The question of the influence of color upon sight is one which has received very little attention in England, because the number of illuminants which vary much in color have been very few, until quite recently. What the influence of these different colors, which have been recently introduced, has been upon the sight, very few have been able as yet to determine, as there has not been a great deal of information upon the subject. The defect of color blindness transmits itself from generation to generation. Professor Starling of the Royal Institution recently lectured on the question of "Color in Sight," and showed the remarkable fact that it is transmitted only to the male descendants. If a man is color blind, and he has a son, the son will also be color blind, but if he has a daughter her sight will not be so affected; yet if the daughter marries, her male descendants will be color blind, although she may not be. I am given to understand that Professor Duma reported before the Royal Institution a hundred years ago on some color effects upon sight. The result of his lecture led to the investigation of the question of color blindness. The history of families was traced, and it was found that over a period of a hundred years all the direct male descendants and the sons of the daughters were color blind. I was pleased to notice in the demonstrations this evening when the comparisons were made between the different lights, that the enclosed arc with the diffuser showed white. I should like to have heard why it was white, constantly, because that might aid us in educating the architects to use this light when they desire a purely white light. The amount of feet per candle is much higher here than we are accustomed to in England. Your foot-candle standard of 2.5 and 3 startled me. In England our foot-candle is only 1.8; it does not get over that.

D. McFarlan Moore, Newark, N. J.: The three most important facts in connection with any illuminant are efficiency, color and steadiness. A few years ago there was practically no way of changing the colors of the various forms of lamps, that is, the candle had its color perforce; such a thing as modifying it was not dreamed of. At the present time there are only two ways widely in use of varying the color; that is, if a person wishes to have a light of a different color, there are two main ways of getting it. One way is to get another light, and the other way is to use the diffusion globe of some kind, which, in any instance, is extremely unscientific and inefficient. With the flaming arc lamp we have an instance where the first step, at least, was taken toward scientifically controlling the color value. I refer to placing different chemicals within the arc and thereby obtaining a color which can to a very great extent be determined previously. But still it cannot be said that by means of the flaming arc lamp the color factor is under perfect control; however, it is possible now to have the color value under perfect control, and this is obtained by utilizing a vacuum tube, and by changing the various gases used in the tube to change the color. This has many advantages, and from a scientific standpoint it cannot be criticized like the other methods which have been used. For example, if you use a properly regulated vacuum tube and feed it with air only a pink light results; if you feed it with nitrogen a yellow light results. Such a light can be used for a great many purposes; in fact, its range of usefulness, so far as the color is concerned, is about the same as that of the ordinary incandescent lamp and therefore can be used by florists or by clothing merchants, and the distortion is not any worse than that of the ordinary incandescent lamp. However, it is not claimed that when a tube is fed with nitrogen, the color is at all near daylight; it is simply a color which appears about the same as that produced by the ordinary incandescent lamp, and it appears about the same as the incandescent lamp at nighttime. Due to the enormous radiating surfaces of the tube, the color in daytime looks considerably redder than that of the incandescent lamp, because the lamp is extremely small as compared with the tube. At night a tube fed with nitrogen has a comparatively dense light and has the same color value as the ordinary incandescent lamp. When such a tube is fed with carbon dioxide at a definite pressure, and at a definite intensity, we obtain a light that undoubtedly is closer to average daylight conditions than anything which has ever been produced before, and we can almost say that it is entirely satisfactory.

The problem of obtaining the proper color value for any particular light can be said to have been solved by using simply ordinary carbon dioxide. For instance, experts in matching colors in the large dye works of this country—men who have tried all other forms of light and found them not at all suitable for their uses—have matched their colors under a vacuum tube supplied with carbon dioxide and have found, after months of practice, that they could not detect the difference between the most delicate lavender shades matched at night, under the tube, and matched by daylight. If daylight were a constant quantity it might do to try to imitate it accurately, but of course you cannot imitate a variable, so that the only thing to do is to determine whether it is positively a fact that carbon dioxide gets closer to average diffused daylight, not direct sunlight, but average diffused daylight, like daylight under a cloudy sky. If that is so, then it naturally suggests itself that such a tube ought to be used as a standard of light. The first step in reducing to a scientific basis any subject is to eliminate variables and decide on a constant. There should be a standard color value, and this scientific society, as well as other scientific societies, should unite and work out certain specifications, exactly as worked out with the ordinary amyl acetate light, and decide that such and such a light is a standard white light; then we could express other forms of light, and if we claim a certain light is a pink light, we mean it is pink as compared with white carbon dioxide light.

There is one experiment which has come to my attention frequently during the last 10 years, and that is in taking two long tubes 50 feet in length and placing them six inches apart, if you turn on the first tube, and there are a dozen persons present, and you ask them what color it is, they will without exception say it is a beautiful white tube. Turn on tube No. 2, and immediately something happens to tube No. 1; tube No. 1 turns pink, usually because tube No. 2 shows a purer white than tube No. 1. It seems beyond belief that something has not been changed on tube No. 1, as it seems decidedly pink, where before it was white. This shows the necessity for having standards of color, and also demonstrates the short memory of the eye for remembering color values. As soon as you throw off tube No. 2 and turn on tube No. 1 again, you immediately have a white light. If that is true with carbon dioxide producing a pure white light, it is thoroughly satisfactory as a duplication of average daylight, and it ought to be the final form of light to use as a standard for photometric measurements, because our photometers are varied and the results attained are influenced by the kind and quality of the light of the standard used. The efficiency of any light is largely dependent on its color. That is due to the fact that the yellow rays are maximum luminous rays, and therefore a light which predominates in yellow or green has better efficiency than one with a larger number of colors.

The measuring of illumination is an extremely complicated matter, and one that will remain complicated for a long time to come. Since the measurement of illumination depends on the eye and is therefore a physiological problem, the sphere of activity for the illuminating engineer, as this matter of color values becomes more and more refined, will become greater and greater. If we speak of the efficiency of a motor for transforming electric energy into power, we can determine with great exactness the efficiency of that motor for doing that work, but if we take the same amount of electrical energy and say we wish to transmit the efficiency of a device which we call a dynamo, and turn that electrical energy into useful illumination, not only does the problem become complicated because of the transition, but because our final practical result is useful illumination, and the objects illuminated become of prime importance.

G. L. Hunter: The efficiency of the different colors of lights in illumination seems to me to vary greatly with the color of the walls. In practical illumination the color of the light as compared with the color of the wall must be taken into consideration; the color of the wall is of the greatest importance. You may have all the efficiency in the light that is possible, but unless you carefully consider the various furnishings you do not get the effect desired. For instance, take a room where the upholsterings are of green and the walls of orange, in the use of a certain light the conditions are such that they actually reverse the contrast effects of the other. By using a light of one color, the furniture will stand out and appear to jump into the middle of the room, and the walls will recede; reverse the light, the walls will come toward you, and the furniture disappears. I think if you can make a series of experiments to find out how the photometric efficiency of the light varies under these conditions, it will be a practical help for the decorators.

H. H. Seabrook, Baltimore, Md.: Color blindness, absolute color blindness, cannot be helped. One per cent. of the women and five per cent. of the men are partially color blind, and that is a condition which can be cured by education. There are three primary colors, but that is a question of pigment. Pigments when mixed, red, yellow and blue, will make green, because the yellow and blue neutralize, leaving the green to show; whereas, in the spectrum, yellow and blue when mixed are complementary colors and form gray. Upon this the whole mathematical doctrine of the neutralization of colors of artificial light rests. In 1885 Van Genderen Stort, in his experiments upon animals, found that the chemical rays of light which were not absorbed by the retina of the eye produced

dissimulation of the retinal pigments. He found that these cells were broken down but slightly in yellow light, which is, of course, the light which contains the luminous rays in the greatest quantity. Following that, a young Parisian suggested that protective glasses for the eyes should be of a gray-yellow color. Tyndall showed in his articles on light that the injury occurred in rarefied atmosphere, snow blindness, just such injuries as occur from the arc light; these injuries occur only in rarefied atmosphere, because the actinic rays of the light are absorbed by the dust of the atmosphere giving the yellow color to the light.

E. Y. Porter: It has been said that the electrical engineer should be one-tenth an electrical engineer and nine-tenths a steam engineer, and I think it might be equally well said that the illuminating engineer should be one-tenth an illuminating engineer and nine-tenths an oculist, because really the effect of illumination upon the eye is the important thing. We illuminate only to be able to see, but if thereby we either injure or deceive the eye, we are defeating the end which we are striving for. I believe more important than toning down the color through any outside color to a neutral color, is the matter of toning down the intensity of the light from that which is too strong for the eye to something which is safe. If the light does not glare, the actual injury to the eye will be very slight, within quite a range of color. As to the question of the white light, I think the matter is again a question of intensity. White light is all right, if it is not too bright. I am very strongly of the opinion that we will eventually come to get white light that is daylight, or its nearest equivalent, for most purposes. I have noticed that, as people get accustomed to using a white light, they prefer it, provided it is not too intense. We can hardly hope to improve upon nature's color, and I am sure that is the color for general purposes which we should try to obtain, but, unfortunately, that means greater cost. We see that in the flaming arc. We duplicate daylight closer by the use of certain chemicals, but at a loss of efficiency. It is the cost which comes in in the production of white light. If we have to distribute energy over all the spectrum to get all the colors, we must take more energy to get a given effect on the eye than if we concentrate the energy on certain given colors, white and yellow, which affect the eye most strongly.

As illuminating engineers, we ought to try to eliminate as many of the variables as possible. We have been talking very glibly about the watts per square foot and the watts per candlepower, and the various other factors. At the last meeting I mentioned the illuminating efficiency as being the ratio between the watts per square foot and the average intensity. It might be called a multiplying factor. This is only one step toward getting some expression which will express the real value of getting any light or system of lights from the standpoint of efficiency, and it does seem to me that it will be possible some time to take another step in referring the efficiency of all lights to a standard color. It may be possible to work out the relation, say, between a yellow light and its equivalent white light and get a definite basis of comparison for different colors, because we would always want different colors for certain purposes. In department-store work it is often desirable to have lights that are red.

G. H. Stickney, Lynn, Mass.: I thought, after I sat down, that perhaps I had given the impression that the arc lamp was a sort of panacea for all lighting ills. I did not mean to do so. There are certain places where an arc light is most desirable. As far as we have been able to work over large areas of general illumination, and especially where color values are important, as in department stores, we have been able to find nothing in our laboratory work that is equal to the arc light, properly modified. The Moore light is now coming practically to a point where it will be perhaps a commercial element. There are certain places, such as restaurants and houses, where I am not sure it is desirable to use a white light. In these cases I think the yellow light is fully as satisfactory, at least at present.

Weak Track Caused New York Central Wreck.

The report of the State Board of Railway Commissioners of its inquiry into the causes of the wreck of the Brewster express on the Harlem division of the New York Central Railroad on February 16th, in which 24 people were killed, gives a weak track as the direct cause of the wreck. The board made 10 recommendations for reforms in conditions on the New York Central lines in the "Electric Zone," which range from better methods of spiking down the rails and the superelevation of curves to changes in the administrative officers which will place responsibility more directly where it belongs. As to the responsibility of those who had charge of the adjustment of conditions to the electrification requirements, the report has no fault to find, except for the failure of the operating officials to run dummy trains for a sufficient period over all parts of the road to determine the actual working conditions of the new equipment.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XVI.—Electrical Measuring Instruments.

Electrical measuring instruments for measuring all kinds of electrical values are made in a very wide variety of styles, and are far too numerous to be included in this series of articles. A number of these instruments which are, however, in more common use, will be described, and will be considered according to the following classification:

First—Instruments of precision, including laboratory instruments for the most highly accurate work.

Second—Portable instruments, which are somewhat less accurate than the precision instruments.

Third—Meters, which are used on switchboards and for measuring the amounts of current consumed by central-station customers.

Galvanometers—These were the earliest instruments used for measuring current, and are still considerably used in laboratory work for accurate determinations of very small currents.

Galvanometers.

There are two general types of galvanometers, one of which employs a magnetic needle which is deflected by a current in a coil of wire surrounding it, while the other consists of a fixed permanent magnet, between the poles of which is suspended a movable coil whose deflection measures the current.

We have previously learned that a wire carrying a current is surrounded by a field of force, and if a magnetic needle be brought in proximity to the wire, it will be deflected. The deflection of the needle depends upon the direction of the current through the wire, and also whether the needle is above or below the wire. If the wire passes first over the needle and then under it, or, in other words, if the needle is in the center of a loop of wire, the effect of the current in the wire both above and below the needle is to deflect the needle in the same direction. If this coil consists of a large number of turns of wire, the effect on the needle is greatly multiplied, each turn of wire adding its effect to that of all the others. An arrangement such as that just described is known as the tangent galvanometer. This consists of a coil of wire with a large number of turns and of a large radius, having a magnetic needle suspended at its center, the proportions of the needle and the diameter of the coil being 1 to 10, or more.

The sine galvanometer is similar in general arrangement to the tangent galvanometer, except that the coil can be moved about a vertical axis. In making a reading the coil is first placed parallel to the needle. When the current passes through the coil the needle is deflected a certain amount, and the coil is then revolved on its vertical axis until it is parallel with the needle as deflected. The amount of deflection from the original position of the coil determines the value of the current.

The Thomson galvanometer is a very sensitive instrument, in which the current is measured by the deflection of a ray of light reflected from a concave mirror. In this instrument, instead of using an ordinary magnetic needle, an astatic needle is used. The astatic needle consists of two magnetic needles of the same size and magnetic strength, which are held together with their opposite poles next to each other, and as one needle is acted upon in the opposite direction to that of the other, there is no resulting effect; but, owing to the impossibility of having the two needles exactly the same strength, they will have a very slight tendency, when joined together in this way, to point north and south, due to the earth's magnetism.

The galvanometer is supported on a tripod with three leveling screws, and inside of the coil of wire are suspended two or more astatic needles. A small permanent magnet is supported over the instrument, which may be raised and lowered, by means of which the attraction of the earth's magnetism is counterbalanced. The astatic needles are supported by very fine fiber, and to one of the needles is attached a small concave mirror, by means of which a ray of light which measures the deflection of a needle is cast upon a scale.

The D'Arsonval galvanometer is an example of the second kind of galvanometer mentioned, consisting of a permanent magnet and movable coil. The movable coil is suspended between the poles of a permanent magnet, and is carried by very thin platinum wire, and a small concave mirror is attached to the movable system for measuring the deflection of the coil. There is a soft iron core within the coil, through which the lines of force passing between the poles of the magnets are concentrated, so that the coil moves in a strong magnetic field. When a current passes through the coil, it has a tendency to turn so as to include the greatest number of lines of force, and this movement of the coil is resisted by the torsion of the wires by which it is suspended. This form of galvanometer has the advantage that it may be used in proximity to electrical machinery or electrical currents without being affected, on account of its strong magnetic field.

The ballistic galvanometer is one whose needle has a slow motion of oscillation, and can therefore be made to measure the strength of currents which are of short duration, such as the charge of a condenser. The quantity of electricity is measured by the amount of deflection at the first movement of the needle.

The differential galvanometer has two coils through which current flows in opposite directions, and is used for comparing the relative strength of two currents. If the currents in the two coils are unequal, the deflection of the needle is proportional to the difference of the currents passing through them.

Wheatstone Bridge.

The Wheatstone bridge is the instrument used for making all ordinary measurements of resistance, and is very widely used in laboratory work. The principle upon which it operates is that by connecting an unknown resistance in a certain relation to a number of known resistances, a proportion is

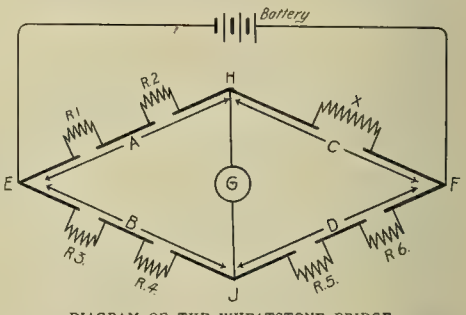


DIAGRAM OF THE WHEATSTONE BRIDGE.

established between the different resistances from which the unknown resistances can be calculated. To make this clear, it will be necessary to refer to the accompanying diagram.

The source of current is usually a battery, and the battery circuit is divided at the points (E) and (F), so that part of the current passes through the sides (A) and (C) and the other part through the sides (B) and (D). The unknown resistance (X) is connected in series in the side (C) and in the sides (A), (B) and (D) are inserted a number of variable resistances, (R_1), (R_2) (R_3), etc. At the junctions (H) and (J) a connection is made across the divided circuit, and a galvanometer (G) is inserted in this connection. In the actual instrument there is a much larger number of resistances than is shown in the diagram, and each one of these known resistances can be cut out of the circuit by the insertion of a plug.

The known resistances in the three sides of the bridge are varied by means of changing the plugs, until there is no deflection of the galvanometer, which indicates that no current is flowing between (H) and (J). When the resistances are so balanced that no current flows through the cross-connection (H J), and consequently no deflection of the galvanometer takes place, it is evident that the resistances in the four sides of the bridge (A), (B), (C) and (D) are balanced so that under these circumstances there is the same drop in the potential in the resistances in (A) and (B) and also in the resistances in (C) and (D). From this we have the proportion, $\frac{A}{B} = \frac{C}{D}$. The unknown resistance is in the side (C) and the known resistances are in the sides (A), (B) and (D). Therefore, the unknown resistance (X) equals $\frac{A}{B} \times D$.

A large number of testing sets are to be found upon the market, all of which include the Wheatstone bridge and plugs for adjusting the resistances,

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

the galvanometer, the battery and one or two keys for closing the circuits momentarily, when observing the galvanometer deflections.

THE USE OF GALVANOMETERS.

In using galvanometers, only a small amount of current should be passed through them if the indications are to be accurate. If too much current is passed through them, the instruments, being delicate, are liable to be burned out and, moreover, a very large deflection of the needle would take place, which would prevent the amount of current being accurately determined.

To avoid this, shunts are usually employed, so that a large proportion of the current to be measured passes through the shunt, and a very small proportion of it through the galvanometer. If the resistance of the shunt is accurately known, this method permits very accurate measurements, as a shunt of suitable resistance can be chosen to give just the desired deflection of the galvanometer needle. The result obtained from a galvanometer reading in this case must be multiplied by a certain number, which is known as the multiplying power of the shunt, in order to obtain the value of the total current passing through both the instrument and the shunt. This multiplier is equal to one, plus the ratio of the galvanometer resistance to the shunt resistance.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Compressed Air and Altitude.

E. G. A., Tularosa, N. M.: (1) Having read of utilizing the weight of compressed air, I would like to know what difference, if any, in pressure would result if a windmill compressor plant were erected upon a mountain peak to compress free air to 60 pounds pressure, and led to an engine 1,000 feet lower down, or what loss or gain would there be in about 2,500 feet of 1-inch pipe at 60 pounds pressure (at the high point) and 1,000 feet fall. The highest point is about 8,000 feet above sea level. (2) What difference in efficiency would result in compressing free air at sea level and at an altitude of 8,000 feet?

ANSWERS.

(1) No difference, except what might be due to loss by leakage. (2) No difference.

Polyphase Apparatus.

E. G. A., Tularosa, N. M.: (1) Can a three-phase four-wire dynamo, as described on page 143, February 16th issue, or any star-connected machine be used with the neutral grounded? (2) If so, when a line wire breaks or the system is grounded, will it open an automatic circuit-breaker? (3) Is a 25-cycle current used as much for lighting as a 60-cycle? What is the lowest periodicity that can be used and not be noticed in the lights?

ANSWERS.

(1) Yes, and it should be so used, the grounding being done at the station only. (2) The grounding of a phase wire of such a system with neutral grounded will short-circuit that phase and trip the circuit-breaker. (3) No. Twenty-five-cycle current is used for lighting in but few instances. Arc lamps will not operate satisfactorily at a lower frequency than 44 cycles, and ordinary incandescent lamps are not considered satisfactory under about 30 cycles.

Direct-current Dynamo Without Commutator.

D. C. McK., Victor, Colo.: What types of generators delivering direct current and not using a commutator are patented in this country? I have a method of generating direct current which I wish to keep secret, and I wish to know if the idea is already covered by patent.

ANSWER.

In the United States Patent Office classification of subjects of inventions there is no division, class or sub-class of "Generators Delivering Direct Current Not Using Commutators," construing the word "generator" to mean an apparatus in which electricity is produced by mechanical movement of conductors through a magnetic field so as to cut the lines of force.

A unipolar dynamo produces direct current, usually of very low electromotive force, without a commutator, the word "commutator" meaning a device for changing the direction of the current. There are many sources of electricity not coming under the term "generator," as the term is defined above, that produce current without the aid of a commutator, such as pyro-magnetic generators, thermopiles, primary batteries and several other devices.

The inquirer should explain his device or method to a reputable patent attorney in whom he has confidence and have him make a preliminary examination in the Patent Office to ascertain and determine its novelty.

The Gyroscopic Principle Proposed for Railroading.

The working model of a new-style railway car and motor, running on a single rail, was exhibited a few days ago at the Royal Society in London. The model is the work of Louis Brennan, the wealthy inventor of the Brennan torpedo, which is used in the British navy.

Mr. Brennan caused a miniature car or locomotive, standing entirely above a single rail with apparently nothing to balance it, to run about the hall, turn sharp corners at high speed, cross a single strand of wire cable in lieu of a bridge, and climb heavy inclines—all with perfect stability, according to the cabled account in the newspapers.

Sometimes the car was loaded, sometimes empty. No attempt was made to balance the load. The vehicle itself did that instantly and automatically. If the load was piled up all on one side the overloaded side automatically rose in proportion to the burden, as the empty side was depressed. It is asserted that a speed of 150 miles an hour can be maintained with the new system of locomotion.

Mr. Brennan began experimenting with the gyroscope. The characteristic feature of the system of transportation, according to the inventor, is that each vehicle is capable of maintaining its balance upon an ordinary rail laid upon ties on the ground, whether it be standing still or moving in either direction at any rate of speed, notwithstanding that the center of gravity is several feet above the rail and that wind pressure, a shifting load, centrifugal action, or any combination of these forces may tend to upset it.

The mechanism consists essentially of two flywheels rotated directly by electric motors in opposite directions at a very high velocity and mounted so that their gyrostatic action and stored-up energy can be utilized. These flywheels, mounted on high-class bearings, are placed in air-exhausted cases, so that both air and journal friction is reduced to a minimum. The track wheels are placed in a single row beneath the center of the car and are carried on trucks which are not only pivoted to provide for horizontal curves in the track but for vertical ones also. By this means, it is declared that the cars can run upon curves even of less radius than the length of the vehicle itself, or on crooked rails, or on rails laid over uneven ground without danger of derailment.

The motive power may be either steam, petrol, oil, gas or electricity, as considered most suitable for local conditions. In the experiment it was decided to use a gasoline-electric generating set carried by the vehicle itself to supply the current to the motor's stability mechanism.

"Everything points to great economy resulting from making the cars wider in proportion to their length than on ordinary railways," said Mr. Brennan. "Brakes capable of being operated by pneumatic or manual power are provided for all wheels. The rail only requires to be of the same weight as one of the rails of an ordinary line in order to carry the same load on the same number of wheels in each case. The ties also only require to be one-half the usual length.

"The bridges would be of the simplest possible construction, a single wire hawser stretched across a ravine or river being all that is necessary for temporary work. Strange to say, the lateral swaying of the hawser does not disturb the balance of the cars, and the strongest winds will fail to blow them off. In other cases for bridge building a single row of piles with the rail on top suffices, or a single girder carrying the rail may be conveniently used."

Sir Hiram Maxim, while conceding that the Brennan model is exceedingly interesting, is reported to have no faith in the practical utility of the plan. He is thus reported: "Mr. Brennan's proposal to construct a monotrack-railway system differs from other such systems in that the rail is placed below the center of gravity instead of above it. I think his plan to keep the carriages from tipping by the action of the gyroscope will be beset with a great many difficult problems, so difficult, in fact, as to make the whole scheme absolutely impracticable. It is quite safe to say that if Brennan's trains were running east or west and there was a strong wind from the north the wind would exert considerable force on the train in the same direction, and I think that under these conditions the plane of the gyroscope would gradually yield, capsizing the train."

Articles of association have been filed by the Central Indiana Lighting Company at Anderson, Ind., with a capital stock of $3,000,000. William M. Wherry, Jr., John W. Tobin and Ivan L. Meloon, all of New York, are the incorporators.

More about England and the Wireless Conference.

With evidence from the new Amalgamated Radiotelegraph Company, which owns the Poulsen and De Forest patents for Great Britain and a large portion of the world, and from Mr. Marconi himself, the parliamentary committee which is dealing with the Berlin Wireless Telegraph Convention of 1906 is nearing the end of its labors. Mr. Marconi, naturally, took strong objection to the convention on both commercial and technical grounds. On the latter point he mentioned that whereas the convention stereotyped wave length it had left the question of amplitude out of account, and without which, tuning (specified in the service regulations), he said, was impossible. He also hinted that he was at work on and would shortly use a new system in which he made use of the principles of both the "spark" and "continuous-wave" systems, with which it would be a technical impossibility to intercommunicate. In this way he urged that the convention would retard scientific progress.

Both Mr. Marconi and his managing director have made the sweeping statements that all other systems are infringements of the Marconi patents and that the company is advised by the highest legal authorities here that patent litigation being practically inevitable in the future, any consent on their part now to intercommunication would seriously prejudice their rights hereafter. In fact Mr. Marconi almost wished for patent litigation in order to make quite clear the rights of the various patentees. Not until then did he think an international convention could be made workable. What the effect of all the evidence upon the committee is, of course, is impossible to say; but to judge from the tone of the questions, there are only three members out of 11 which are favorable to the view of the company.

Prizes for Electrical Co-operator's Creed.

Prizes aggregating $250 are offered by the Co-operative Electrical Development Association for the composition of the "Electrical Co-operator's Creed." The object is to give the best possible brief expression to the idea and purpose of the Co-operative Electrical Development Association. The first prize is $100; second, $50; third, $25; and there are three of $15 and three of $10. Competition is restricted to men interested directly or indirectly in the electrical business. Compositions must be received at the association's office in Cleveland (1814 East Forty-fifth Street, N. E.) by May 31st, so that the winning compositions can be printed in pamphlet form and distributed at the Washington convention of the National Electric Light Association, June 4th to 7th. Awards will be made by a committee of three appointed by Mr. J. Robert Crouse, who will give further information to anyone requesting it.

Following is a "Credo" by Mr. Edwin Osgood Grover, which is given as suggesting the character of composition wanted:

I believe in the goods I am selling, in the firm I am working for and in my ability to get results. I believe that honest goods can be sold to honest men by honest methods. I believe in working, not waiting, in laughing, not weeping, in boosting, not knocking, and in the pleasure of selling goods. I believe that a man gets what he goes after, that one order today is worth two orders tomorrow, and that no man is down and out until he has lost faith in himself. I believe in today and the work I am doing, in tomorrow, and the work I hope to do, and in the sure reward which the future holds. I believe in courtesy, in kindness, in generosity, in good cheer, in friendship, and honest competition. I believe there is an order somewhere for every man ready to take one. I believe I'm ready right now.

Combustion and Smoke Consumption Tests.

With a view to studying coal combustion at several large plants in Indiana and to experimenting with devices for consuming smoke, H. W. Weeks, an engineer connected with the coal-testing plant at St. Louis, established by the United States Geological Survey, is in Indiana, where he will investigate the kind of coal burned, the character of the load, the percentage of horsepower developed, the draft carried and the kind of furnaces and boilers employed in the electric railway and other large power plants. One object of the geological survey is to encourage the consumption of the home product in each city.

The coal-testing plant was established at St. Louis during the Louisiana Purchase Exposition, and it was understood that a permanent location should be decided on at the close of the exposition. Mr. Weeks says that part of the plant is now at Denver and another part at Jamestown, while the rest remains at St. Louis. At the close of the Jamestown Exposition a commission will visit a number of cities to determine where the plant shall be permanently located.

Non-arcing Lightning Arrester.

In presenting its new type Shaw non-arcing lightning arrester the Lord Electric Company of New York remarks that what central-station managers and constructing engineers want today for the protection of their electric equipment against the abnormal potential discharges to earth is not a complicated piece of apparatus, consisting of many parts with theoretical utility, but a simple and positive device constructed on lines of practicability

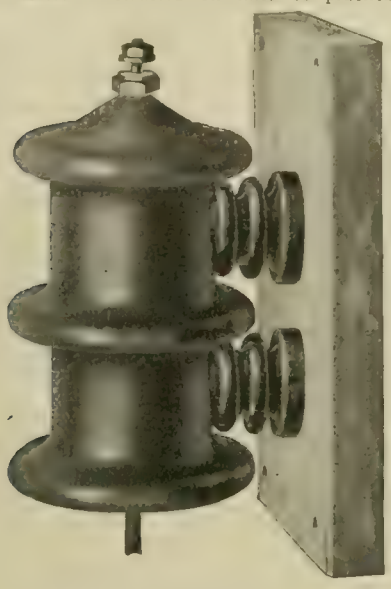


FIG 1. MODEL A, SHAW NON-ARCING LIGHTNING ARRESTER.

and uniformity, and especially designed for actual service under most adverse conditions.

The principles underlying the present design of the Shaw non-arcing lightning arrester are based on results obtained from the various models heretofore placed on the market by this company. The new arrester has no moving parts, needs no adjustment or attention, is accurately tested and carefully constructed. The Shaw patents cover the basic principles of a series of partially conducting disks or rings separated by laminar insulating material in such a combination as will give the easiest possible path for a discharge of a static character and present an impenetrable barrier to the dynamic line current of the normal voltage.

The portions of the arrester serving as static low-resistance conductors consist of non-arcing rings made in accordance with a special formula. The rings are separated from each other by mica washers. The combination of non-arcing rings and mica disks properly proportioned is mounted on specially vitrified porcelain arbors, so constructed as to give great mechanical strength. The arbors have strong dielectric properties and are not affected by changes of temperature.

All lightning arresters for railway, electric-light and power work are mounted in porcelain housings, the material used consisting of vitrified porcelain of high insulation test, and finished in a dark-chocolate glaze. Fig. 1 illustrates a model A arrester. The company calls special attention to the design of the porcelain housings. A direct path is provided for the static discharge from line to ground, angles or bends being avoided.

Model B, having six units in series, is shown in Fig. 2. This type is designed for higher voltages than model A and is furnished mounted on marble base for either line or station use.

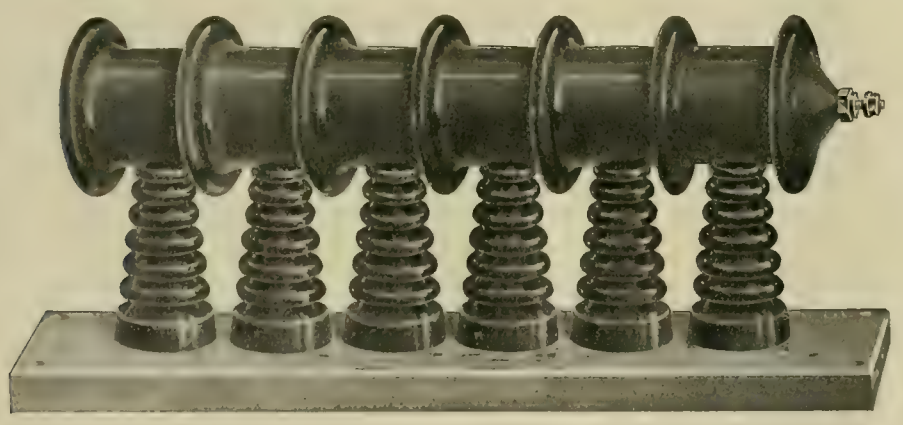


FIG. 2. SHAW ARRESTER, MODEL B, SIX UNITS IN SERIES.

Plans have been completed at Lawton, Okla., for the Comanche Light and Power Company plant. The building will be 81 by 50 feet. Bids will be advertised for by F. H. Grubb.

Lightning Arrester for Low-potential Lines.

The Chapman lightning arrester here illustrated was designed for the protection of telephone, telegraph, fire-alarm and other low-potential lines. It is manufactured by the Minnesota Electric Company of Minneapolis. It is weatherproof and intended to be erected on the most exposed sections of the line to be protected.

It is built for the protection of two wires or one metallic circuit, and consists of two heavy discharge plates with a short air-gap to ground. By the peculiar arrangement of the plates and air-gap, it will withstand the heaviest lightning discharges without deterioration or danger of grounding the line. The weatherproof case consists of a base and cover of heavy pressed steel, the joint being closed with a rubber gasket. The porcelain is a one-piece

CHAPMAN LIGHTNING ARRESTER.

fitting with outlets for the conductors, extending through the base. The exposed line electrode has its surface composed of discharge points arranged in vertical rows. This arrangement admits of a short air-gap with a multiplicity of discharge points and with an extremely large clearance.

The manufacturer reports an increasing demand for these arresters, one company having over 4,000 in use. It is said that in Minneapolis the adoption of these arresters has cut down the repair bills due to lightning troubles to such an extent that the saving of this item has paid for the arrester equipment in addition to uninterrupted service, which is a very important feature in fire-alarm service.

Supreme Court Affirms Lipsey Conviction.

The manufacturing and jobbing trade generally will be interested to learn of the success that has attended the prosecutions of Ralph Lipsey, former president of the Great Northern Metal Company, and second-hand dealer of Chicago, whose conviction for receiving stolen property has just been affirmed by the Supreme Court of Illinois, and also of the plea of guilty made by Arthur Dietrickstein, held under a charge of larceny, and of his imprisonment on the plea. These two cases against Lipsey and Dietrickstein arose by reason of the fact that they conspired together and succeeded in stealing several cases of lamp sockets from one of the large Chicago jobbers. Dietrickstein stole the goods and sold them to Lipsey, who acted as the "fence." These prosecutions have resulted in putting Lipsey entirely out of business and thus removing a constant menace to the Chicago trade, for it will be readily understood that petty thieving of this character could not be successfully carried out if it were not for the dishonest and criminal junk dealers and second-hand establishments that connive with the thieves and receive and pay for the property.

The cases against both Lipsey and Dietrickstein were worked up by Frederic P. Vose, Esq., counsel for the National Electrical Trades Association, and attorney for many of the electrical manufacturers and jobbers, and the matter was ably handled by Assistant State's Attorney James J. Barbour, whose work in the trial of the cases resulted in conviction, and whose argument before the Supreme Court won a notable victory, thus successfully eliminating one menace to the legitimate trade of Chicago.

Milwaukee Northern Railway.

The Milwaukee Northern electric railway, which will open up communication between the eastern Wisconsin towns of Sheboygan, Port Washington, Fond du Lac, West Bend and numerous others in this populous district and Milwaukee, will probably be ready for operation on at least one division by early summer. Except for short distances in the centers of some of the larger towns, the Milwaukee Northern roadbed is located on its own right-of-way and in almost a straight line. There is practically but one curve on the line—between Fort Washington and Grafton—and that is one of only two degrees. Where the road crosses twice both the Northwestern and St. Paul tracks, subways of steel bridging and masonry abutments or viaducts are used.

The right-of-way was planned to secure high-speed operation from one end to the other. The complete power equipment was purchased from and built by the Allis-Chalmers Company of Milwaukee and is of standard design both for gas engines and alternators. Three-phase alternating current will be generated in the power house at 405 volts by three direct-connected alternators, each of 1,000-kilowatt normal capacity, driven at 107 revolutions per minute by twin tandem gas engines, each with a rated capacity of 1,500 horsepower. This equipment when in operation will enjoy the distinction of being the largest installation in America of gas-engine-driven electric-generating units for traction purposes. The main power house is located at Port Washington and sites for sub-stations have been provided at Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport.

Electric Motors for Rolling Mill.

The largest order for steel rails ever placed with a single concern was made public on May 11th. This was the order for 150,000 tons of steel rails placed by the Harriman railroad lines with the Tennessee Coal and Iron Company for delivery after March, 1908. In order to handle its greatly increased business the Tennessee Coal and Iron Company has just placed an order with the Crocker-Wheeler Company of Ampere, N. J., for the complete electric-motor equipment of its new steel-rail mill at Birmingham, Ala. The Crocker-Wheeler Company has recently been obliged to open an office in Birmingham to handle the rapidly increasing business in this section. The order includes 15 Crocker-Wheeler form W rolling-mill motors. The line of form W motors is designed for the arduous service of rolling mills, and has attracted the favorable attention of steel makers by reason of its ruggedness and simplicity of design. The order aggregates about 575 horsepower.

GENERAL TELEPHONE NEWS.

A new down-town telephone exchange calculated to provide for 15,000 subscribers, to be known as "Randolph," has been established by the Chicago Telephone Company. The new exchange was opened to relieve congestion and take care of future growth in the Central district of the city.

A new telephone company has been formed in Canada called the Glengarry Telephone Company, with Donald McCaskill of Laggan, Ont., president. It is the company's intention to build a telephone line between Alexandria, Ont., and points east and west. Arrangements have been made with the Bell Telephone Company.

It is reported that President E. L. Barbour of the Louisville Central Home Telephone Company was recently called to New York for a conference with the Bell and Independent telephone interests, it being further rumored that the American Telephone and Telegraph Company has acquired many Independent telephone systems in Kentucky, Tennessee and other states.

R. A. McDowell of the special committee of the Commercial Club, Louisville, Ky., investigating the pending telephone ordinance, has reported strongly against extension of certain privileges. The report says that the ordinance is drawn in a most unskilled manner as compared to that purchased by the Home Telephone Company, under which it is now operating. Several objections are stated by the committee, which believes that the proposed ordinance will give undue advantage to the Home company and will be contrary to the interests of the city.

The following-named telephone companies have recently been incorporated: Smart Telephone Company, Burnet, Tex., capital stock, $10,000; Twin Creek Telephone Company, Oklahoma City, Okla., $50,000; Independent Telephone Company, Crete, Neb., $100,000; Mount Pleasant Mutual Telephone Company, Butler, Mo.; Union Telephone Company, Wellington, Tex.; Capron (Okla.) Telephone Company, $7,000; McCammon (Idaho) Telephone Company, $10,000; Arkansas Valley Telephone Company, Great Bend, Kan., $10,000; Rose Valley Rural Telephone Company, Liberty, Kan.

Bell and Independent Interests May Get Together in Indiana.

A correspondent of the Western Electrician in Indianapolis writes that there is a strong probability that the Central Union (Bell) and Independent telephone interests in Indiana will "get together" in some definite way on a basis that will do away with competition in every section of the state outside of Indianapolis and Evansville. The proposition comes from the Central Union Company to withdraw all its local exchanges and give up all its local business provided the Independents will connect with its long-distance exchanges on a percentage basis. The Independents hope to determine the matter at their annual convention this week, but it is rumored that in several instances the agreement has already been entered into. It is roughly estimated that when the series of deals is completed it will place at least 75,000 telephones on Independent lines in Indiana on the long-distance lines of the Bell company.

The effect of this agreement, if consummated, will be the practical elimination of competition as well as the end of the fighting between the Bell and Independents, which has resulted in rate-cutting and other methods which have caused immense losses to both.

James S. Brailey, Jr., president of the Indianapolis Telephone Company and the New Long-distance Telephone Company, says that no merger between the Central Union Telephone Company and the Indianapolis Telephone Company or the New Long-distance Telephone Company is contemplated or has been contemplated. He was asked as to the rumor that the Central Union Telephone Company may take over the Indianapolis Telephone Company, and that throughout the state where there is competition between the Central Union and the Independent telephone companies the stronger company should take over the weaker and an arrangement should be made as to joint use of the toll boards. He said he was not in a position to make a statement as to the situation throughout the state.

Telephone Matters in New York City.

It is reported that the American Telephone and Telegraph Company of Boston is to take up a New York domicile within a short time. The retirement of Frederick P. Fish from the presidency and the election of T. N. Vail to that office may help to bring the change about.

John C. Sheehan, who controls the Manhattan Transit Company, is planning to operate an Independent telephone company in Manhattan on the charter of the Long Acre Electric Light and Power Company. He says that the Bell Telephone Company operates in the city without a special franchise chiefly because it controls the Empire Subway Company, which owns the conduits for carrying wires, and that the recent decision of the Court of Appeals giving the Manhattan Transit Company the right to use these conduits entitles it to all the privileges enjoyed by the Bell Telephone Company.

At a meeting of the city affairs committee held on May 10th it was voted that the New York Telephone Company and the New York and New Jersey Telephone Company ought not to receive a 25-year franchise for a bonus of $3,000,000 and an annual payment to the city based upon its earnings. The committee voted in favor of a franchise for an Independent telephone company to operate automatic telephones. Martin W. Littleton, counsel for the Atlantic Telephone Company, stated that whereas the old companies offered $3,000,000 for a 25-year franchise on condition that no other company be let in to compete with them, his company was willing to pay $3,000,000 to the city and furnish telephones free to all municipal departments for a franchise by which it could come in and compete with the monopoly. The committee decided to take no decided action pending the trial of two suits which the city has against the Telephone and Empire Subway companies. P.

Ohio Telephone Notes.

The Henry County Mutual Telephone Company has been granted its incorporation papers at Columbus.

The New Riegle Mutual Telephone Company has started to build its plant with a subscription list of 53 members. The plant will be in operation this fall.

Throughout the state the rumor is still afloat that the Independent companies are to become the owner of the Bell local exchanges and that the Bell is to get the toll lines. As yet positive information as to the closing of any such deal has been confined solely to the Marion project some weeks ago. Indications are that it will be but a very short time till the Central Union interests are entirely out of all the local fields in Indiana and Ohio. A Toledo official of the Bell company is quoted as saying that within six months the Home company would have control of the local field. S.

High-potential Railroading Interferes with Telephone Service.

Indiana telegraph and telephone engineers continue in some places to encounter serious difficulties in the operation of their circuits because of the development of high-tension electric-railway systems. As the employment of high-potential alternating current for electric traction purposes expands, as it is doing rapidly in Indiana, it is obvious that the telegraph and telephone engineer will have to face numerous problems from induction effects. The telephone men say that it is not easy to foretell what the ultimate effect of these high-potential alternating-current circuits upon the telegraph and telephone service will be. They assert that in the event of the general electrification of steam railroads it would become necessary to remove the wires from the vicinity of the railroad tracks and seek right-of-way. Indeed this action has already become necessary in one or two instances in Indiana.

Indiana District Telephone Meeting.

The representatives of the Independent telephone companies included in the second Indiana district held their quarterly meeting at Cambridge City on May 7th. L. A. Frazee of Rushville, vice-president for the district, presided. After the secretary's report was read and routine business disposed of the representatives rushed into a vigorous discussion of the proposition submitted by two representatives of the Central Union Telephone Company to take over all the long-distance business in the district in exchange for the Bell company's giving up to the Independents all local business. The discussion brought out a variety of opinions and suggestions and resulted in the postponement of action until after the state meeting. It was evident from the discussion that a majority of the Independents in the second district are inclined to favor the proposition, and it is thought that at the Indianapolis meeting they will vote to accept the offer. The reports of representatives of the 23 companies in the district showed remarkable progress.

Telephone News from the Northwest.

The Caryville Telephone Company of Caryville, Wis., has been incorporated to build lines to the surrounding territory.

The Montana Independent Telephone Company of Helena will start work on the construction of new lines as soon as possible. The system will be automatic.

Frank Stanfield has purchased the Mutual Telephone Company's exchange at Le Grand, Iowa.

Plans and specifications are about completed and bids will be asked very shortly for the new central exchange building to be erected at Omaha by the Independent Telephone Company. The building will be two stories and basement, 50 by 100 feet, and will cost about $60,000.

The Remsen (Iowa) and Meadow Township Telephone Company will be incorporated, with Aug. Haack as president.

The Mankato (Minn.) Citizens' Telephone Company has decided to increase its capital from $100,000 to $150,000. R.

New England Telephone Company's Report.

The annual meeting of the New England Telephone and Telegraph Company of Boston was held on May 6th. William J. Denver, F. H. Dewey and Matt B. Jones were the new directors elected. Except A. Cochrane and D. B. Parker, the directors were re-elected. Gross revenue for the year 1906 is given as $9,312,999, compared with $8,071,244 for 1905. Expenses aggregated $7,489,349, leaving a net revenue of $1,823,650. More than $3,000,000 was expended in construction during the year. The number of subscribers' stations added during the year is given by President Sherwin as 38,621, making the total number 205,184. The report says that the system is now next to the largest in the United States.

A Country Newspaper and Telephone Combination.

Virgil A. Geiger, editor and proprietor of the Cherubusco (Indiana) Truth, is perhaps the only newspaper man in the country who owns and operates a complete telephone system in connection with his paper. This service consists of nearly a hundred party lines, on which are over 700 subscribers. The service requires 650 miles of wire and makes connection with all outside lines. Farmers are charged $1 and town people $1.50 a month, with free country service if they are subscribers to Truth. There is a complete exchange in the office of Truth, and every day Editor Geiger calls up his friends and gets the news from the different neighborhoods.

CORRESPONDENCE.

Continental Europe.

Paris, April 29.—A hydro-electric plant of considerable size has been erected in order to secure the current which is needed for the city of Lucerne, Switzerland. It is located on the Erlenbach River and operates with a head of water of 312 meters. At present it has a capacity of 8,000 horsepower. Water from the Erlenbach is taken off above the dam by a canal some 400 feet long, and this leads to a regulating reservoir of large capacity. A flume a mile and a half in length leads from this point to the water chamber for the penstocks. There are now two penstocks in place, leading for a length of 620 meters to the turbine house, and place has been left for two others, which will be installed later on. Four turbines are now erected in the station. They are of the Pelton type and have 2,000-horsepower capacity at 300 revolutions per minute. Alternators built by the Oerlikon concern are coupled to the wheels. The distance from the plant to the city of Lucerne is about 16 miles, and the greater part of the current is used there, but some of it, about 200 kilowatts, is used at Engelberg and other localities.

Owing to the success which the first set of electric automobile postal vans is having at Paris, there is some talk of replacing all the horse vehicles of the Postoffice department by automobiles. This will be quite an undertaking, as there are a large number of the postal vans in use, which circulate between the central postoffice and the numerous branch postoffices in town. The cars now in use were built by the Mildé Company and consist of a large box body with a good space for postal matter, mounted on a truck which carries the motor mounted on the rear axle. The storage battery is placed in a separate compartment. The driver's seat is on top and at the front of the car.

New electric-lighting projects are under consideration at Toulon, and the Municipal Council has been engaged in a plan for erecting a second electric plant of some size, which will compete with the existing company's plant. It is expected that this will lower the price of current both for the city and for private consumers.

It is only within a recent period that the south branch of the Paris Metropolitan railway has been practically completed according to the plans. The line runs from the Place de l'Etoile to Place de la Bastille, making a semi-circular tour through the southern part of town, and serving an extensive district. There is a change of cars at Place de l'Italie; but, on the other hand, passengers do not need to leave the train at the Bastille should they desire to proceed further north, as the line now extends from the latter point toward the East Railroad Depot, and it will soon be run as far as the depot itself, which will be a great convenience. It is to be noted that the southern line runs overhead at a point near the Seine, and the road pierces through the large building of the Orleans Depot on the overhead structure, which is a somewhat original feature. After leaving the depot it crosses the Seine on a special bridge and then runs underground for the rest of the way. At the Bastille passengers can change cars for the other subway section which runs across town and along the Seine.

A new electric company has been formed at Nimes, France, and it proposes to utilize the power of the Gardon River at a point lying just above the ancient Roman aqueduct known as the Pont du Gard. A series of dams will be constructed at this point. Current for some of the surrounding towns will no doubt be secured at a low price, this being one cent per hectowatt for lighting and 0.4 cent for motor current. The new company has already made contracts with some of the tramway companies and intends to supply them with current. A. DE C.

New York.

New York City, May 11.—The Interborough-Metropolitan Company will reject the proposition adopted by the Rapid Transit Commission at last week's meeting, that if the company agrees to build the Seventh, Eighth and Lexington Avenue extensions at its own expense and provide for a universal system of transfers between the underground, surface and elevated lines it will be permitted to build additional tracks on the Second and Third Avenue elevated lines.

The moving of the large dynamo weighing over 50 tons from the power house of the Edison company at the foot of East Thirty-eighth Street to the plant of the company in Duane Street attracted much attention on the streets through which it passed on its two-mile journey. The huge truck supporting the dynamo, drawn by 28 horses, made a procession a block long and was one of the heaviest loads ever hauled through the streets of New York.

At a meeting of the Brooklyn Engineers' Club at the clubrooms in the Brooklyn Library on May 10th Mr. William T. Donnelly read a paper entitled "New Methods of Pumping Floating Dry Docks," illustrated by lantern slides. After the reading of the paper a collation was served. It was also announced that the annual June dinner to the

ladies would take place at the Manhattan Beach Hotel on the evening of June 20th.

Brooklyn Rapid Transit is said to be planning the purchase of the Coney Island and Brooklyn road. Stock of this company, which is controlled by the Equitable Life Assurance Society, has been paying 16 per cent dividends and has been quoted at 300 per share. It needs new money, and new stock is to be offered to shareholders at par.

In its report to the State Railroad Commission the Interborough system of this city states that for January, February and March its roads carried 121,067,098 passengers, an increase over the same period last year of 14,303,080. The net earnings for the same period were $3,535,242, an increase of $387,000. The gross income was $3,768,954; the net income, $2,304,275, and surplus, $1,254,275.

The State Gas Commission has announced that it has decided to investigate the complaints made by the Merchants' Association of New York City as to alleged discrimination practiced by the Edison company against the users of private lighting and power plants. There has been a difference of opinion as to the obligation of the company to supply so-called "break-down" service.

The commission has approved the application of the New York and Ontario Power Company for a certificate of authority to do business and consents to the issuance of $150,000 in stock and $150,000 bonds. The original application was for consent to issue $2,000,000 bonds and $2,000,000 stock. The company will sell electricity for light, heat and power in the city of Ogdensburg, the village of Waddington and towns of Waddington and Lisbon.

Representatives of the Board of Fire Underwriters appeared before the building codes revision committee at a public hearing in the City Hall last week to request that it embody stricter requirements for construction in the new building code.

D. E. P.

Great Britain.

London, May 4.—The last two or three years have witnessed a considerable expansion in the use of overhead wires for power-transmission purposes in Great Britain, but, as is not unusual in the development of a new branch in an industry, certain aspects have been left more or less uninvestigated. The case in point is the strength of wooden poles for power-transmission purposes. Aside from telegraphic and telephonic work, which has no comparison, little has been done and almost still less has been known here of the qualities in, or desirable in, wooden poles for the purposes indicated. But a paper just read before the Institution of Electrical Engineers has been instrumental both directly and indirectly in letting a flood of light upon the subject in a manner not often experienced. Mr. A. P. Trotter, the electrical adviser to the Board of Trade, seeing a trade list from a firm of timber merchants wrote to ask if they had any data of bending and other stresses. Correspondence followed and the firm in question generously undertook a series of, in Mr. Trotter's words, destructive tests, and the results have been published in the most open manner. The Board of Trade requirements are a factor of safety of 10, and a wind pressure of 30 pounds to the square inch in connection with the use of wooden poles for power transmission, and the immediate result of the experiments above referred to is an agitation in favor of the reduction of the regulations, with the consequent cheapening of the production of such poles. It is significant and it points to the existence of large margins in both directions that during the exceptionally heavy winter of last year no accident of any sort occurred in connection with the 50 or 60 miles of overhead power-transmission wires and poles now existing in England. But the sympathies of Mr. Trotter do not appear to be in the direction of such a reduction. Be this as it may, and opinions differ, there seems to be a distinct feeling against the use of single poles, mainly on the score of economy in production, and the tests prove that A poles are likely to prove the most serviceable. The discussion brought forth remarks from almost everybody using overhead power transmission, and it is quite clear that there is a considerable field for development. With regard to the design the view is taken that although considerable experience has been gained by the Postoffice engineers with wooden poles, their practice ends where power-transmission practice begins.

How far the negotiations between the London County Council and the existing electric supply companies have progressed nobody seems to know, but it may be taken that a hitch has occurred, and in the meantime the second reading of the bills in the House of Commons has been further postponed. In fact it is not improbable that after all the council's bill will be withdrawn.

The variety of tramway gauges in the provinces has often led to difficulties, and especially so since common sense has prevailed among our tramway authorities and running powers over each other's lines have become to be regarded as a sine qua non to the public convenience. Some time ago I referred in these notes to a patent tramcar truck designed by the manager of the Bradford corporation tramways with the object of running over different gauges by means of an automatic alteration in the gauge of the wheels. One of these trucks is now on trial in actual service, and the results from the point of view of maintenance, etc., are being watched for with great interest. The Bradford gauge is four feet and the Leeds gauge the standard of four feet 8½ inches. For some time the passengers have had to change cars where the two systems meet.

It is officially announced that the government does not propose to legislate this session in regard to the report of the Royal Commission on London Traffic. The question is said, however, to be engaging the earnest attention of the government, but in the meantime the problem seems to be very much settling matters for itself. Apart from new tramways proposed by the County Council there is little probability of new schemes of traction being promoted in London for the reason that most traffic routes are covered not only by electric railways but also by motor omnibuses, which are waging a very effective competition.

Although it is an unfortunate fact that the whole of the Woolwich municipal electricity undertaking is in a very chaotic condition, both financially and otherwise, yet the circumstance that a refuse destructor is attached to one of the generating stations serves to call attention to it as a factor in maintaining the high works costs. It has just been decided to give a month's trial to the use of coal alone.

A legal action has been in process for many weeks to determine a question of the validity of patents for the electric welding of tramway rails. The action was taken at the instance of Thermit, Ltd., against Weldite, Ltd., and the former won as to all the patents in dispute. The decision affects the main patents.

There has just been opened in Scotland, at Glasgow, a large new dock which has an electrical equipment of much interest, although both engineer and contractors have been somewhat reticent on the matter, as they prefer to give the installation a thorough trial before too much publicity is given to what is being done. The generating plant consists of small reciprocating engine sets with heavy enclosed flywheels between to meet the varying loads inevitable in an equipment which contains many cranes, hoists, capstans, etc. Electric coal-hoists, said to be the first of their kind used in Great Britain, are installed, each capable of dealing with four tons, with a lift of 80 feet through a radius of 45 feet, and traveling at a speed of 120 feet per minute. An electrically operated tipping turntable 18 feet in diameter also forms part of the equipment of this dock, which is known as Rothesay dock. There will be altogether four coalhoists, 36 cranes, transporters, capstans, turntables and other auxiliary machinery, and the main generating plant consists of an engine of 450 horsepower and three generators, the one next the engine being used to supply the general dock machinery and the other two on the other side of the flywheel as mentioned above being required for supplying the coal-hoists, etc. There is also a lighting plant.

G.

Dominion of Canada.

Ottawa, May 11.—Thomas Moran of Arnprior, Ont., who proposes to form a company for the development of the waterpower at Galetta, has obtained permission to erect poles and wires on the streets of Arnprior. Should the scheme go ahead the town will be supplied with electrical energy from a point on the Mississippi River five miles distant from Arnprior.

The Ottawa City Council has unanimously ratified the agreement made to secure power from the Ottawa and Hull Power Company through the Ontario Hydro-electric Commission. The contract is for 10 years and power is to be supplied at $15 per horsepower for 1,500 horsepower and as much more as the city may require up to 2,500 horsepower in units of 200 horsepower. This disposes of what at one time threatened to seriously interfere with the operation of the lighting plant acquired by the city and now owned and operated by it.

That the province of Ontario possesses an immense heritage of waterpowers in the east is shown by the fourth report of the Hydro-electric Power Commission of Ontario just made public. The report deals with the Ottawa Valley and the St. Lawrence River districts and details the power potentialities afforded by the network of rivers which flow in these districts. The report declares that in the central and southern portions of the district the future needs of the various industrial centers will fully tax the capacity of the available smaller waterpowers, and the St. Lawrence River will need to be developed in a large way to fully get requirements. Dealing with the possibilities of the St. Lawrence as a source of waterpower, the commissioners say that a peculiar situation is created by the ship canals. They can be used to a limited extent as head races for power development, but this would be objectionable to the navigation interests. All over the northern portion of the district, including the Upper Ottawa Valley and tributaries there is ample waterpower available for generations to come which will have a marked influence on the development of the mineral and timber reserves of this part of the province. The possibilities of power in aiding the mining industries is specially referred to and it is pointed out that the Montreal River has 13,000 horsepower adjacent to the Cobalt silver mines.

W.

Winnipeg, Man., May 11.—The Winnipeg civic power committee has decided to extend the time for receiving tenders for the $3,000,000 power plant to be erected at Lac du Bonnet until September 1st instead of June 31st as was at first intended. It is expected that tenders will be called for about May 20th.

The Winnipeg Electric Company has adopted a new style of air-brake on its cars which has proved so successful that similar brakes will be fitted to the 135 cars on its system.

An electrical engineer has been engaged by the Town Council of Minnedosa, Man., to prepare plans for developing electrical power on the Little Saskatchewan River at that town. E. B. Fisher, Minnedosa, Man., can give information.

A company with a large capital is being formed to build an electric ore smelter at a cost of $1,000,000. E. B. McKay, Port Arthur, Ont., is interested.

L. White, formerly of Calgary, Alberta, has been appointed superintendent of the civic lighting plant at Saskatoon, Sask.

Arrangements are about completed for the installation of a long-distance telephone system connecting Kaslo, B. C., with a number of mines in that district along the route of the Kaslo and Slocan Railroad. The telegraph instruments along the railway will be taken out and telephones installed. In addition, each train will be equipped with telephones with attachments to connect anywhere along the line.

The electric-light plant at Fort Saskatchewan, Alberta, has been sold by O. Higman to a local syndicate, to be known as the Fort Electric Company. Several extensions are planned.

A scheme to develop electric power at Currie's Landing, on the Assiniboine River, is being discussed by the Brandon City Council. An electrical engineer will be instructed to report on the possibilities of such a development.

Cecil Goddard of Winnipeg has been engaged by the town of Morden, Man., to superintend the construction of the electric-lighting plant in that town.

The installation of an electric power plant at Roleau, Sask., is being discussed by the council. A. C. McKean may be addressed.

The Winnipeg City Council is considering the advisability of constructing a municipal street-railway system to compete with the Winnipeg Electric Company.

The town of Raymond, Alberta, will install an electric-lighting system this summer. Address G. W. Green.

R.

New England.

Boston, May 11.—E. Moody Boynton, the inventor of a bicycle railway, at a public meeting Tuesday evening, discussing his invention and the demand for it, said that his idea was admitted to be feasible, but the opposition of railroad companies had prevented his getting a charter from the Massachusetts Legislature. Under the name of the Boston, Quincy and Fall River Bicycle Railway Company, Mr. Boynton obtained a charter in 1894, but it lapsed in 1903, before anything practical had been accomplished. He is trying to get a renewal.

The shareholders of the Edison Electric Illuminating Company took 600 shares of the company's new stock and 10,902 shares were sold at auction in Boston Wednesday, at prices ranging from 202 to 204¾. The Massachusetts Gas and Electric Light Commission fixed the price at 215, which was the price paid by the stockholders who took the 600 shares. The largest portion of that sold at auction was taken by brokerage houses.

The Massachusetts Railroad Commission and the electric-railway superintendents will hold a conference on May 21st, at which the types of fenders and wheelguards to be used will be decided upon.

According to the State Bureau of Labor Statistics, Massachusetts is fourth among the states in the manufacture of electrical machinery.

The Massachusetts Senate has refused to pass a bill submitting the question of a Boston municipal lighting system to the voters of the city.

Edward Franklin Ripley, secretary and treasurer of the Cohasset (Mass.) Electric Company since its incorporation in 1890, died at his home in Cohasset, Saturday, after a long illness.

The constructing quartermaster, U. S. A., in Boston, has advertised for proposals to construct a street lighting system and install electric-light fixtures at Fort Strong, Long Island, Boston Harbor, the proposals to be opened June 1, 1907.

A large number of the Postal Telegraph company's messengers struck for more pay last Thursday but returned to work in a few hours under the superintendent's promise to consider their demand. They had been notified that, beginning April 29th, pay would be on a commission basis. They had been receiving $4 and $5 per week, with a commission of 1¾ cents on every message collected and 1½ cents on every message delivered in excess of the number necessary to make their regular pay, per week. Under the new arrangement the regular pay has been abolished and they receive two cents per message collected or delivered. The former pay was based on seven days' work

per week. Now they receive 10 cents per hour for Sunday work.

Estabrook & Co., of Boston, representing a syndicate of New England capitalists, have purchased a controlling interest in the Woonsocket (R. I.) Electric Machine and Power Company, which furnishes power to three electric-railway systems and does municipal and commercial lighting in Woonsocket. The company has a capital of $500,000. Its secretary-treasurer is charged with the embezzlement of $57,000 from the company. B.

Southeastern States.

Charlotte, N. C., May 11.—The plant of the Durham (N. C.) Light and Power Company, which has been financially embarrassed for some time, has been sold to New York capitalists for close to $125,000, it is reported.

The Raleigh and Durham Passenger and Power Company, proposing to erect a 28-mile interurban electric line between Raleigh and Durham, has secured an amendment to its charter, moving the principal offices from Raleigh to the Loan and Trust Building at Durham. B. S. Jerman is president of this company, and Jones Fuller, secretary.

The Georgia Railway and Electric Company has secured a charter for the Georgia Electric Railroad Company, which will build a four-mile branch line in and about Atlanta, Ga. The capital stock is $10,000. P. S. Arkwright and others are the incorporators.

The North Georgia Electric Company will be among those presenting bids for the lighting of the city of Atlanta for a term of years. All reports of this company having been absorbed by competitive interests are stoutly denied.

The Chattanooga (Tenn.) Electric Company is installing the final addition of new machinery in its plant, from which power is to be distributed to consumers at a cost of about $28.50 per horsepower per annum. The company is developing considerable power at Hale's Bar, to be sold in the contiguous territory.

The Whitney Company, whose new plant near Salisbury, N. C., promises to be one of the largest in the South, will shortly begin work on the power house. About 46,000 horsepower will be developed for distribution throughout the surrounding towns and country. George I. Whitney is head of the undertaking, the completion of which will occupy about three years.

The city of Brunswick, Ga., will purchase the plant of the Mutual Light and Water Company.

The Williamston (N. C.) Light and Power Company has been chartered to do business at Williamston, N. C., with $50,000 authorized capital, those interested being J. D. Biggs, Asa T. Crawford and S. J. Everett of Williamston.

The electric street-railway company at Owensboro, Ky., will expend $50,000 in improvements during the coming summer, it is said.

The Southern Power Company of Charlotte, N. C., is securing right-of-way to run transmission lines to Gaffney, S. C., and other nearby points, from its electric waterpower development at Ninety-Nine Islands and Gastonia Shoals. L.

Ohio.

Toledo, May 11.—Specifications for $187,500 worth of electrical apparatus to be used for power stations for the Lake Shore Electric at Fremont and Beach Park were filed in Fremont last week. The specifications cover the equipment bought of the Westinghouse company.

At Bucyrus the Ohio Central railroad shops are being fitted out with an electric crane.

There is a movement on foot in Youngstown to utilize the waterpower of the Mahoning River for the city lighting. At present there is a committee at work trying to cut down the expense of electric lighting, and this committee has had engineers engaged to report on the building of a dam in the river and the construction of a municipal lighting plant. It is understood that they have reported favorably.

The Canton Light, Heat and Power Company of Canton has absorbed the property of the Merchants' Heat, Light and Power Company, recently organized. The Canton company will continue to operate the plant of the Merchants' company as well as its own.

The Village Council of Cridersville has sold the electric-light plant and a five-acre tract, including several factory buildings, to a number of Lima men connected with the Fort Wayne, Van Wert and Lima Traction Company, the highest bidders. H. L. S.

Indiana.

Indianapolis, May 11.—It is rumored that the five syndicates that now own all but two interurban lines in this state are planning for the merger of all the lines in the state, and to include also all the street railways in Indianapolis, Evansville, Terre Haute, South Bend, Michigan City, Laporte, Lafayette, Richmond, Goshen, Elkhart, Anderson, Muncie, Marion, Wabash and other cities. Members of one syndicate hold stock in all the other syndicates so that the merger will simply be a rearrangement of stock in the name of a single company.

W. H. Palmer of the Indianapolis and Louisville Traction Company reports all track laid between Louisville and Scottsburg and that the new power house in Scottsburg will be tested next week. Immediately upon the arrival of the new cars service will be inaugurated.

The Fort Wayne and Wabash Valley Traction Company has completed its extension between Logansport and Lafayette. This line parallels the Wabash Valley steam road the entire 42 miles and crosses it twice with underways. The road connects with six steam roads en route and with five interurban lines and promises to be a profitable extension to the system.

It is understood that the steam and interurban railroads of Indiana have agreed to grant no reduced rates for any occasion whatever. The transportation committees say that in view of the recent two-cent law concessions of all kinds are being justly withheld. The electric roads are unwilling to cut their rates, inasmuch as they know that their equipment will be inadequate to handle the big crowds on various summer outings, and it will be inadvisable to offer inducements for increased travel when they will be taxed to transport the people at the usual rate.

The Indiana Railroad Commission has appointed Alexander Shane and David E. Matthews as railway inspectors to keep informed of the steam and electric railroads as to the compliance with lawful devices calculated to render greater security to employes and the traveling public.

An injunction has been asked by the receiver of the Fort Wayne Gas Company against the city of Fort Wayne to prevent the city from interfering with its plan of using its old natural gas mains for the distribution of artificial gas. The city has refused to allow the company to use them for artificial gas at a rate higher than 75 cents a thousand feet. There are 22 miles of mains in good serviceable condition.

The contract for the purchase of the Consumers' Gas Trust Company mains in Indianapolis by the Citizens' Gas Company has been closed. The price paid is $409,061. This company has a franchise to manufacture and sell gas at 60 cents per thousand feet.

The Central Indiana Heating Company, with a capital stock of $3,000,000, has been incorporated, with main office in Bloomington. The company takes in the plants of Alexandria, Shelbyville, Columbus and Summitville, and will do a large business in the installation of gas, electric light, power and heating plants, with branch offices in each of the cities named. William Wherry, J. W. Torbin and I. L. Mellon are directors.

The electric-light plant, a municipal venture of Washington, Ind., which has proved to be a failure, will now be taken charge of by the City Council to be directed by that body instead of through an intervening board of trustees. The situation has come to a crisis.

At a recent meeting of the State Board of Agriculture it was decided to erect a waterworks and electric-light plant on the State Fair Grounds. Bids will soon be invited to construct and equip the plants.

The King Manufacturing Company, State Life Building, Indianapolis, has incorporated to manufacture a patented rotary engine invented by J. M. King. A large factory will be equipped at once. D. W. Bolen is president, J. H. King secretary, and J. M. King general superintendent. S. S.

Illinois.

Peoria, May 11.—Eddebrock Bros. are erecting an electric-light plant at Chapin and will soon have it in operation.

The Senate at Springfield has defeated the bill which provided that cities could own and operate gas and electric-light plants. The bill also gave the municipalities the right to regulate the price of gas and electric light.

The Illinois Traction Company stole a march on the Terminal Railway at Venice, Ill., by laying its tracks and switches over the Terminal's track at night. This will give the traction company track right up to the Mississippi River front on the east side. In the immediate vicinity will be built a new bridge, and in the meantime the company will transport its cars across the river by ferry.

The Illinois Traction System has appointed S. K. Holland, formerly of Springfield, traffic manager of the Peoria-Bloomington line and he has opened an office here in connection with the Peoria Terminal Railway. At present only passengers are carried, but it is expected that by the last of the month it will be ready to carry both freight and express. The company is building a temporary shop at Decatur to use until the large shop is finished which will be in the fall. The shop is needed now to make repairs on the coal cars now operated by the company. It now has 250 of them and has just given an order for 50 more.

It is now reported that all the interurbans under the control of Congressman McKinley have been consolidated into one company. Heretofore there have been two companies, one controlling the northern properties and the other the southern. The southern properties have been under the control of Canadian men and the other has been controlled by men of Portland, Me. The extending and connecting of properties will now be pushed as fast as possible. This is important as it makes the Chicago-St. Louis line a greater possibility. The company to build the line has been incorporated, and as soon as the Lincoln-Mackinaw line is built this city will have a line clear to St. Louis. The plan then is to build from here to Ottawa and Joliet, there connecting with a road now operating to Chicago, thus making a through line between the two cities.

The highway commissioners have given to the Peoria Gas and Electric Company permission to extend its pipes and build pole lines outside the city, in Richwoods Township.

The McKinley syndicate has bought the Quincy Horse Railway and Carrying Company. This company is to be united with the Traction and Light Company which owns the street railways and the lighting plants in Galesburg and La Salle and the Illinois Valley road running north to Ladd.

The Interstate Commission has been quietly investigating electric roads to see if they have complied with the law requiring safety appliances. The time to equip the roads has been extended several times, but some are still not equipped as required. It is now proposed to institute proceedings against the roads at fault. V. N.

Northwestern States.

Minneapolis, May 11.—An "air-line" electric railway from the Twin Cities to Duluth and Superior is promised by the new Twin City and Lake Superior Railway Company, which has just been formed by W. H. Crossland of Minneapolis and E. W. Farnham of Chicago, the latter being the president of the new company. They announce that they will have the line completed within two years.

The North American Telegraph Company has moved into its new offices in the Phœnix Building, where an entirely new equipment has been installed.

An increase in the wages of all conductors and motormen in the Twin Cities and Duluth and Superior has been voluntarily announced by the Twin City Rapid Transit Company.

The La Crosse (Wis.) City Railway Company has decided to increase its capital stock from $250,000 to $500,000. Extensive improvements are being planned.

Power has been turned on through the first generating unit of the Great Northern Power Company's plant near Duluth, Minn. This unit is capable of providing 10,000 horsepower, and a second of similar capacity will be completed within a few weeks.

The Northern Hydro-electric Company of Oshkosh, Wis., has secured sites on the Peshtigo River and will erect power plants which will generate about 20,000 horsepower. F. H. Josslyn heads the list of stockholders of the new company. It is capitalized at $2,000,000.

The Wagner (S. D.) Lake Shore and Armour Company has been incorporated to build a trolley line connecting those towns. It is capitalized at $1,000,000 and A. H. Pease heads the list of stockholders.

G. H. Gard, city clerk of Fergus Falls, Minn., will receive bids until May 28th for the construction of a concrete dam and power house for the municipal electric-light plant. R.

Mexico.

Mexico City, May 8.—Messrs. McQuatters & Truehart, who have the contract for constructing the electric street railway in the city of Parral, state of Chihuahua, will soon begin the work of construction.

Carlos F. de Landero, manager of the Bank of Hidalgo in the city of Puebla, is organizing a company for the purpose of installing a hydro-electric plant on the Tuxpan River, near the town of Tuxpan, state of Jalisco. It is estimated by experts that 15,000 horsepower can be developed. It is proposed to transmit this power to Tuxpan, Colima, Manzanillo and a number of other towns and industrial centers of that region. Mr. Landero has purchased the Rio Blanco Falls near Guadalajara, where the company will install a hydro-electric plant.

Colonel Samuel Garcia Cuellar of Mexico City has taken steps toward installing a hydro-electric plant on the Chuta River in the state of Michoacan.

Inigo Noriega of Mexico City has been granted a concession by the Mexican government to build an electric railway from Mexico City to the town of Chalco, a distance of about 20 miles.

J. C. Avendano of Mexico City will install a hydro-electric plant on the Humaya River, district of Culiacan, state of Sinaloa. The power will probably be transmitted to Culiacan and other towns of that section.

The dam which was being built across the Chuviscar River near the city of Chihuahua for the purpose of affording power for that city as well as its water supply was recently destroyed. The dam will be reconstructed as rapidly as possible.

Frank G. Stevens of the Favor Mining Company has made application for a concession to install a hydro-electric plant on the Santiago River in the state of Jalisco.

Makeever Bros. of New York are preparing to install a hydro-electric plant with a capacity of

1,000 horsepower at Real Alto, state of Jalisco. The plant will be located on Los Reyes River and will be for the purpose of furnishing power for the mines which Makeever Bros. own in that district.

W. D. H.

Pacific Slope.

San Francisco, May 8.—The strike of the platform men which was declared early Sunday morning, May 5th, by a vote of the union employes of the United Railroads of San Francisco has resulted in the complete tying up of that system, covering nearly 200 miles of track in the city and suburbs. The tie-up is complete with the exception of a few blocks of electric road operated by the Presidio Ferries Railway in the extreme northern part of the city. Instead of paying 10 cents as in previous strikes to ride in an express wagon from "the Ferries to Fillmore," it is now 25 cents by wagon and 50 cents by automobile. The first attempt at using strike-breakers under Farley's management was made on May 7th. This resulted disastrously to about 20 persons, who were shot by bullets fired by the desperate Farleyites who were intimidated by mobs of men and boys who bombarded the cars with brickbats lying conveniently at hand in the ruins. Six cars were run down Turk Street toward the business center, but were overtaken by the mob before the intersection of Market Street was reached. When the rioters swarmed over the cars the strike-breakers opened fire indiscriminately, bringing down innocent bystanders, striking carmen, policemen and several chauffeurs of pursuing automobiles. About 1,000 shots were also fired from the car barns, where Farley's men were intrenched, into the crowds surrounding the barns on Fillmore and Turk streets. Several persons were struck. Two victims are dead and two more are mortally injured. On the 8th the police department, awakened to the seriousness of the situation, kept the crowds a block away from the barns and disarmed every strike-breaker who came outside. The militia will be called out if lawlessness continues.

The Pacific Telephone and Telegraph Company is keeping its local and long-distance lines in working order, notwithstanding the desertion of all but a handful of its 600 girl operators a few days ago. Sleeping accommodations are now provided at the exchanges for operators who are timid. The girls had formed a strong union and demanded certain concessions as to recesses, manner of supervision, wages and hours. Emergency calls are given the first consideration, but the service in general is very good, considering the extremely reduced force at the switchboards. The company claims to have increased its strike-breaking operators from 28 to 150. The operators' union is affiliated with the local labor council and sympathetic strikes of the telephone linemen and members of other unions are possible. At the last meeting the linemen decided to defer action for one week, and it is hoped that a compromise between the operators and the company may be arranged in the meantime so that the public will not be menaced by the danger of having their lights cut off as a result of a sympathetic strike of the employes of the electric-lighting and gas companies.

Samuel Naphtaly, who has the general management of all of the electric power plants in which the Fleishhacker Bros. of San Francisco are interested, has returned from New York. He went East on business connected with the equipment for the local steam plant which the City Electric Company is erecting on the San Francisco water front at North Beach. The station is being constructed of reinforced concrete by Frank B. Gilbreth. Two 2,500-kilowatt Westinghouse-Parsons turbo-generators will soon be installed and underground conduits are being laid through districts where there is a heavy demand for light.

The General Electric Company, which has had the main office of its Pacific Coast district agency located in Oakland since the great fire, has removed to San Francisco. The entire tenth floor of the reconstructed Union Trust Company's building on the corner of Post and Montgomery streets is occupied.

Charles A. Wilson of the United States Signal Corps has been instructed to install wireless plants on all of the army transports in Pacific waters. The transport Thomas, which is about due from Manila, will be equipped first.

A very extensive electric-railway and hydro-electric power plant project has been planned by eastern capitalists for the state of Washington. An investment of $40,000,000 in the aggregate is talked of. The plan includes the construction of waterworks and electric power plants in the towns between Tacoma and Spokane, the supplying of water and light and furnishing electric railways with power. It includes the completion of the proposed Puyallup Valley and Northern Rapid Transit Railway at a cost of $2,500,000. The Snohomish Valley Railroad, which is under construction, is to be completed at a total cost of $3,000,000. A third electric line is included in the plans in the country tributary to Spokane, Wash. A large electric power plant at Tacoma is also under consideration.

There has been filed in Portland, Ore., a trust deed for $15,000,000 in favor of the Trust Company of North America covering all the properties of the Portland Railway, Light and Power Company. The amount of the mortgage is half the value of the properties owned by the company. It will provide for taking up underlying bond issues against subsidiary corporations owned by the Portland Railway, Light and Power Company, and will also provide for extensions and improvements. It is the purpose of the company to spend $1,250,000 this year on improvements of various kinds. The second Cazadero power plant is provided for in the mortgage.

A.

PERSONAL.

W. R. Sweaney has resigned his position with the Minneapolis General Electric Company to accept a position with the Savannah (Ga.) Electric Company.

Prof. P. B. Woodworth of Lewis Institute, Chicago, gave an address before the Electrotechnic Club of Fort Wayne, Ind., on the evening of May 7th. The subject of the lecture was "The Engineer's Curve."

Perrin Kellogg, a lawyer and electric-light plant owner, died at Whitefield, N. H., recently. Mr. Kellogg was largely interested in the Whitefield Electric Light Company and he also owned a large interest in a plant at Marshfield, Vt.

Charles H. Haswell, who was undoubtedly the oldest civil engineer in the United States, died at his home in New York city on May 12th at the great age of 98. He was once engineer in chief of the United States Navy. Until a short time ago he remained active in the practice of his profession.

Hector W. McKay, formerly superintendent of the Boston and Worcester Street Railway Company, has been appointed superintendent of the New Hampshire Electric Railways at Haverhill, Mass. Mr. McKay supersedes C. P. Hayden, who has been given the superintendency of the western division of the system.

Charles H. Clark, engineer of maintenance of way of the Cleveland (Ohio) Electric Railway Company, will shortly enter the service of the International Traction Company of Buffalo. Mr. Clark's position with the Buffalo company will be similar to that held by him in Cleveland. He is the inventor of a well-known cross-over switch.

N. P. Wilcox of Medfield, Mass., has been appointed general manager of the Woonsocket (R. I.) Electric Machine and Power Company, the control of which has passed from the citizens of Woonsocket to the firm of Estabrook & Co. of Boston, which is said to represent the Sayles interests of Pawtucket, and which owns the Woonsocket Gas Company as well as the lighting plants of the towns and cities between Woonsocket and Providence.

Edward B. Moore of Michigan was appointed by the president on May 10th to succeed Frederick I. Allen as commissioner of patents. Mr. Moore, who is the present assistant commissioner, won his appointment through merit. After serving in various government departments, he was appointed to a position in the Patent Office, and in 1900 was sent to the Paris Exposition. While absent he was made assistant commissioner by President McKinley, and reappointed by President Roosevelt.

The Portland (Ore.) Railway, Light and Power Company at its recent directors' meeting in New York elected C. M. Clark of the banking firm of E. W. Clark & Co. of Philadelphia, to succeed the late Henry W. Goode as president of that corporation. Mr. Clark, who has been interested in the Portland street-car lines for the last two years, will maintain his residence in Philadelphia and later may name a representative in Portland. M. S. Hopkins, consulting engineer for the Clark interests, will soon visit Portland.

At the moment of going to press the Western Electrician learns with great pleasure that Mr. B. E. Sunny of Chicago, western manager for the General Electric Company, has been appointed first vice-president of the company, succeeding the late General Griffin. This exceptionally interesting piece of news will be received with the greatest pleasure by all electrical men of the West, by whom Mr. Sunny is held in high esteem. It is believed that Mr. Sunny will continue to make his headquarters in Chicago. The Western Electrician begs to offer its congratulations no less to the company than to Mr. Sunny.

Henry C. Porter, well known in storage-battery circles as an inventor and designer, died on May 3d at his home in Evansville, Ind. Mr. Porter was born in Sandy Creek, N. Y., in 1858, and spent the greater part of his life as a worker with electrical devices. For the last 20 years he had devoted most of his time to storage batteries. In 1896 Mr. Porter organized the Porter Battery Company of Chicago, owning personally all the patents that applied to his various forms of batteries. The Evansville Battery and Electric Company of Evansville, Ind., was formed in 1905 to manufacture storage batteries of the type covered by Mr. Porter's patents, and he then became vice-president and general manager of the company. The decedent had been in poor health for several years, his death being due, it is believed, to locomotor ataxia. Mr. Porter was a believer in the operation of street railways by storage batteries. A widow and four daughters survive him.

F. W. McAssey, formerly auditor of the Rockford (Ill.) and Interurban Railway Company has been appointed general superintendent of the company. Mr. McAssey has been with the company for almost 15 years. W. H. Dunerly of the Utica (N. Y.) and Mohawk Valley Railway Company will take Mr. McAssey's old position.

ELECTRIC LIGHTING.

Dawson, Minn., has voted bonds for a municipal electric-light plant.

Valley City, N. D., is contemplating installing a municipal lighting plant.

The Casper Electric Light Company will erect a larger plant at Casper, Wyo.

F. W. Curtis has sold his electric-light plant at Bowie, Tex., to Writhe Bros. & Co.

Fire on April 29th wrought much damage to the Union City (Pa.) electric-light plant.

E. E. McKee has been granted a franchise for an electric-light plant at Cantril, Iowa.

Application for an electric-lighting franchise has been made by W. C. Blair of Moravia, Iowa.

H. J. F. Heiberg has been granted a franchise for an electric-light plant in Twin Valley, Minn.

J. B. Thon of Owatonna, Minn., proposes to erect an electric-light and steam-heating plant in that town.

The Tuscarawas County Electric Light and Power Company of New Philadelphia, Ohio, has been capitalized at $200,000 by W. E. Fox, H. S. Irving and others.

A stock company, consisting of members of business concerns, has been formed in Toyah, Tex., for the purpose of conducting an electric-light and power system.

The Ithaca (N. Y.) Electric Light and Power Company has, it is said, closed a contract with the Fort Wayne Electric Works for a new switchboard to cost $10,000.

The Cortland County Lighting Company has been incorporated for $250,000 by J. J. Hatch, A. McCausland and others. The office of the company will be in the town of Cortland, N. Y.

The Northern Colorado Power Company has completed plans for the erection of a $1,000,000 power plant at Cheyenne, Wyo., to replace the plant of the Cheyenne Light, Fuel and Power Company.

The contract for the erection of the building to house the gas and electric-light plants of the Central New York Power Company at Canastota, N. Y., has been let. It is said that the plant complete, including machinery, will aggregate an outlay of over $30,000.

The electric-lighting plant of the Vincennes (Ind.) Light and Power Company has been sold to the Vincennes Electric Company, a corporation recently formed of Boston capitalists. The price paid was $20,000. Albert Heitz of Vincennes will be appointed manager of the plant, it is said.

Thirty-one contracts for electric signs—display, outline and window lighting—were closed in March by the Denver Gas and Electric Company. Sixty-four contracts for electric power were signed with the company in March, 426 horsepower being called for in these contracts. These are the results of an aggressive, up-to-date business-getting policy.

Articles of incorporation have been filed by the Idaho-Washington Light and Power Company. The new corporation is a successor to the Moscow (Idaho) Electric Light and Power Company. The capitalization is $500,000. The object is the furnishing of light, heat and power for domestic and public uses. Eleven towns are now being served by the corporation, and this number is being gradually increased.

The officers of the Lancaster County Railway and Light Company of Lancaster, Pa., have retired from office. President W. W. Greist has been succeeded by George Bullock, president of the United Gas and Electric Company of New York; Vice-president C. B. Keller has been succeeded by R. E. Griscom of Philadelphia, and M. E. Dodge of New York succeeds John S. Graybill as secretary and treasurer.

ELECTRIC RAILWAYS.

The Bristol Tramways and Carriage Company, operating the tramways of the city of Bristol, England, recently purchased an Allis-Chalmers vertical cross-compound Reynolds Corliss engine, which will be installed in the central power station at Bristol to drive a 1,000-kilowatt direct-coupled direct-current generator. The Bristol station now contains

four such engines, somewhat smaller, which have been in continuous operation for eight years.

The Electric Transportation Company of Seattle, Wash., has been incorporated for $50,000 by C. J. Zinthes, E. M. Farmer and others.

John L. Clawson of Philadelphia has been appointed receiver of the Atlantic City and Suburban Traction Company which operates a 15-mile trolley line.

The Denton (Tex.) Interurban Railway and Power Plant Company has been incorporated for $100,000 by H. M. Griffin, W. W. Wilson and others.

The Baltimore and Annapolis Short Line Railroad Company has arranged for the sale of $750,000 in bonds, and the proceeds are to be used for converting the road from steam to electric operation and for other purposes. Electric power will be supplied by the Consolidated Gas, Electric Light and Power Company of Baltimore.

A power house and plant to cost $250,000 will be located at Ashland, Ohio, by the Cleveland, Ashland and Mansfield Traction Company. The company recently purchased 75 acres of ground in that town. It will furnish power for the company's line from Ashland to Mansfield; also, it is said, for the Ohio Central lines, and possibly for the Cleveland and Southwestern line.

The Southern Engineering and Construction Company of Pine Bluff, Ark., has secured a 50-year franchise from the city of Russellville, Ark., for an electric railway and light plant, and the company proposes to build in connection with the new enterprise an interurban line from Russellville to Dover, Ark. About $200,000 will be spent in the enterprises. Adam J. Robinson of Pine Bluff is president of the company.

Following reports on the increasing number of railroad accidents caused by broken rails, an important step has been taken to bring about an improvement in the steel-rail product. Experts named by the American Railway Association and the steel manufacturers will make an investigation of conditions, and it is believed the manufacturers and railroad managers will agree upon a standard of excellence that should not be questioned.

A bill has been introduced into the Illinois Legislature providing that railroad companies shall erect railings on the elevated-station platforms for the protection of passengers, and that they shall not run trains closer than 25 feet to each other. The bill seems to have been inspired by the fact that at intervals a passenger meets death in attempting to board an elevated train after the car gates have been closed. The bill if passed may cause a considerable change in the manner of operating the elevated railways in Chicago.

President T. E. Mitten of the Chicago City Railway Company has notified the street-car employes' union that its demand for a higher increase in wages than that offered by the company cannot be entertained. The company's offer is 23 cents an hour for employes who have worked for less than three months, 25 cents for those who have served less than a year and 27 cents for old employes. The demand of the union is 25 cents for men who have worked less than three months and 33⅓ cents for employes longer in the service of the company.

Contracts for electric-railway equipment have just been closed by the Chicago, Lake Shore and South Bend Railway Company with the Westinghouse Electric and Manufacturing Company of Pittsburg. The company was organized some time ago by a number of Cleveland capitalists, among them being J. B. Hanna, E. G. Tillotson and R. F. Lang. The sum of $2,500,000 is being spent by the company in the enterprise and the single-phase system is to be adopted. In the power house there will be to begin with three 3,000-horsepower Westinghouse steam turbines, three generators of corresponding capacity and the requisite switchboard appliances. The new road will be 70 miles long and will connect a number of towns in Illinois and Indiana. The road will open with 31 cars, each equipped with four 100-horsepower single-phase motors.

POWER TRANSMISSION.

At Vallicita on the Stanislaus River in California a new power-transmission plant is to be constructed. The installation will include three water-wheel units of 12,000 horsepower each. The power will be transmitted, it is said, to San Francisco and will be tapped for use in the southern mines and in the upper San Joaquin Valley.

The Northern Hydro-electric Company, which has been organized in Oshkosh, Wis., with a capital of $2,000,000, will undertake one of the largest improvements in undeveloped waterpower in Wisconsin. The new company's field of operation is the Peshtigo River, which empties into Green Bay half way between Lake Michigan and the mouth of the Fox River. The company has secured three waterfalls which it will dam up and use in making electric energy. It claims that the falls can furnish about 20,000 horsepower. The electric power may be transmitted to Marinette, Menominee, Green Bay and possibly to Oshkosh.

Oshkosh (Wis.) capitalists are said to have secured options on land at various points along the Little Wolf River. It is proposed to "harness" the river and provide power for nearby towns. Leander Choate, F. W. Josslyn and Caspar Faust are among those interested.

The York Haven Water and Power Company of York, Pa., has increased its bonded indebtedness from $2,500,000 to $4,000,000. It is proposed to add another 10,000 horsepower to the current capacity of the plant at once and to extend another cable across the Susquehanna River.

Work has been commenced by the St. Anthony Falls Water Power Company on a new electrical power house on the east bank of the Mississippi at Minneapolis, Minn. The company will put in a plant at an expenditure of $300,000, nearly $1,000,000 being saved, it is said, by the fact that the present dams in the river will not have to be altered. The new power house is expected to generate at least 14,000 horsepower, making the total horsepower generated in Minneapolis 58,000. The new plant will be fitted with the most modern equipment.

A company has been organized to control electric power in Southern Colorado, with a capital of $10,000,000. It has a three months' option on the Trinidad (Colo.) Electric Street Railway Company, the Trinidad Electric Light and Power Company, the Walsenburg electric-light plant and other electric plants. It is said that the company will control practically all the electric power south of Pueblo and will be known as the Southern Colorado Power Company. The estimated value of the plants on which it has an option is said to be $5,000,000.

The waterpowers of Peru, their development and possible application, form the subject of an interesting investigation undertaken by Mr. Emile Guarini, formerly of Brussels, Belgium, who is professor of physical and electrical science at the Escuela de Artes y Oficios of Lima, Peru. Mr. Guarini describes the amounts and relative locations of the waterpowers of Southern Peru, the feasibility of their development, the present and prospective demand for power in the locality, and the possible application of electricity to old and new industries, the Tambo Valley and Lake Titicaca being the sources of supply, and the towns of Mollendo and Arequipa the markets for consumption of the power produced. Through the efforts of Mr. Guarini, a petition is now before the Peruvian Congress urging the appointment of a special commission to make surveys and reports on the feasibility of such a development as he outlines and to prepare estimates on the probable cost of construction, with a view of drawing up a bill of conditions governing a concession under which foreign capital will be invited to undertake the project.

PUBLICATIONS.

The Ward Leonard Electric Company of Bronxville, N. Y., has issued a pamphlet entitled "Motor Starters versus Fire Starters," giving its side of the controversy in relation to the enclosed versus ventilated types of rheostats.

The Automatic Electric Company, Chicago, is sending out an attractive postal card requesting those interested to write for information about "Automatica." The desirability of secret communication in some instances is graphically shown.

The Robbins & Myers Company, Springfield, Ohio, is mailing a very neat bulletin, No. 55, telling of its "standard" direct-current bracket, desk, exhaust and ceiling fans. The 500-volt "special" is a large fan, specially wound and insulated, for running on street-railway and other 500-volt power circuits.

The Electric Storage Battery Company of Philadelphia has just issued the tenth edition of its Price List X., which describes the Exide type of battery in electric-vehicle and sparking service. A copy of this price list will be forwarded upon application to any of the company's sales offices or Exide depots.

In advance of a complete catalogue which the Minneapolis Steel and Machinery Company intends getting out on the Twin City Corliss engine the company has published a handsome brochure, No. 101, illustrating and describing the details of this engine. The company will be pleased to send a copy of the brochure to anyone asking for it.

The Western Electric Company is about to issue the 1907 edition of its supply catalogue. This will be a large volume of 700 pages, and will list everything of any importance in the electrical line. The supply catalogues which have been gotten out by the Western Electric Company in the last few years have been greatly in demand by dealers and those interested in electrical supplies all over the country, because, while the catalogues are primarily published to furnish a complete list of all material handled by that company, they contain many features of general interest. The edition for this year will be much more complete and instructive than any of its predecessors. The company has instituted an entirely new organization in its advertising department, now in charge of Mr. Howard M. Post. It is understood that Mr. Post is instituting numerous new systems in advertising, and that the results so far are highly satisfactory.

Joseph Dixon Crucible Company, Jersey City, N. J., is sending out a calendar on which appears a picture of the mammoth City Investing Building, now in course of construction in New York city. The structural steelwork of the building above the street level, the calendar says, will be protected from corrosion with Dixon's silica graphite paint.

The various types of Tuerk alternating-current ceiling fans are described and illustrated in an attractive booklet published by the Hunter Fan and Motor Company of Fulton, N. Y. It is asserted that the variety of Tuerk fans as now made meets the varied needs of fan users the world over, and the quality is right, as proven by years of practical use. The booklet contains valuable information for fan users.

Manifestations of wonderful progress and prosperity in the South were the inspiration for a pamphlet of 72 pages, entitled "Facts About the South," written by Mr. Richard H. Edmonds, editor of the Manufacturers' Record, and just published. In it the whole story of southern material upbuilding, the romance of the South's redemption from poverty to prosperity since 1880, and the resources of this section in coal, iron, timber, phosphates, cotton and other wealth-producing resources are dealt with, recognizing the natural resources of the fields, the forests, the mines and the watercourses.

The high class of the work accomplished by the Bureau of Standards of the Department of Commerce and Labor, Washington, D. C., is reflected in the excellence of the "Bulletin" issued by the Bureau. No. 3 of Vol. II. and No. 1 of Vol. III. are the latest to appear, and they contain some valuable technical papers. Among the subjects treated in the issues mentioned are the following: "Preliminary Measurements on Temperature and Selective Radiation of Incandescent Lamps," by C. W. Waidner and G. K. Burgess; "On the Determination of the Mean Horizontal Intensity of Incandescent Lamps by the Rotating Lamp Method," by Edward P. Hyde and F. E. Cady; "Purity and Intensity of Monochromatic Light Sources," by P. G. Nutting; "The Compensated Two-circuit Electrodynamometer," by E. B. Rosa; "A Comparison of the Unit of Luminous Intensity of the United States with Those of Germany, England and France," by Edward P. Hyde. Mr. S. W. Stratton is director of the Bureau and Mr. E. B. Rosa is acting director. Copies of any of the papers already published will be furnished free on request to the Bureau.

The Indiana Rubber and Insulated Wire Company of Jonesboro, Ind., has issued a catalogue describing and illustrating Paranite and Peerless rubber-covered wires and cables. The company asserts that the ingredients used in the Paranite formula have every feature to withstand the corrosive elements met with. Paranite insulation is said to be impervious to the action of air or water and to the greatest extremes of heat or cold. It consists of a white core or a thin coating of Para rubber over tinned copper wire, upon which is placed the standard thickness of black Paranite. Peerless rubber-covered wire is practically the same as Paranite except that it is not given the white inner coating, but the single coating of black insulation of standard thickness is prepared as a combination of the qualities of Paranite insulation. Both Paranite and Peerless wires and cables are covered with cotton braids of various sized thread to correspond with wire sizes. Much valuable information for the architect, contractor and wireman is given in the book relative to wire sizes, weights, resistances, etc. A number of useful tables appear, together with a photographic reproduction of the portions of the National Electrical Code under which Paranite and Peerless wires are manufactured.

SOCIETIES AND SCHOOLS.

"They do say that Commercial and New-business Day at the Washington convention of the National Electric Light Association, June 7th, will be a record-breaker. You can attend the convention and the Jamestown Exposition in the one trip. Why don't you be a co-operator?" Thus the siren voice of Mr. J. Robert Crouse.

The University of Illinois, Urbana, Ill., has published a booklet in which is given information concerning the instruction now offered at the university to those who wish to prepare for service in the various departments of steam and electric railways. Various departments in the College of Engineering and the College of Literature and Arts of the university have heretofore given effective training for railway work, but a distinct department under the name of the School of Railway Engineering and Administration will now offer instruction and training in this work. There will be four courses, viz., railway civil engineering, railway electrical engineering, railway mechanical engineering, railway

administration. The university now has about $600,000 in buildings and apparatus devoted to engineering, and a transportation laboratory will be added. Besides the use of these, the new department has several model test cars, a locomotive and other similar equipment.

At a recent meeting of the executive committee of the National Electric Light Association a large number of new members were admitted—17 in class A, 25 in class B, 5 in class D and 5 in class E. One of the central-station companies admitted in class A is in Havana, Cuba, while among the individual members are P. H. Bartlett of Philadelphia Electric Company and L. A. Osborne and C. E. Skinner of the Westinghouse Electric and Manufacturing Company. The Jandus Electric Company of Cleveland was one of the manufacturing companies admitted. As chairman of the membership committee Mr. J. Robert Crouse is making an active campaign for new members.

MISCELLANEOUS.

The submarine boat Lake made standardizing runs over a measured mile course at Newport, R. I., a few days ago, running continuously for 4½ hours without a hitch. Eleven runs were made, the first three with gasoline engines and electric motors, both coupled onto the shafts, giving the craft her maximum power. The engines are intended for surface running and for charging the batteries. The motors are for the submarine work.

Speaking of the problems of aerial navigation, Prof. Alexander Graham Bell is quoted as follows: "The problem of aerial navigation already is solved and America is in advance of the rest of the world in heavier-than-air flying machines. It is merely a question of time until the progress of aerial navigation will make it possible to have dinner in America and breakfast the next morning in Europe. I believe an airship will be perfected capable of flying at the rate of 175 to 200 miles an hour. Even aerial fighting machines for use in war probably will be created." Mr. Bell gives great credit to Octave Chanute of Chicago, author of "Progress in Flying Machines," to whose efforts and inspiration, he says, much of the progress made in America is due.

It is stated that satisfactory results have been obtained at Sheffield, England, with the electrical furnace for the tempering of steel. The requisite temperature can be maintained with great precision, and there is a marked saving of time as compared with the former process. Thus in tempering drills, which formerly took 1½ hours to reach the desired temperature, the time required in the electric furnace was only 14 minutes, and other tools gave equally good results.

Power from Niagara to send a ship across the Atlantic by wireless transmission to the ship is what is believed possible by Lewis Nixon, the well-known expert in naval construction. In a recent interview Mr. Nixon is credited with saying: "A way may be found to realize certain waves of magnetic or electric influence that are undoubtedly a part of the energy of this earth of ours. These currents are inherent to the earth itself and are generated by the perpetual motion of the world around its axis."

The United States Civil Service Commission will hold examinations on June 5 and 6, 1907, to fill two vacancies in the position of piece-work computer, Naval Observatory, Washington, D. C., and similar vacancies as they may occur in that observatory. The work pays from $800 to $1,200 a year. The examination covers pure mathematics, astronomy, practical computations, and training and experience. Citizens 20 years of age or over (preference in appointment being given to eligibles under 35 years of age) are eligible to take the examination. Applications may be made to the United States Civil Service Commission, Washington, D. C.

Electrically operated baggage trucks, such as are used at railroad stations to carry trunks to trains, are now said to be in use. The general appearance of the trucks is similar to that of the old hand-pulled ones, but beneath the platform are a storage battery and an electric motor. It is important that these trucks must neither run away nor get beyond control if accidentally left standing. In this respect they have proved satisfactory. Their speed is controlled from a small lever fastened on the tongue by which they are steered, and it is further arranged so that if this tongue is dropped or let down the current is shut off and the brakes are put on. A catch is also provided, so that the tongue can be fastened up against the front of the truck, in which position the current is also shut off and the brakes are held on the same as when the tongue is on the ground.

TRADE NEWS.

On May 15th Berthold & Jennings, St. Louis, Mo., dealers in poles and ties, removed to their new offices, 1302-1305 Lumbermen's (Wright) Building.

The Abner Doble Company, engineer, of San Francisco, has appointed Misui & Co. to act as its agents in Japan, Korea, China and Manchuria, for the sale of Doble tangential waterwheels and hydraulic apparatus.

The H. C. K. Company, manufacturer of electrical and mechanical applicances, New York city, has moved its offices from 45 Broadway to 30 Greenwich Avenue, so as to secure larger quarters and to consolidate the offices with the factory.

Mr. C. R. Wood, sales manager of the Moline Incandescent Lamp Company, Moline, Ill., passed through Chicago last week on his way East. Mr. Wood says that the demand for Moline lamps continues brisk and that the outlook was never better.

J. B. Horne, president of the Crown Electrical Manufacturing Company of St. Charles, Ill., has sold his interest in that concern to William McCredie and Thomas McBride of Elgin. A new building for the plant, to cost $25,000, will be erected, it is reported. The company manufactures gas and electric fixtures.

BUSINESS.

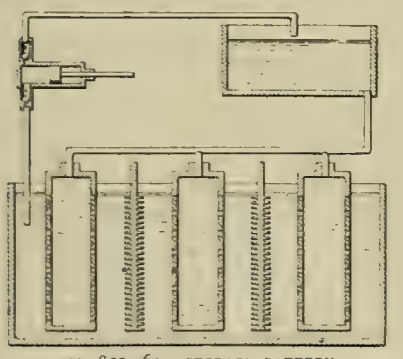
Among orders recently received by the Bliss Electric Car Lighting Company of Milwaukee is one from the Baltimore and Ohio Railroad to light the Royal Blue limited trains with the Bliss system of electric car lighting.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 7, 1907.

852,414. Circuit-making and Breaking Device. Samuel Bouton, Lynn, Mass., assignor of one-half to Albert B. Black, Concord, Mass. Application filed February 10, 1906.

The device comprises a contact carrier, a pivot therefor, means to adjust the contact carrier about the pivot, and a contact stud insulated from and arranged to slide upon the carrier longitudinally of the pivot.



NO. 852,464.—STORAGE BATTERY.

852,424. Secondary Battery. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed November 28, 1902.

The battery includes a can with a threaded opening, a number of plates and a conductor connected to the plates and extending through the opening. A washer surrounds the conductor in the opening, a nut being threaded into the opening and engaging the washer to expand it diametrically.

852,438. Process for the Extraction of Metals from Their Ores. Richard Lamb, New York, N. Y. Application filed December 22, 1902.

The process described consists in reducing the ores to a granular condition, placing the ores within a closed leaching vessel, introducing a quantity of acidulated solution derived from copper by electrolysis, forcing SO2 into the vessel whereby free sulfurous acid will be formed and a further solution of the copper effected, separating the solution from the residue. The solution is then subjected as an electrolyte to a current of electricity and deposits between insoluble anodes and cathodes, upon the latter will be deposited and the solution will regain its acidity. The solution is finally recirculated for leaching fresh charges of ore.

852,452. Machine for Making Impressions. Francis H. Richards, Hartford, Conn., assignor to the American Typographic Corporation, a corporation of New Jersey. Application filed July 24, 1906.

An electromagnet is employed having an electrically-actuated device in operative connection with a frame-shifting lever and effective for actuating the lever to shift the frame, an electrical circuit being connected to energize the magnet. A key-actuated circuit closer is located in the circuit and operative for controlling the energization of the magnet.

852,464. Storage Battery. Edward Sokal, Binghamton, N. Y., assignor of one-half to others. Application filed May 4, 1906.

The battery comprises a hollow porous storage-battery electrode, and means for forcing the storage-battery electrolyte through the pores of the electrode and maintaining a forcible circulation of the electrolyte through the pores of the electrode from one side of the latter to the other. (See cut.)

852,468. Motor Controller. Emmett W. Stull, Norwood, Ohio, assignor to the Allis-Chalmers Company, Milwaukee, Wis. Application filed July 30, 1906.

The controller embraces a number of drums connected to operate together, each of the drums being connected and arranged to independently control one or more motors. A switch is arranged to cut out any one of the drums and the motor or motors controlled thereby.

852,484. Telegraphic Safety Device. Selden R. Wright, Morton, N. Y., assignor to the Circuit Protecting Relay Company, Rochester, N. Y. Application filed August 7, 1903.

Details are described.

852,489. Cluster Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed January 31, 1903.

A two-light electric-lamp cluster having an insulating base, has lamp receiving shells mounted upon the base and supporting the lamps substantially in axial alignment. There is a suitable casing for the shells. Insulating rings are disposed between the shells and the outer edges of the casing.

852,490. Twin Lamp Socket. Reuben B. Benjamin, Chicago, Ill. Application filed February 29, 1904.

In a two-light lamp cluster having an inclosing sheath formed from two separable interlocking members, are lamp receiving shells disposed within the opposite ends of the sheath and arranged to support the lamps in axial alignment.

852,491. Plural Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed October 1, 1904.

Combined with a twin or two-light socket having a pair of lamp receiving shells mounted end to end, is a plug extending transverse thereto and having a ring contact and a center contact, the latter being yieldingly mounted to accommodate the partial rotation of the plug in a socket.

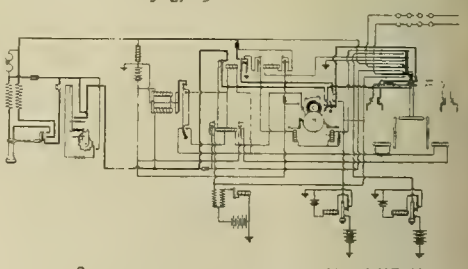
852,495. Multiplex Telegraphy. John Burry, Ridgefield Park, N. J. Application filed January 21, 1905.

In a system of multiplex telegraphy are a number of telephone instruments, a common transmission circuit therefor, means at each telephone transmitter for delivering thereto inarticulate tones representing letters or other symbols according to a prearranged code, and means for connecting the telephones to the circuit in groups at regularly recurring intervals.

852,502. Signaling System. Eugene Garretson, Buffalo, N. Y. Application filed July 17, 1905. Renewed October 11, 1906.

In a signaling system employing inductively derived currents are a signal receiving apparatus comprising a relay for recording the transmittted signals, and a regulable shunt in connection therewith. Means for operating another signaling system are also employed.

852,523. Automatic Telephone Exchange. John G. Roberts, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 5, 1906.



NO. 852,523.—AUTOMATIC TELEPHONE SYSTEM.

In the telephone exchange described are a calling subscriber's line and a selector therefor, subscribers' lines having terminals in the selector, means controlled by the calling subscriber to select the line of a desired subscriber and to connect the line of the calling subscriber thereto, a source of ringing current, ringer mechanism at the central station adapted to automatically connect the source of ringing current to the selected line, a busy tone apparatus, and automatic mechanism operated by the ringer mechanism after a predetermined time upon the failure of the called subscriber to respond for connecting the busy tone apparatus to the calling subscriber's line. (See cut.)

852,536. Resistance Box for Electrical Measurements. Frank Aronson, Evanston, Ill. Application filed March 11, 1907.

In the box are combined an insulating plate, a number of coils thereon, a number of contact plates on the insulating plate and connected in circuit with the coils. The contact plates are arranged in a row and have their ends separated and bent to form yielding contacts with sockets therebetween. Plugs fit in the sockets.

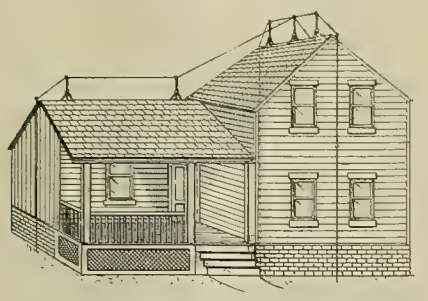
852,537. Circuit-controlling Mechanism for Electrically Heated Tools. William J. Barr, Cleveland, Ohio. Application filed April 19, 1906.

The mechanism comprises vertically spaced and suitably supported contacts adapted to participate in the formation of an electric circuit and circuit closing means to establish electrical connection between the contacts and normally in an inoperative position. An insulating block bears the circuit closing means and is normally arranged to be lowered. There are means for actuating the block downwardly, means acting to retain the block in its upper and normal position, and means for limiting upward movement of the block.

852,539. Indicating Device for Electric Fuses or Cut-outs. Leonard B. Buchanan, Woburn, Mass. Application filed December 17, 1906.

The device consists of a miniature electric lamp and a resistance device, connected in series, and terminals therefor adapted to be connected with the current at opposite ends of the fuse or cut-out.

852,548. Lightning Conductor. William P. Finn, Dansville, N. Y. Application filed October 29, 1906.



NO. 852,548.—LIGHTNING CONDUCTOR.

A system of lightning conductors which extend in the form of loops from earth to earth over the building, free from points and sharp angles, comprises insulating devices which hold the conductors above all parts of the roof of the building, and which are adjustable to fit different pitches of the roof and to keep the conductors free from points and sharp angles. (See cut.)

852,569. Secondary Battery. Lamar Lyndon, New York, N. Y. Application filed June 3, 1905.

An envelope for storage-battery electrodes comprises two porous diaphragms of vegetable matter, one being laid against each face of the electrode in contact with the active material thereof, the edges of the diaphragms being enclosed in a flexible elastic frame to exclude the passage of electrolyte to the electrode, except through the pores of the diaphragm.

852,572. Lightning Conductor. William H. McCullough, Chicago, Ill. Application filed November 1, 1906.

The conductor consists of two or more sections of woven-wire tubing connected together, the end of one section being inserted through the wall of the other section and the ends of the wires of the inserted section being bent about the wires of the receiving section.

852,575. Telephone Exchange. Nils E. Norstrom, Chicago, Ill., assignor to others. Application filed October 4, 1901.

The system comprises a selecting magnet and a connecting magnet located at a local station in a party-line exchange, a telephonic connection for its station closed by the operation of the connecting magnet, and means for causing the connection to be broken by an operation of the selecting magnet.

852,582. Electromagnetic Switch. Walter Scribner, Columbus, Ohio. Application filed December 1, 1905.

The switch is provided with means for connecting an electrical conductor to each of the fixed contact plates and to the contact plate of the armature, and with a carbon strip slidably and yieldingly mounted upon the outer face of each of the fixed contact plates with which the carbon strip carried by the contact plate of the armature is adapted to contact prior to the contacting of the contact plates with each other.

852,627. Automatic Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed November 24, 1905.

A locomotive is equipped with an air-brake apparatus, an electrically-controlled vent valve and duplicate contact brushes and circuits at the opposite sides of the locomotive, a switch, an axle-operated means for automatically shifting the switch, the means embodying an arm depending from the switch and carrying a swinging finger having a limited vibration, and a tappet on the axle.

852,628. Automatic Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed November 24, 1905.

In combination with a main track and an adjacent track are a pair of stopping contacts independent of the rails on the main track at each side of the adjacent track, a supplemental pair of stopping contacts on the adjacent track and independent of the rails and electrical devices for simultaneously rendering these contacts active, and devices for simultaeously restoring them to normal.

852,629. Electrical Switch-lock for Railways. Hiram G. Sedgwick, Mill Valley, Cal. Application filed November 24, 1905.

Combined with a railway switch are a normally unlocked locking device adapted to be interposed between the switch rail and the main rail, and roadbed devices for actuating the locking device by an approaching train.

852,630. Railway Signal. Hiram G. Sedgwick, Mill Valley, Cal. Application filed November 24, 1905.

The system described comprises electric motor means for alternately shifting the signal to danger and to safety, two branch circuits connected to the motor means, a circuit breaker in each branch adapted to be automatically operated by the signal operating means, a main local circuit including a battery and a switch, electrical means for shifting the switch to alternately throw the battery into circuit with the two-branch circuits, and roadbed devices operable by a passing locomotive in circuit with the switch, whereby each train as it passes will first shift the signal to danger and subsequently shift it back to safety.

852,631. Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed June 14, 1906.

This and the following four patents deal with an electric-breaking system for railways, similar to that described in Patents 852,627 and 852,628.

852,632. Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed June 14, 1906.

852,633. Train-stopping Apparatus. Hiram G. Sedgwick, Mill Valley, Cal. Application filed June 14, 1906.

852,634. Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed June 14, 1906.

852,635. Automatic Electrical Train-stop. Hiram G. Sedgwick, Mill Valley, Cal. Application filed November 24, 1905. Renewed January 2, 1907.

852,639. Electrical System of Distribution. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed July 25, 1906.

Combined are a generator, a regulating battery therefor, a battery booster, a field winding for controlling the booster, two motors connected in series with each other, means for varying the relative electromotive forces of the motors responsively to changes of electrical condition of the system, and means for varying the current in the field windings in accordance with the relative electromotive forces.

852,643. Car-dumping Apparatus. Truman H. Aldrich, Jr., Birmingham, Ala. Application filed January 16, 1906.

The apparatus comprises an electric motor for moving the cars, a trolley wire from which the motor derives current, and a conductor movable with the structure in circuit with and forming a part of the trolley wire when the structure is in position to receive and discharge cars.

852,649. Transmitter for Systems of Submarine Signaling. Lucien I. Blake, Boston, Mass., assignor to the Submarine Signal Company, Boston, Mass. Application filed January 29, 1907.

A transmitter for submarine signaling by sound comprises a body of consonant material, a bar of magnetic material connected therewith, energizing coils surrounding the bar, a source of direct current including in its circuit one of the coils, and a controllable source of alternating current including in its circuit the other of the coils.

852,662. Process for Eliminating the Odors of Fish Oils. Alexander de Hemptinne, Ghent, Belgium. Application filed March 17, 1906.

The process consists in subjecting the oil to the action of the silent electric discharge in an atmosphere of hydrogen.

852,675. Telephone Exchange. Nils E. Norstrom, Chicago, Ill., assignor to others. Application filed April 6, 1901.

The system comprises a telephone selecting switch provided with two contact strips, a movable contact maker, means whereby a movement of the contact maker in one direction will cause it to make a series of contacts with one of the strips, means whereby a pressure upon the contact maker will extend the contact of the contact maker to the other contact strip, and means whereby a movement of the contact maker in the opposite direction will act to prevent the contact maker from making contacts with either strip.

852,678. Back-geared Motor. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 21, 1906.

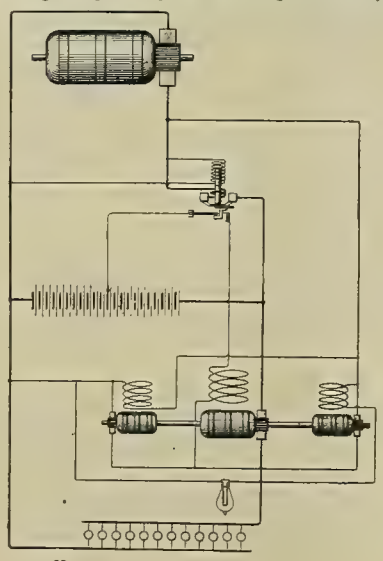
Combined with a standard motor and a standard subbase are an interposed frame adjustable with the motor, a countershaft mounted in the frame and geared to the motor, and a gear-case supported on the frame.

852,680. Electric Rock Drill. John Riddell and George B. Painter, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 19, 1902. Renewed October 29, 1906.

The rock drill is provided with means for clutching the drill, means for retracing and turning and also advancing it, and means for uncluteching it when advanced, so that it will be entirely free when struck.

852,686. Brush. George A. Thornton, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 11, 1906.

Combined are a carbon brush, a gauze strip over one end of the brush, a pig-tail having one end arranged between the brush and the gauze strip, and means for securing the parts together consisting of electrolytically deposited metal entering between the meshes of the strip and in contact with the end of the brush.

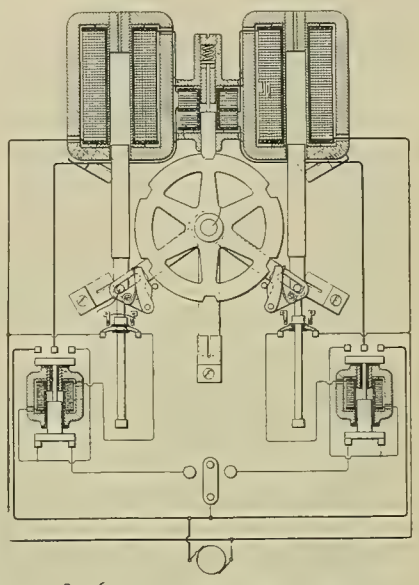


NO. 852,687.—SYSTEM OF ELECTRICAL DISTRIBUTION.

852,687. Electrical System of Distribution. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company, a corporation of New York. Application filed July 25, 1906.

In combination are a generator, a battery connected thereto, a work circuit and a dynamo, the armature of which is in series with the work circuit. Beyond the battery connection are two normally equal electric motors mechanically connected to the dynamo and in series with each other. There are means for causing voltage variations of the generator to differently affect the field strength of the motors, and a field magnet coil for the dynamo connected at one end between the motors and at the other midway between the battery terminals. (See cut.)

852,690. Remote Control Device for Electric Switches. Gilbert Wright, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, a corporation of New Jersey. Application filed April 12, 1905.



NO. 852,690.—REMOTE-CONTROL SWITCHING.

Combined with a rotary switch are means for operating the same step-by-step, comprising an electromagnetic driving means, a control switch therefor, and electromagnetic means controlled by the switch for opening the control circuit and simultaneously closing a circuit through the driving means and maintaining it closed until the end of a step. (See cut.)

852,691. Cable-bonding Device. Harry E. Adams, Pittsburg, Pa. Application filed March 12, 1906.

The device includes a number of receptacles open both at the top and at the bottom, the end walls of the receptacles being cut out to permit the receptacles to fit snugly upon electric cables. There are bowed connecting devices, the free ends of which pass longitudinally through the receptacles.

852,700. Automatic Device for Producing Intermittent Motion. Peabody A. Brown, Denver, Colo. Application filed July 25, 1905.

In combination are an electric motor, a revoluble disk, a spindle actuated by the motor and connected in operative relation with the disk, a part fast on the spindle, and a spring-actuated armature apertured to receive the spindle and adapted to engage the part on the spindle as soon as the motor circuit is broken.

852,702. Induction Motor. Paul Bunet, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed July 12, 1906.

A main induction motor has a high-voltage primary member and a coil-wound low-voltage secondary. An auxiliary induction motor is mechanically connected thereto and has a low-voltage primary member adapted for connection for different pole numbers. There are means for connecting the primary of the auxiliary motor with different pole numbers in series with the secondary of the main motor.

852,708. Attaching Plug and Receptacle. Frank C. De Reamer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 31, 1904.

Combined are an attaching plug, a receptacle therefor provided with terminal contacts and a locking bolt with one end arranged in proximity to one of the terminal contacts. A switch is mounted on the receptacle and provided with a rotary contact adapted to close the circuit and engage the opposite end of said bolt.

852,711. Telephone Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 14, 1906.

In a transformer are two cup-shaped members, a magnetic core clamped between the members and forming therewith an enclosing casing, primary and secondary windings on the core within the casing, the lower of the members being extended downwardly below the windings and provided with an opening at its bottom, an insulating bushing extending through the opening and providing a passage for the primary leads of the transformer, and supporting lugs on the lower member.

852,712. Transformer Core. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 14, 1906.

A transformer has a laminated closed magnetic core comprising parallel legs and end-pieces having their ends interleaved with the ends of the legs, the inner laminations of both the end-pieces and the legs being of greater width than the outer laminations.

852,724. Device for Electrically Operating Bulkhead Doors. David R. Knapp, Philadelphia, Pa. Application filed August 27, 1906.

The device consists of a magnet provided with electric contact points in combination with a weighted armature supported in a movable position by a guide-rod attached to the core of the magnet. A contact ring is attached to but electrically insulated from the armature for circuit closing through its contact with the contact points.

852,728. Automobile Control. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 11, 1905.

In an electrically-driven vehicle are independently rotatable driving wheels on opposite sides of the vehicle, series-wound electric motors mechanically connected to the wheels, a resistance, and a controlling switch adapted to connect the motors in short-circuit through the resistance, and with the motor fields in series and armatures in parallel.

852,730. Insulator. Fred M. Locke, Victor, N. Y. Application filed November 16, 1903.

A porcelain insulator comprises a short cylindrical center piece having a threaded socket extending upwardly from the bottom and a bell-shape skirt fitted upon and secured to the top and sides of the center piece and having portions thereof flaring abruptly from and above the bottom of the center piece.

852,732. Electrical Heater for Metal Workers. Joseph O. Luthy, Austin, Tex., assignor of three-fourths to others. Application filed February 1, 1906.

An electrical metal-heating device consists of a containing vessel of non-conducting material having an inwardly projecting lip at its upper edge, a resistance bath in the vessel, an electrode at the bottom thereof, a superficial layer of muffling material on the top of the bath and an electrode connection for the top of the vessel.

852,743. Apparatus for Registering Telephonic Calls. David F. Stakes, Philadelphia, Pa., assignor to the Keystone Telephone Company, Philadelphia, Pa. Application filed June 17, 1905.

In a telephone call registering and recording instrument are means for registering calls; a traveling carriage provided with contacts, a circuit including a recording instrument at the central station, and comprising the contacts, means whereby when the carriage is moved in one direction the contacts are closed in accordance with the registered calls, and an interrupting plate indicating the number of the telephone by which, when the carriage is moved in the opposite direction, the contacts are closed so as to indicate the number.

852,744. Apparatus for Registering Telephonic Calls. David F. Stakes, Philadelphia, Pa., assignor to the Keystone Telephone Company, Philadelphia, Pa. Application filed January 24, 1906.

Combined are a numerical registering device comprising an escapement, a countershaft having a pinion mounted thereon, a handle mounted to rotate and having a sector arranged to engage the pinion, the handle being operatively connected to the registering device, a stationary contact, a movable contact carried by the escapement, and an electric circuit including the escapement whereby the movement of the handle operates the escapement to make and break the circuit to transmit a signal indicating that the handle has been operated.

852,766. Automatic Electrical Cut-off Device. Rudolf Brebach, Leipzig-Reudnitz, Germany. Application filed July 21, 1904.

In an electric cut-out device are an electromagnet, an armature forming a one-armed lever, a connecting wire between the fulcrum of the armature and the coil of the electromagnet, a double-armed lever located about parallel to the first lever opposite the electromagnet and contact pieces attached one to the free end of the first lever and the other to the free end of the neighboring arm of the other lever.

852,773. Electro-thermostatic Heat Regulator. Lloyd G. Copeman, Spokane, Wash., assignor of one-half to Charles A. Walker, Cœur d'Alene, Ida. Application filed May 21, 1906.

A circuit controller includes an energized circuit, a solenoid, a bracket depending from the solenoid, a screw threaded in the bracket and provided with a cup-shaped contact, a contact carried by the armature of the solenoid and insulated from the armature, and a thermostat adapted to operate the solenoid to make and break the circuit.

852,778. Electric Cable. Robert D'Unger, Chicago, Ill., assignor to the Electric Loop and Cable Company, a corporation of New Jersey. Application filed September 19, 1904. Renewed October 3, 1906.

The cable is made up of a series of disconnected conductors, portions of the adjacent sections of each conductor being wound upon a common core, a continuous conductor extending the length of the cable and having a portion wound around each of the cores and a source of electric supply in the continuous conductor, the conductors and cores being embodied in a continuous cable.

852,806. Locking Device for Telephones. Francis S. K. Smith and David C. Reinohl, Washington, D. C., assignors to Ralph E. Walker, Washington, D. C. Application filed September 5, 1906.

A telephone apparatus comprises a column provided with a vertical slot, a receiver-hook in the slot, a detachable metallic band surrounding the column and engaging the hook, and a lock engaging the ends of the band.

852,851. Motor-controlling Rheostat. Frank J. Seabolt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 14, 1907.

A motor starting and controlling rheostat comprises an armature resistance and a field resistance, a controlling member therefor, connections whereby the member is movable in one direction to cut out starting resistance and in the opposite direction to cut in field resistance, and means for automatically returning the member to the off position upon the occurrence of abnormal circuit conditions.

852,853. Electrical Heater. Milton H. Shoenberg, San Francisco, Cal., assignor of one-half to Bernard Lowenstein, San Francisco, Cal. Application filed September 13, 1906.

The heater comprises a number of core plates insulated from each other and having independent integral terminals, a single winding of naked wire in separated coils insulated from the core plates and independent connections between the wires and the plates whereby different lengths of wire and resistance may be introduced into the circuit.

852,854. Electrical Fluid Heater. Milton H. Shoenberg, San Francisco, Cal., assignor of one-half to Bernard Lowenstein, San Francisco, Cal. Application filed September 13, 1906.

A fluid-heating apparatus consists of a reservoir, a metallic chamber connected therewith having an insulating casing, a resistance coil enclosing the casing with electrical connections whereby the temperature of the chamber may be raised and a tube centrally disposed, within the chamber, the tube having its upper end in open communication with the reservoir and openings near the bottom whereby a circulation of fluid may be effected.

852,886. Switch-operating Mechanism. Jacob Long and Benjamin F. Boyd, Bellaire, Ohio. Application filed July 12, 1906.

In a switch-operating mechanism and signal system are an electric circuit normally incomplete having a lamp therein, a movable bridle constituting a portion of the circuit. A contact plate adapted to be contacted by the bridle completes the electric circuit to the lamp when the bridle is shifted to a position, opening the side track.

852,895. Apparatus for Detecting the Presence and Volume of Firedamp and Other Light Gas in Mines, etc. James McCutcheon, Edinburgh, Scotland. Application filed April 18, 1906.

A float carries an electric terminal in a tube. An electric terminal is adapted to be contacted with the float terminal by the movement of the float. An electric alarm circuit is connected with the terminals. There are batteries and an alarm and an indicator adapted to be acted upon by the movement of the float.

852,926. Electric Tool Driver. Allen F. Carver and James N. Stout, New York, N. Y., assignors to the American Invention Company, New York, N. Y. Application filed December 21, 1905.

In an electric tool driver are combined with a series of magnetic coils, a reciprocating hammer within the coils and means for supplying an electric current to energize the coils, a solenoid switch for making and breaking the main current to energize the coils, contacts in the handle of the electric tool driver electrically connected with the poles of the solenoid and means for closing the contact in the handle to energize the solenoid and operate the switch in the main circuit.

852,937. Electrically Actuated Signal Bell. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed July 18, 1906.

A bearing for the armatures of electrically actuated bells consists of a strip of metal bent to form an upper bearing, a support for the upper bearing, a bracing support for the upper bearing, and an arm for the tension adjusting screw.

852,969. Trolley Circuit Former. Gerald R. Livergood, St. Joseph, Mo. Application filed January 29, 1906.

The apparatus comprises a terminal provided with a hole in its top, duplicate legs provided with notches and a contact point, the terminal being adapted to be engaged by and clamped into position between the separate parts of a trolley hanger.

852,978. Trolley. Albert J. Reif, Allegheny, and Albert L. McCormick, Knoxville, Pa. Application filed June 2, 1906.

Details are described.

853,001. Trembler for Induction Coils. Charles H. Bryant, Hammersmith, England. Application filed April 23, 1906.

An induction-coil trembler comprises a stationary contact, a second contact, a spring bearing the second contact and keeping it always touching the stationary contact, an armature carried by the spring and having a limited movement relatively to it and a secondary spring between the contact-bearing spring and the armature.

853,002. Telephone System. Edward J. Burke Brooklyn, N. Y. Application filed October 14, 1905.

In a multiple board central system are a number of subscribers' stations, a number of jacks connected with each subscriber's station, a lamp at all times controlled by the subscribers' instruments and associated with each set of the jacks, a pair of plugs for connecting the jacks together, means for causing the lamps to produce lights of a different character to indicate when a connection is desired and when the conversation is completed, a switch connected to the plugs and a second lamp controlled by the switch.

853,033. Portable Electric-light Cabinet. Harvey H. Roberts, Lexington, Ky. Application filed July 11, 1906.

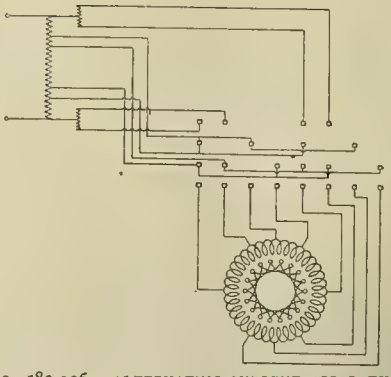
A portable electric-light-bath cabinet consists of a casing open upon one side and closed upon the other sides and groups of differently colored electric lamps projecting into the box in a mixed relation.

853,035. Flashlight Photography. Edgar Russell, United States Army. Application filed July 25, 1906.

A flash-light apparatus comprises a stand, a box adjustably connected to the top of the stand, parts of the box being covered with translucent material, a cartridge holder adapted to project into and to be detachably connected to the box, a cartridge mounted in the holder, electric conductors carried by the holder and forming a gap in juxtaposition to the cartridge, a source of electricity and means for completing the circuit through the conductors and thus forming a spark at the gap.

853,096. Depilatory Instrument. Henry H. Lewis, Louisville, Ky. Application filed June 16, 1906.

Means for supplying an electric current to the needle are a feature of the invention.



NO. 583,106.—ALTERNATING-CURRENT APPARATUS.

853,106. Alternating-current Apparatus. Ralph D. Mershon, New York, N. Y. Application filed February 1, 1904. Renewed April 10, 1907.

The apparatus comprises a primary element, means for producing different numbers of poles therein, means for producing a given magnetic flux distribution in the primary with a particular number of poles. There is a secondary element having the width of its circuits proportioned as to the arcs embraced thereby to produce a predetermined flux wave therein with the given flux distribution. Means are provided for varying the flux wave in the secondary. (See cut.)

853,107. Method of Operating Electric Motors. Ralph D. Mershon, New York, N. Y. Application filed February 15, 1904. Renewed April 10, 1907.

The method of operating commutating motors to maintain a power factor equal to or above a predetermined limit, consists in starting the motor with a maximum number of poles, allowing its speed (with a power factor equal to or above a predetermined limit) to increase until the desired percentage of synchronous speed for a lesser number of poles has been reached, and changing to the lesser number of poles.

853,118. Telephone Receiver Holder. Harry E. Richey, Perrysville, Pa. Application filed January 16, 1907.

Details are described.

853,119. Electric Alarm Clock. John F. Rodgers, New York, N. Y., assignor of one-half to Harry MacCanlis and Arthur Barman, Brooklyn, N. Y. Application filed June 15, 1906.

The clock is provided with a lever pivotally mounted on the frame. An electric circuit with an alarm has its terminals in the frame and in the contact of the lever, respectively.

853,126. Rail-spread Indicating Device. Joseph A. Shires, Denver, Colo. Application filed October 31, 1906.

A rail-spread indicating device comprises an extensible bar composed of a number of members normally spring-retained in a predetermined position, the bar being provided with means arranged to be acted on when the rails are spread to cause the extension of the bar. There are an electrical circuit, and means mounted on the bar for closing the circuit when the bar is extended.

853,155. Amusement Apparatus. Frederick E. Boardman, West Somerville, Mass., assignor of one-half to John J. Jung, Brooklyn, N. Y. Application filed February 15, 1907.

The device is actuated by a number of electric motors mounted on a wheel.

853,186. Telephone. William J. Murdock, Boston, Mass. Application filed May 26, 1902.

The patent covers a composite structure for a telephone.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on May 13, 1907:

427,541. System of Electrical Distribution. L. Bell, Lafayette, Ind.
427,569. Trolley Arm for Electric Cars. W. F. Harriman, Des Moines, Iowa.
427,571. Alternating-current Apparatus. E. Heymann and F. W. Heymann, Boston, Mass.
427,574. Electric Heater. B. C. Howard, Baltimore, Md.
427,606. Electromagnet. F. J. Patten, New York, N. Y.
427,621. Multiple Switchboard Test System. C. E. Scribner, Chicago, Ill.
427,622. Switchboard. C. E. Scribner, Chicago, Ill.
427,623. Test Circuit for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
427,624. Multiple Switchboard Test Circuit. C. E. Scribner, Chicago, Ill.
427,681. Electro-matrix Machine. G. A. Goodson, Minneapolis, Minn.
427,710. Composition for Supports for Secondary-battery Electrodes. W. F. Smith, Philadelphia, Pa.
427,724. Automatic Electric Cut-out. E. M. Bentley, New York, N. Y.
427,725. Electric Railway. E. M. Bentley, New York, N. Y.
427,726. Contact Device for Electric Railways. E. M. Bentley, New York, N. Y.
427,742. Telephone-exchange Apparatus. J. J. Carty, New York, N. Y.
427,746. Electrical Conductor for the Transmission of Power. W. J. Cordley, Richmond, Va.
427,748. Electric Meter. S. C. C. Currie, Philadelphia, Pa.
427,749. Method of Measuring and Registering Electric Energy. S. C. C. Currie, Philadelphia, Pa.
427,751. Electrical Converter. S. Z. de Ferrenti, Hampstead, County of Middlesex, England.
427,762. Electrical Signal. J. Haas, Jr., Vienna, Austria-Hungary.
427,783. Electric Circuit-closer for Railway Signals. F. E. Morgan and F. A. Lane, New York, N. Y.
427,876. Telegraph Key. J. S. Kaylor, Bismark, Ill.
427,878. Guard and Stay for Electric-railway Wires. C. J. Killan, Milwaukee, Wis.
427,917. Multiple Switchboard. C. E. Scribner, Chicago, Ill.

WESTERN ELECTRICIAN

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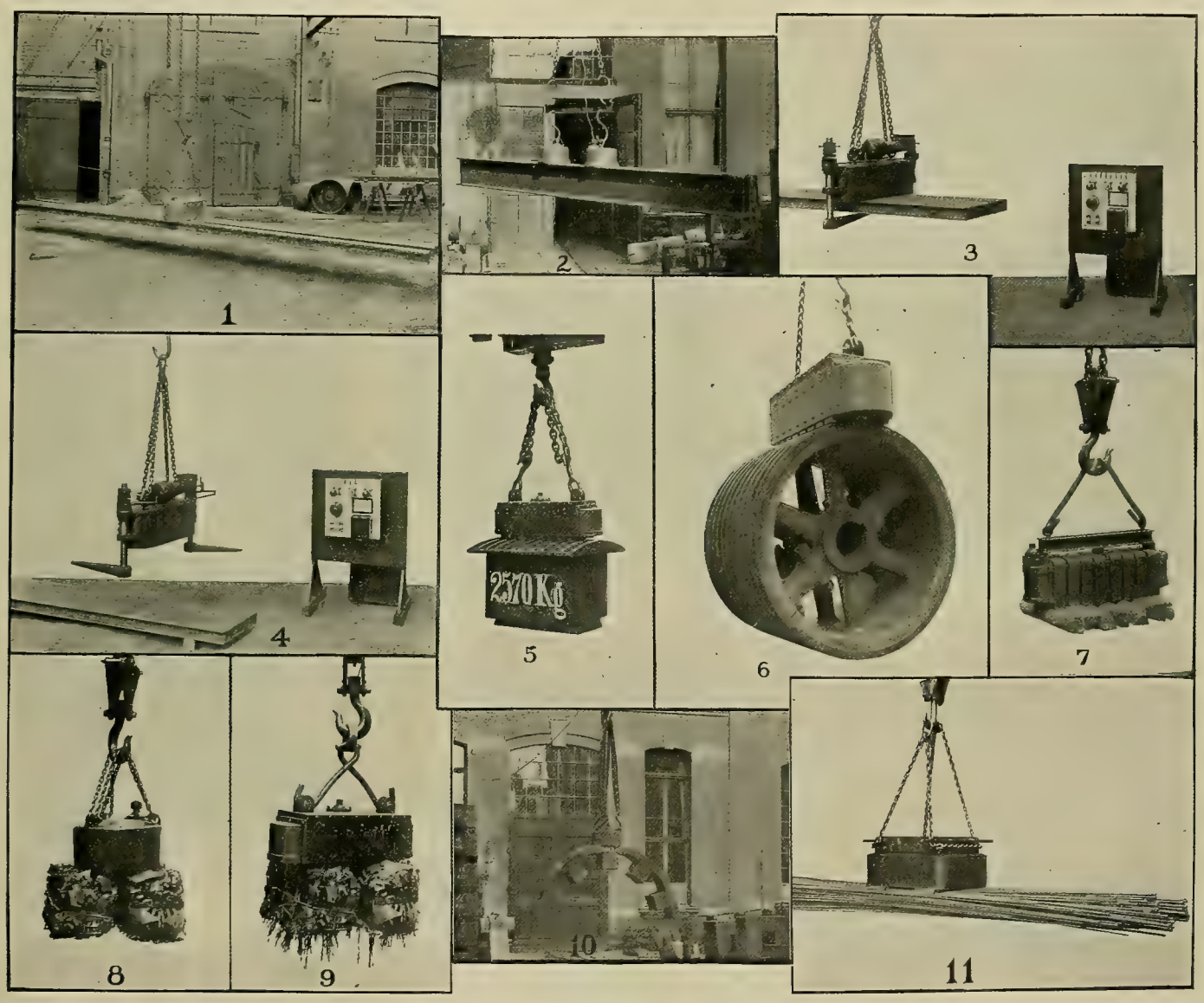
Electric Crane Lifting Magnets.

By Frank C. Perkins.

It goes without saying that by means of electricity and magnetism many labor-saving devices are now available in machine shops, iron and steel plants and other manufacturing establishments which were unheard of in the earlier days, before electrical devices were perfected to their present state of efficiency, and before electric power could be utilized as advantageously as at present.



1. Oblong Iron-clad Magnet Lifting Steel Rails. 2. Two Round Magnets Lifting Iron Beams. 3. Lifting Magnet for Channel Beams, with Motor-operated Gripping Arms Closed. 4. Magnet with Gripping Arms in Open Position. 5. Pole-piece weighing 2,570 kilos Raised by Compound Magnet. 6. Compound Magnet Lifting Heavy Driving-wheel Casting. 7. Pig Iron Handled by Compound Magnet. 8. Round Magnet Lifting Two Bundles of Iron Scrap. 9. Oblong Magnet Lifting Scrap Punchings. 10. Round Iron-clad Magnet Lifting Field Frame Weighing 2,612 kilos. 11. Special Magnet Raising Collection of Iron Pipe.

SOME EXAMPLES OF GERMAN LIFTING MAGNETS USED WITH OVERHEAD ELECTRIC TRAVELING CRANES.

Among the latest and most interesting of modern electromagnetic devices now being extensively used in this country as well as in Europe is the electric-crane lifting magnet, which is so designed that when energized by the movement of a switch and conducting electric current through its coils it will pick up heavy iron or steel masses without the necessity of chaining or otherwise fastening the load to the crane hook.

The accompanying group of illustrations show a number of different types of electric crane magnets for lifting purposes, as designed and constructed at Berlin, Germany, by one of the great electrical manufacturing companies of that country.

For lifting heavy rails for steam and electric-railway construction a special type of lifting magnet has been designed, as shown in Fig. 1. It is iron-clad and of oblong form, with two holes provided in lugs at the top and end of the casting for holding the magnet in place on the crane hook, while a light, flexible cable passes over the hook from the lifting magnet coil to the source of energizing current. This lifting magnet, as will be noted, is sustaining the weight of six steel railway rails, each 6.5 meters long and weighing 1,200 kilograms.

In some instances it is necessary or advisable to utilize two lifting magnets coupled together and suspended from the crane hook, as shown in Fig. 2, where heavy I-beams are to be raised. These electromagnets are of circular construction of the ironclad type, the steel girders lifted in this case being 6.5 meters in length. It will be noted that, in order to hold the lifting magnets the proper distance apart, hooks are provided connected with a spacing beam supported from the main crane hook by chains and smaller hooks, as shown.

Another type of lifting magnet of novel construction for use in iron and steel works and for architectural work and bridgework, where a number of I-beams or channel beams must be handled at once, is shown in Fig. 3, together with the switchboard and electric controlling apparatus for the operation of the same. An electric motor is provided on the top of the lifting magnet whose extended shaft gears with one of the arms for holding the channel beams securely in position after the magnet has been energized, the other arm being operated by a link connected with the first, as shown in the illustration, Fig. 4, in an open position. This gripping device is said to work very satisfactorily, the opening and closing being easily accomplished by the reversible electric motor when the controller handle in the switchboard is operated to the right or left, the lifting coils being energized from the same switchboard, white and colored lamps indicating the operations to the attendant.

A special form of lifting magnet has been devised for raising heavy castings, as noted in the accompanying illustrations, Figs. 5, 6 and 7. The first of these illustrations shows a field-magnet pole-piece weighing 2,570 kilograms being lifted. The second represents a heavy driving wheel cast in two sections and securely bolted together being raised by a similar magnet, while the third illustrates the use of a somewhat similar construction, without an outside casing, handling seven bars of pig iron.

It will be noted that these lifting magnets are of the compound type, having a large number of poles, the soft-iron cores being of M construction, held in place over an oblong coil. These magnets

are particularly useful for large foundries, where hot castings must be handled and the pig-iron moved rapidly and without hand labor. Direct current is utilized to the best advantage for energizing these lifting magnets, either of 110, 220 or 500 volts pressure. Where direct current is utilized for operating the electric-crane motors the same circuit is employed. In some instances where alternating current is provided for operating the crane a small motor-generator set is supplied for supplying the necessary current for the lifting magnet.

In Fig. 8 a round type of lifting magnet is shown raising two bundles of scrap sheet metal, indicating one of the many uses to which this labor-saving device is put. The oblong type of lifting magnet, with multiple poles, is equally efficient in handling material of this kind, and the round type of electromagnet is also frequently employed for raising castings of dynamo field poles and dynamo and motor frames.

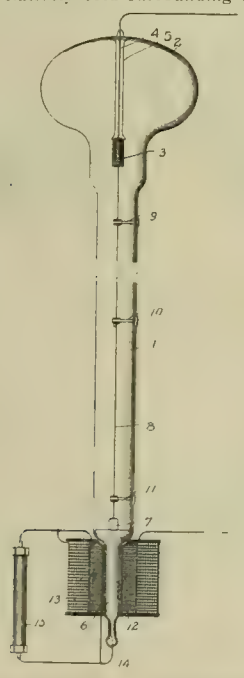
An especially designed electromagnet has been built by these German engineers for lifting gas and water pipes, 350 lengths being readily handled without any other gripping device, these pipes being one-half and three-fourths inch in diameter.

Fig. 9 shows the oblong compound magnet lifting a mass of punched waste sheet metal, while the round type of magnet is shown in Fig. 10 raising a generator field frame weighing 2,612 kilograms. The type of electromagnet for handling the wrought-iron pipe before mentioned is indicated in Fig. 11.

In American iron and steel works electric lifting magnets have been largely used to advantage, particularly for handling plates, as at the Otis Steel Works. A large number of different types of lifting magnets have been designed and constructed for this class of service in this country, and it seems to be acknowledged that these interesting devices accomplish the work as no other mechanical device can.

Heating Attachment for Mercury-arc Lamp.

Mercury arc lamps and similar apparatus when operated under conditions where they may be subjected to a relatively cold surrounding atmosphere—



HEATING ATTACHMENT FOR MERCURY-ARC LAMP.

as, for example, when operating out of doors in winter—sometimes start with difficulty. In order to overcome this difficulty Dr. Charles P. Steinmetz of Schenectady has invented means for preheating the lamps or other apparatus, so that in cold weather they will be able to start without difficulty. This attachment is automatic, so that it will be cut out of circuit after a moderate predetermined interval.

The mercury lamp shown in the drawing is of a well-known type and requires but a brief description. The exhausted glass tube or envelope of the lamp is indicated at (1). This tube is surmounted by an enlargement or bulb (2), constituting a condensing chamber. An anode (3) of artificial graphite or other suitable material is mounted at the mouth of the upper end of the tube and is supported in position by a depending wire, the upper end of which in the usual manner is sealed through the glass of the bulb and constitutes a current-leading-in conductor. The exposed portion of this wire is surrounded by a protecting glass tube (5).

The lower end of the tube is contracted to form an extension (6). A body of mercury forming the cathode of the lamp fills this extension and to a slight depth spreads over the lower end of the tube (1). A float or plunger (7) of soft steel or other suitable magnetic material is immersed in this fluid, with its upper end projecting from the surface, as indicated. This upper end is hollowed out so as to form a cup. After the plunger has been once submerged and has come to the surface it is filled with mercury.

A filament (8) similar to the ordinary incandescent-lamp filament is supported from the anode (3) and passing down through centering guides dips at its lower end into the mercury held in the cupped upper end of the plunger (7).

A lamp such as described is ordinarily started, says Dr. Steinmetz, by means of a solenoid located about the extension (6) and in series with the lamp circuit. This solenoid when energized pulls down the plunger (7) and by thus causing an initial arc at the lower end of the filament (8) puts the lamp into normal operation.

But the present invention provides a heating coil located, in addition to the starting solenoid, about the extension (6). This heating coil is indicated at (12) and the starting solenoid at (13). These solenoids or coils are represented one inside the other. The heating coil may be of relatively small conductor and is preferably located next to the lamp tube, as indicated, though, if desired, the coils may be otherwise arranged. The coils are connected in series with each other and by means of the leading-in conductor (14) with the lamp proper. The heating coil (12) has approximately the same number of turns as the starting coil, but is wound in the opposite direction. It is shunted by a resistance (15), the temperature resistance coefficient of which is negative. This resistance is preferably made of magnetite. The magnetite may be arranged in the form of a baked stick, or it may be in powdered form and compressed within a tube having suitable terminal connections. A quantity of powdered mica may be mixed with the magnetite powder, if desired. This mica, among other properties, has the advantage of preventing agglomeration of the powdered magnetite and consequent permanent variation of resistance.

When current is turned on to the lamp the resistance of the magnetite member (15) being, when cold, extremely high, causes practically the entire current to pass through the heater coil. The heater coil and the actuating or starting coil being, as already noted, wound in opposition to each other have no resultant magnetizing effect. The heater coil thus rapidly imparts heat to the lamp structure and takes away the undue chill, which is detrimental to the starting of the lamp. The parts adjacent to the mercury in the lamp are thus heated up. The current traversing the filament (8) heats this filament to redness, and thus heats the upper part of the tubular member of the lamp.

The magnetite member is so proportioned that its voltage—that is, the voltage at which it short-circuits—is slightly below the voltage consumed by the resistance of the heater coil (12), about which it is shunted. Therefore for a short time and somewhere in the neighborhood of one-quarter of a minute or more the main current passes entirely through the heater coil. By the time this period has elapsed the current, though small, which passes through the magnetite heats the latter and rapidly reduces its resistance until a condition is reached where the magnetite forms practically a short circuit about the heating coil (12). The actuating or starting solenoid (13), then largely overpowering the counter magnetizing effect of the heating coil, pulls down the plunger (7), and the parts then being relieved of their chilling temperature readily starts the lamp.

The resistance of the magnetite element varies greatly in temperature and is very much higher near 0° F. than in warm summer weather. Therefore such a magnetite element will short-circuit the heater coil in summer time almost instantly or within a second or so, but in winter will keep it energized for a quarter of a minute or more. The heater action of the apparatus is thus automatic, since in summer, when no such heating action is required, the heater coil is cut out of action almost instantly, whereas in winter, when such heating action may be necessary, the heater is maintained in circuit for such a moderate time as is necessary for it to perform its function.

The invention is patented.

Government Ownership Destructive to Invention.

Asked what he thinks is responsible for the great difference between the efficiency of telephone service in London and that of any large American city, Prof. Alexander Graham Bell is quoted in a London dispatch to the New York Herald as saying: "Government ownership or control may have something to do with it, for whatever may be said in favor of government ownership of telephones and telegraphs, it certainly militates against their improvement. English inventors are not stimulated to improve the telephone or the telegraph by any competition or hope of reward, for with the government in control there can be no competition. Government ownership is destructive of invention."

Stereoscopic X-ray Pictures.

While in former years the only method enabling physicians and students to get an idea of the anatomy of the human body was to study cadavers and skeletons, or to examine such pictures (obtained by the same method) as are contained in medical treatises, X-ray pictures have of late years been found a valuable aid in anatomical investigation and instruction.

Whereas the former method was mainly confined to studying the dead, the X-ray process first allowed the inspection of vital organs in life. Now, in view of the great differences which frequently exist between vital conditions and those of the

FIG. 1. CENTIMETER SCALE USED WITH X-RAY STER O-SCOPIC PROCESS.

dead body, the enormous importance of the newer method will be readily appreciated.

X-ray processes are thus the only means of inspecting vital organs situated at some depth. However, this method has heretofore been practicable only to a limited extent, as objects which in reality are situated behind each other, are, by the aid of X-rays, projected in one plane, so that only a very expert physician will be in a position to draw some indirect conclusion as to the depth of the objects in question.

Endeavors were therefore made to devise a process by the aid of which an appropriate idea of the invisible inner parts of living organisms could be obtained by mere inspection and without any reasoning.

This was actually obtained by means of stereoscopic X-ray pictures, though many difficulties had to be overcome in this direction, as only those parts which are of different density can be made visible by means of these rays. But this process has been improved to such a degree that X-ray stereograms now afford a practically accurate idea of the arrangement of bones and soft parts of the body.

A collection of X-ray stereograms which will be found a valuable aid to both the student and expert, was recently published by Dr. E. Sommer[1], to whose courtesy the Western Electrician is in-

FIG 2. X-RAY DIAPHRAGM WITH STEREOSCOPIC SLIDE.

debted for the reproduction of some samples, which, when inspected in an ordinary stereoscope, will give a striking bodily impression in the right perspective. The method used in producing these pictures will be inferred from the following:

X-ray reproduction obviously is a central projection process from a certain point of the X-ray bulb (inadequately called focus). The X-rays emanate in straight lines, penetrating through the body under investigation, and being partly absorbed by the latter. According to the power of penetration, the weakening of intensity at each part of the picture corresponds to the density of the part of the body traversed, the influence exerted by the rays on the photographic plate (or projection screen) corresponding to their actual intensity.

Projections of bones accordingly appear as bright spots on the photographic plate, while pervious tissues show a darker appearance, the X-rays weakened by bones being unable to influence the photographic plate to any higher degree. As X-ray pictures are produced by central projection, the picture will be proportionally more perfect as the

1. Dr. Ernst Sommer: "Anatomischer Atlas in Stereoskopischen Röntgenbildern." A. Stuber, publisher, Würzburg, Germany.

object is less distant from the plate. In fact, only those portions which are in the immediate neighborhood of the plate will be reproduced with some faithfulness. Now an expert observer will be able, from a mere inspection of the X-ray picture, to judge what part of the organs was situated closer to the plate, and vice versa. These conclusions are, however, far from being decisive, nor are they possible in all cases.

The method of artificially producing stereoscopic X-ray pictures merely consists of imitating the conditions of binocular vision. The experimenter need only produce two pictures displaced parallactically with regard to each other and which correspond to inspection by the left and right eye, respectively. By a stereoscopic device these views are made to coincide and to appear to the observer as one perspective picture.

In the case of stereoscopic X-ray pictures the eye is replaced by the X-ray bulb, or rather by what is called the focus of the latter. Two views are obtained of the object without displacing the latter, one being taken in a position corresponding to an inspection of the object by means of the left eye, after which the bulb (the object being maintained in position) is moved through the distance of corresponding points of the eyes, that is, through a few centimeters, while another plate is substituted for the plate formerly exposed below the immovable object, and another view taken of the latter in the second position.

The special method used by Dr. Sommer is due to F. Dessauer and Dr. Wiesner of Aschaffenburg and consists of a combination of a diaphragm process and a stereoscopical method, enabling views of remarkable definition to be obtained, while eliminating part of the secondary rays.

The diaphragm, designed by Wiesner, is intended for keeping away part of the secondary rays and mainly consists of a base plate with support, to which the bulb holder and compression diaphragm are fixed. The compression diaphragm serves to compress the part of the body under examination, so as to reduce the path of the X-rays and to facilitate the task of the experimenter.

This diaphragm has been combined with a stereoscopic bulb holder, allowing the bulb to be displaced alongside a centimeter scale, without in any way touching the object, diaphragm or base plate. The arrangement used by Dessauer is represented in Fig. 1. The plates are exchanged by the aid of a slide fixed to the base plate of the apparatus, as may be seen in Fig. 2.

In order to obtain a stereoscopic X-ray picture, the object is placed in position (with the plate in the alternate slide below it and the diaphragm above), after which the bulb is adjusted with its focus accurately in a vertical position above the center of the object, or rather the point to be photographed. After ascertaining the total displacement, the bulb should be moved alongside the scale through half that amount to one side, and, after completing the first view in this position and replacing the plate by another, the bulb is moved through half the total displacement in the other direction.

The amount of displacement varies, according to the object to be examined, between two and nine centimeters. The greater this displacement, the more striking will be the impression of perspective and the more marked the difference of the pictures. In many cases these effects should be exaggerated to some extent by increasing the displacement.

Figs. 3, 4 and 5 give interesting reproductions from Dr. Sommer's "Anatomical Atlas," by courtesy of the publisher, Mr. A. Stuber of Würzburg. They all relate to normal anatomy. The arrangement of stereoscopic skiagraphs, diagram and reading-matter (in German) will be readily understood. Fig. 3 shows the skull of an adult, Fig. 4 the elbow joint of a youth of 15, and Fig. 5 the foot of a child of thirteen.

Fig. 3. Skull of Adult.

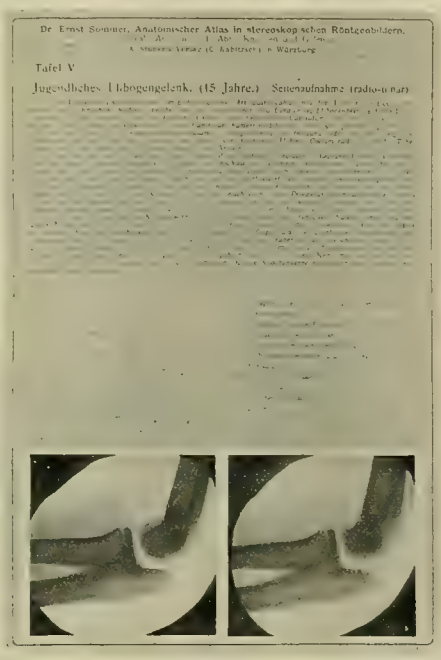


Fig. 4. Elbow Joint of Youth of Fifteen.

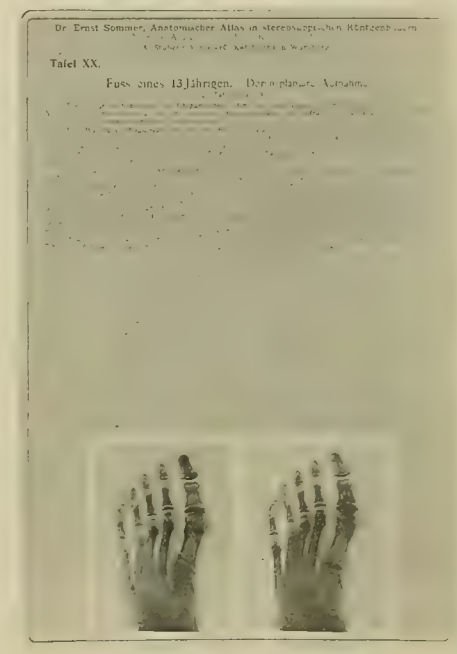


Fig. 5. Foot of Child of Thirteen.

X-RAY STEREOSCOPIC PICTURES USED AS AN AID IN STUDYING ANATOMY.

Carelessness the Cause of Electrical Fires.

Carelessness and a lax enforcement of the specifications of the National Electrical Code for the installation of electric wiring and apparatus are reflected in the quarterly fire report, No. 55, issued by the Electrical Bureau of the National Board of Fire Underwriters. Accounts are given of fires from electrical causes reported by various electrical inspection departments of the United States and Canada, and but few of them seem to be due to electricity as such, but rather to the carelessness of users and to incompetence or a disregard of the specifications on the part of workmen, or perhaps, contractors.

The largest fire reported, an estimated loss of $1,250,000, resulted from the carelessness of a maid in the use of an electric flatiron. The lighting company shut off the current from the building and later in the day turned it on again. In the meantime a maid had attempted to use an electric flatiron and, finding the current off, went away, leaving the iron with the switch "on" standing on a cloth-covered table. When the current was turned on, later the iron became hot and ignited the cloth and the fire spread.

Another case involving a household utensil was a bed warmer made of No. 22 B. & S. gauge copper wire woven into a thick woolen cloth, forming a mat. The wire was connected to an ordinary pendant cord, which was attached to a lamp socket, and the control was by turning on and off by the key of the socket. The user was supposed to turn off the current when the mat became too hot. The occupant of the bed was an old lady too feeble to reach the socket, and the mat set fire to the bed.

A $30,000 fire is said to have started from an auto-starter. The motors operating fans in the dryroom of a tannery were equipped with oil-filled automatic starters. The handle of one of these starters was left in the starting position instead of being thrown over to the running position. The starters were so wired that the fuses only protected the motor and starter when the lever was in the running position, where it was supposed to be kept during operation. This scheme of wiring is resorted to in order to prevent blowing of the fuses every time the motor is started, as at such times the lines carry heavy overload. The lever could be left in the wrong position through ignorance, carelessness or, possibly, purposely, in order to reduce the speed of the motor. This would result in breaking down the coils of the starter or cause such heating that the oil would take fire. It is probable that the latter was the cause of the fire, and the burning oil carried the fire to the surrounding woodwork.

In an instance where a long flexible cord was wrapped around a steam pipe, the insulation of the cord became burned and brittle, so that short-circuiting occurred. The insulation caught fire and flames spread to nearby stock. Sprinklers operated, however, and put the fire out.

Repairmen were working on poles and allowed the telephone wires to fall across a trolley wire. A telephone cut-out was installed in a dwelling in the neighborhood and was not enclosed in any way. The increased voltage caused the cut-out to operate and the flash set fire to a lace curtain which fell to the floor and ignited a straw matting.

A defective car heater caused a $75,000 loss. A trolley car standing in a car barn was used as a loafing place by the night men. The pole was left on the trolley wire and the lights and heaters turned on. The heaters were the old-style spring-coil type. A coil in one of these heaters broke and caused a short-circuit, setting fire to the car. Fifteen cars and the building were totally destroyed and three cars partially.

Fire was caused in another case by an overloaded switch. A three-pole knife switch controlling the lighting system of a store was too small to properly carry the total amount of current. In time it became overheated and ignited the insulation on the leads and caused a short-circuit on the main feed wires, setting fire to the surrounding woodwork.

A case is reported where an electric-light plant was destroyed at a loss of $85,000. A heavy sleet-storm caused many of the overhead wires to break and also crippled the city fire-alarm circuits. One of the power circuits of the lighting plant became crossed outside of the building with a 6,600-volt circuit. A flash across the power circuit inside the building occurred, which set fire to the ceiling of the first floor. The circuit-breaker on the switchboard on the second floor opened, but the employes, not knowing what had caused the breaker to open, closed it again. The building, in addition to being used as a power station, also contained gas blower pumps, taking gas from the gasometer and blowing it into the city mains. The cylinder head of one of these pumps blew off. This was due probably to the heat of the fire, which started almost directly over the pumps, and did not occur until the fire had gained great headway. The flow of gas materially assisted in the destruction of the premises.

The report, signed by Mr. W. H. Merrill, Jr., 382 Ohio Street, Chicago, states that 34 fires at first reported as due to electrical causes, were, upon further reliable investigation by inspectors, found to be due to other causes.

Valley City Has Had Enough.

The city of Valley City, N. D., at an election held on May 6th, voted to sell its municipal electric-light plant. The question was carried by a majority of 107, there being 61 voting against the proposition. As soon as an inventory can be completed bids will be advertised for and the plant disposed of to the highest bidder, together with a favorable franchise for operating it. L. A. Wood is mayor of the city.

The Splicing of Lead-covered Telephone Cables.

By Oliver F. Dubruiel
Underground Cables.

The cables are usually left by the pulling-in gang without much reference to their final arrangement. It is the jointer's first duty to inspect the cable thoroughly, from the edge of the duct to the sealed end, in order to find any injury done to the cable while being pulled in. Where there are several cables to be jointed in the same manhole, care must be taken to joint the proper ends together.

Next put the protectors in the mouths of the ducts. Heat must now be applied to the outside of the cable to aid in bending it so as to stow it around the manhole in a neat manner. This heat is applied to the cable to warm the insulation as well as the lead sheath, so that when the cable is bent the insulation will not break nor crack.

In bending the cables the ends are brought into

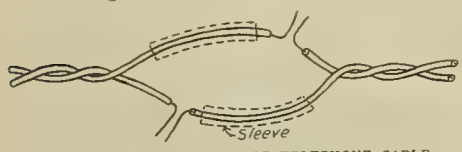


FIG. 1. SPLICING WIRES OF TELEPHONE CABLE

position for splicing and should always be in such a position that when the joint is finished it will be between the hangers or whatever supports the cable, so that no strain will be on the joint.

After making a careful examination of the soldered end to see if any moisture could be admitted from the end, cut off the end with a hacksaw and dip the end into a pan of hot paraffine. Should there be any moisture in the end of the cable, bubbles will show up; should bubbles appear in the pan, cut a little more off the end and again dip the end into hot paraffine. Should bubbles still show and should it not be possible to cut away any more of the cable, although the moisture is still present, heat must be applied to the outside of the cable.

There are several ways in which this may be done. Where there is gas in the manhole, use hot

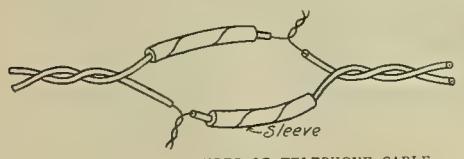


FIG. 2. SPLICING WIRES OF TELEPHONE CABLE.

paraffine. Place a pan under the cable and pour hot paraffine on the lead sheathing, starting at the duct and working very slowly toward the open end of cable. In doing this the moisture is driven out at the open end. Should there be no gas in the manhole a "blow-pot" may be used. Care must be taken not to burn holes in the sheathing. When the cable is covered with saturated fiber and a blow-pot is used a steel screen must be placed between the cable and the blow-pot so that the fiber covering will not catch fire.

Never cut off both ends of cable until sure that there is no moisture in the other end, as it often happens that the location of the splice is moved one way or the other on account of moisture.

When satisfied that there is no moisture in the cable ends, allow them to lap about 8 to 20 inches, according to size of cable. Then score the cable back far enough to allow for the splice. This scoring is first done around the cable and then two cuts are made lengthwise of the cable about three-quarters of an inch apart. Care must be taken not to cut through into the insulation with any of these cuts, except in one place, that being at the end of cable; cut the lead through into the insulation at this point. Then, using some narrow tool, push under this narrow strip and pry upon it until a pair of pliers can be used to take hold of the narrow strip. Remove this strip by lifting up on it until the circular score is reached. Then bend this narrow strip back on the cable and pound it down flat. Next bend the strip back in its former position and it will break off. Then with both hands remove the balance of the sheathing by prying it apart, or open and bend it back and forth; it will break off.

Next prepare the lead sleeve as follows: Scrape the inside of sleeve at both ends back about 1½

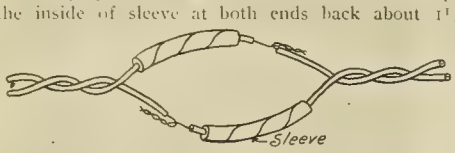


FIG. 3. SPLICING WIRES OF TELEPHONE CABLE.

inches and also scrape the outside of sleeve back about 2½ inches and smear with mutton tallow. This mutton tallow is put on to stop the sleeve from tarnishing by contact with the air and hands. Now slip the lead sleeve over one of the cables and push it out of the way. Have hot paraffine ready and pour over the cable (as soon as you remove the sheathing) to stop the paper from untwisting and also to stop the moisture from going into the cable. Next open out the cable by bending the wires back, layer by layer, until the center is reached. (It is understood that this is to be done at both ends of cable where the splice is being made.) Then choose the center pair from one end and its "mate" from the other end and bring them together as shown in Fig. 1.

Now slip on the paper sleeve as shown by dotted lines in Fig. 1; next twist the ends together as shown in Fig. 2. Then lay them back as shown in

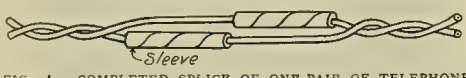


FIG. 4. COMPLETED SPLICE OF ONE PAIR OF TELEPHONE WIRES

Fig. 3. Draw the paper sleeve over the joint as shown in Fig. 4 and close them together as shown.

When the joints are made in this way there is no danger of the paper sleeve working away from the splice, as one sleeve will hold the other in position. Treat all the other conductors in this way and break joints as much as possible, being careful not to cross any pairs and splice red to red or blue to blue. The "mate" of a pair is any pair in that same layer. The object of breaking joints is that when all the splicing is done the joint may be drawn up as small as possible.

When all the joints have been made, "bunch" all the joints together and boil them out with hot paraffine. Have at hand narrow strips of muslin about 2½ inches wide and wrap one layer around the joint, pulling it as tight as possible. Then saturate with hot paraffine to boil out all moisture and put on three such layers, boiling out each layer as put on.

Fig. 5 shows how the cable should look after all the joints have been made and before any wrap-

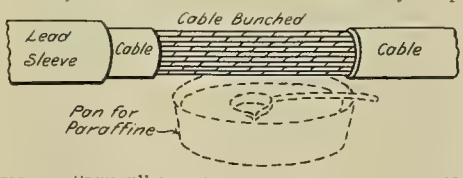


FIG. 5. "BUNCH" OF SPLICED WIRES BEFORE COVERING.

ping is put on. The dotted lines show a pan and ladle placed under the joint so as to catch all drippings in boiling out the joint.

After the joint has been made as above, slide the head sleeve into position as shown in Fig. 6, the ends being beaten down to fit on to the lead sheathing. A plumber's joint is wiped at each end as shown. This wiped joint must never be made by an inexperienced person, for the joint must be put on hot and carefully wiped, so that moisture cannot get in. When the wiped joint is properly put on, after it has cooled off bright spots will be seen in the joint. A good solder for wiping is made from 60 per cent. lead and 40 per cent. tin.

Fig. 7 shows how cables are brought into terminals, while Figs. 8 and 9 are branch joints. Fig. 9 shows how a cable is "split," while Fig. 8 shows a method of looping into a terminal often used, as it affords a method of testing all the conductors in the cable when necessary.

Fig. 10 shows a method of testing with a telephone receiver. (A) and (C) are both ends of the wire under test and (B) and (D) are wires connected to the battery. In arranging the cable ends for the test at the (E) end of cable, remove the insulation from all the wires. Wire (B) is wound around the lead sheathing and the end is wound around the wires as shown. At the (C) end of cable the wires are carefully separated from one another and from the lead sheathing.

After making the connections, as shown in Fig. 10, the test is made by making rapid taps with wire (A) on the screw cap (G). The first tap will produce in the receiver a distant click. If the cable is very long a second faint click may possibly be detected. But if the wire under test is well insulated, no more sound will be heard in the

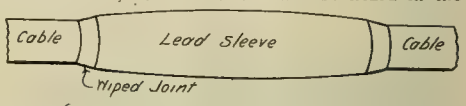


FIG. 6 COMPLETED SPLICE IN TELEPHONE CABLE.

receiver after the tapping. But if the wire under test is crossed with any other wire in the cable, or with the sheathing, every tap will be followed by a clear clicking sound, and if there is moisture in the insulation (being paper), which makes a partial connection, clicking sounds will occur. The loudness of this clicking will depend upon the amount of moisture in the cable. In turn test all the wires in the cable, and if any trouble is found it is best carefully to inspect the exposed ends to be sure that they are cleared from one another and from the sheath.

In Fig. 11 is shown a method of testing for broken wires. Make the connections as shown by removing all the insulation from the (F) end of cable wires and wrap a wire around them all as

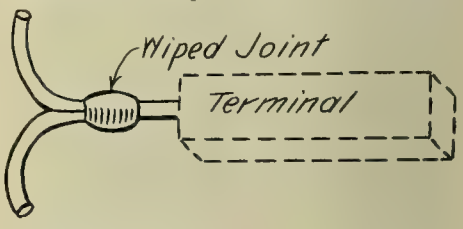


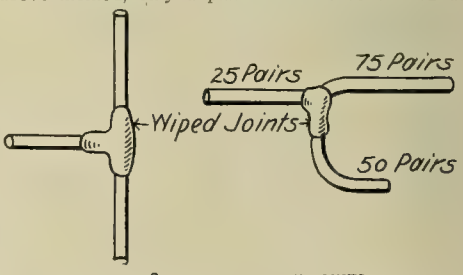
FIG. 7. CABLES BROUGHT INTO TERMINAL.

shown by wire (H). Connect the other end of this wire to one side of the battery. From the other side of battery run a wire (K) to one side of an electric bell. Then from the other side of the bell bring out wire (M). At the (J) end of the cable the wires are carefully separated from one another and from the sheath.

To make the test, touch in turn each wire at the (J) end of cable. Should one or any of them not ring, the wire is broken.

Aerial Cables.

The splicing of aerial cables is the same as the above method, only a platform must be erected at



FIGS. 8 AND 9 BRANCH JOINTS.

the splice and a blanket spread over the joint to keep out the wind and moisture.

Sub-aqueous Cables.

Sub-aqueous cables are spliced in the same manner, the difference being that the armor wires are to be looked after.

In arranging the cable for the splice, bend the

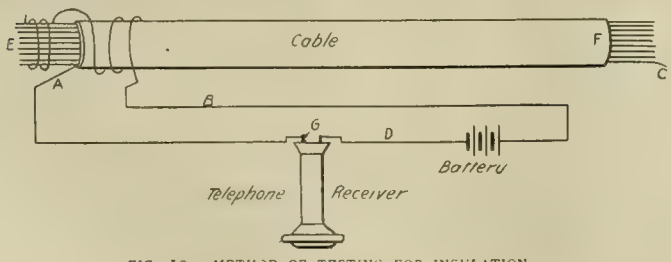


FIG 10 METHOD OF TESTING FOR INSULATION.

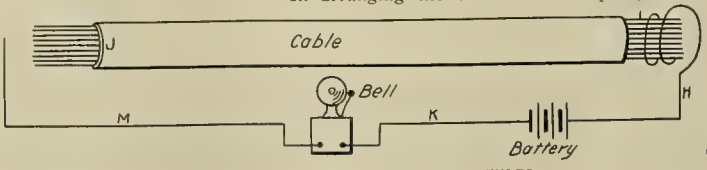


FIG. 11. TESTING FOR BROKEN WIRES.

armor wires back on the cable and tie them in this position until the joint is completed. Then, after laying a wrapping of jute over the joint, lay the wires down on the jute over and around the joint in such a way that when the armor wires from the other end are brought down the wires will interlace like the interlocked fingers of the hand. Then with a spool of steel wire bind these wires down by laying close layers of wire around the joint so as to bind them together the entire length of the cable splice. Then wash off the joint with soldering acid and solder the wrappings very carefully, being careful to get all around the joint with this soldering.

The above method is to be recommended, but a different arrangement of the armor wires is sometimes made, as follows: Take one wire from one end and cut it so that it will lap over the wiped joint about three inches. Then get a wire from the other end and cut it so that it will "butt" with the short wire. Break joints around the cable, wrap in the manner above stated and solder. But the method first mentioned is to be preferred, as it makes the strongest joint.

Heating of Paraffine.

The heating of paraffine deserves a few words. In heating paraffine care must be taken not to heat it too much, as it will ignite. When heating paraffine always remove the cover on the ground before sending it into a manhole, for should hot paraffine be poured on a cable that has moisture in it it will fly all around the manhole and may burn the workmen. The best way to test the paraffine is by rolling a piece of newspaper and pushing it into the paraffine. As soon as the paper chars the paraffine is hot enough. Should it be put into a cable any hotter it would burn the cable.

Power Transmission from the Rhine.

A concession has just been granted by the authorities of the district of Lörrach, in the grand duchy of Baden, Germany, for a new electric power plant on the Rhine, according to United States Consul Gifford of Basel, Switzerland. The project will require the building of another dam across the river between Wyhlen, in Baden and Augst, in the canton of Baselland, Switzerland. The cost of the new enterprise is estimated at $2,000,000 to $3,000,000, to be provided by the canton of Basel city and the power transmission works at Rheinfelden. The latter company will be the real contractor and must begin its work within a year and a half and finish it within seven years under penalty of forfeiting its 80-year concession.

The same corporation has already built and operated the famous waterpower plant at Rheinfelden, only three miles farther up the Rhine, which was one of the first great electric power works of the world, and is still not an unworthy rival of the developments at Niagara and at the falls of the Rhine, near Schaffhausen. The Rheinfelden works furnish light and power to German and Swiss towns and villages and to isolated farmhouses, where silk looms are driven by electricity, within a circuit of 20 miles in all directions.

Test of a 500-kilowatt Steam Turbine and Alternator.

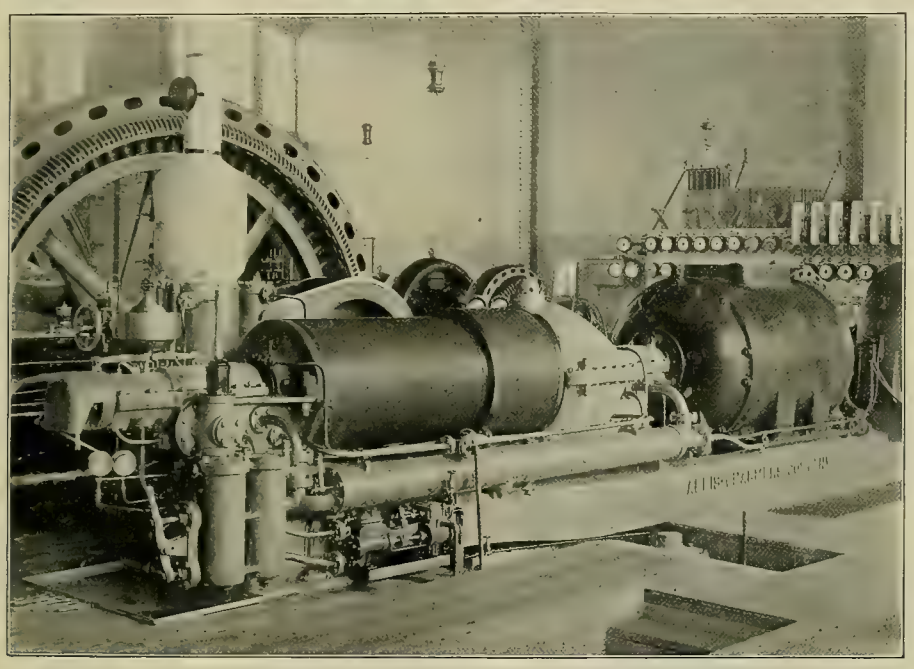
Some interesting tests of a steam-turbine unit in the plant of the Western United Gas and Electric Company at Aurora, Ill., have been made by Mr. H. L. Rice and Mr. W. M. Willett, general manager and electrical engineer, respectively, of the company. The power plant is less than three years old, an illustrated description of it having been given in the Western Electrician of July 2, 1904, at the time of its completion. The turbo-alternator here illustrated and which has been tested with results given below is a recent addition to the power equipment.

The steam turbine is an Allis-Chalmers-Parsons standard horizontal machine rated at 500 kilowatts. The generator is a standard Allis-Chalmers turbo-alternator direct coupled to the steam turbine and rated at 500 kilowatts. The condensing apparatus is of the standard turbo-jet type of the same make.

Characteristics of the unit are as follows:

Rated capacity	500 K. W.
Speed	3600 R. P. M.
Frequency	60 cycle
Winding	2 phase
E. M. F.	2200 volt
Current per phase (normal)	114 amperes
Construction of alternato	2 pole

The turbine was built to operate normally with steam pressure at 140 pounds per square-inch gauge pressure at turbine throttle; dry saturated; and a vacuum of 28 inches of mercury, referred to 30-inch barometer at exhaust nozzle. The unit is calculated to carry an overload of 50 per cent. when operating under the above steam conditions and at 100 per cent. power factor.



500-KILOWATT TURBO-ALTERNATOR AT AURORA, ILL., RECENTLY TESTED.

The time during which the turbine could be spared for test was limited from midnight Saturday to midnight Sunday. It was, therefore, decided to run only two tests, one at 10 to 15 per cent. overload, and one at three-quarter load. As the turbine was provided with a jet condenser, the steam consumption had to be determined by weighing the feed water, and to correct this it was necessary to make a boiler-leakage test during the time available for test purposes.

To determine the amount of feed water used, two barrels, A and B, were placed on a platform and connected with one another by a short horizontal pipe introduced into the sides of the barrels near their tops. A water-supply pipe with valves was brought over these barrels for the purpose of filling them alternately. Each barrel was provided with a large plug cock in its bottom. The barrels were carefully calibrated, and when filled so that the water would just enter the connecting pipe above mentioned, they were found to contain—A, 413 pounds, and B, 391¼ pounds of water at 58° F. As the feed water during the test was of a higher temperature, a correction has been made for the difference. Under the platform two receiving barrels were placed; into these the upper barrels emptied through the plug cocks mentioned. The lower barrels were connected with one another by a large horizontal pipe near their bottoms, and the suction pipe of the feed pump was brought into one of the barrels.

Two Stirling boilers of 250 boiler horsepower each supplied steam to the turbine during the test. Each of the six drums of the two boilers was provided with a gauge glass, and readings of the water levels in all six drums were taken at the commencement and end of the test, and also during the test. The blow-off pipes were blanked off, as were also the feed connections to the other two boilers in the station.

The auxiliary steam header for the feed pumps, etc., was disconnected from the main header, and the portion of the main header receiving steam from the other two boilers in the station was separated from the portion receiving steam from the two boilers which furnished steam to the turbine during the test by means of a gate valve which was closed tightly during the test. In order that there might be no leakage of steam through this valve the pressure on all boilers was maintained at about the same point throughout the test, so that both sides of the valve were under approximately the same pressure. From the header supplying the turbine a pipe ran to a 200-kilowatt Hamilton Corliss engine which was shut down during the test, and the angle valve on the header shut off the pipe. Provision was made near the engine throttle to catch the drains from this pipe, but they were found insignificant and were disregarded.

The condensed steam from the steam header, as also from the steam separator near the turbine throttle, was discharged into barrels filled with a gauged quantity of cold water. As the water accumulated it was taken out in buckets and weighed, and when the water in the barrel became sufficiently hot to vaporize, a weighed quantity of cold water was added. At the end of each test the water in the barrel was brought back to the original quantity.

The feed pump for supplying the calibrated feed water to the boilers was a Duplex outside-packed plunger pump. The leakage from this pump was caught and returned to the lower feed-water supply barrels. It was not necessary, therefore, to keep records of this leakage. The steam gauges were checked by an inspector's test gauge, which had been verified shortly before.

The quality of the steam during the test was determined by a throttling calorimeter introduced into the steam pipe just below the separator at the turbine. A water rheostat was used for providing load for the turbo-unit. Electrical readings were taken from the regular switchboard instruments in the station, and also from a set of calibrated instruments.

Between the overload and three-quarter-load tests the boilers were tested for leakage. To determine this, all valves were closed after the boilers had been filled to marks on the gauge glass, and the boilers were kept under a steam pressure of 150 pounds per square inch for four hours. A calibrated quantity of water was then put into the boilers to bring the water level back to the original marks.

The following are the results of the tests:

TESTS OF A 500-KILOWATT TURBO-GENERATOR.

	First Test.	Second Test.
Average load	570.8 K. W.	385.8 K. W.
Per cent. of rated load	114%	77.5%
Duration of test	4 hours	4 hours
Steam pressure at turbine throttle.	143.3 gauge	142.4 gauge
Steam pressure at turbine inlet	123.02 gauge	87 gauge
Vacuum turbine exhaust	26.77 inches	27.57 inch's
Barometer	29.5 inches	29.45 inch's
Vacuum at turbine referred to 30° barometer	27.22 inches	28.08 inch's
Revolutions per minute	3600	3600
Temperature of feed water	78.8° F.	83.16° F.
Total water used corrected for temperature	48544 lbs	34552 lbs.
Drips from steam header	318.75 lbs.	397 lbs.
Drips from steam separator	68.25 lbs.	91.5 lbs.
Boiler leakage	1927 lbs.	1927 lbs.
Moisture in steam by calorimeter.	5.12%	4.48%
Actual weight of water chargeable to turbine	43878.23 lbs.	30612.01 lbs.
Actual consumption of dry steam per kilowatt per hour	19.21	19.83

Contest Between Steam and Electric Roads.

The Chicago and Milwaukee Electric Railroad Company, it is said, has asked the Interstate Commerce Commission to compel the Illinois Central Railroad to resume traffic arrangements with the electric line and participate in joint tariffs. It will be the first case of the kind heard by the commission, and railroad men generally expect it to be stubbornly contested. If the electric road wins, it may mean the diversion of a considerable amount of business from the steam roads, a loss of more than one-third of the revenue derived from purely local business by some of the roads of Indiana and Ohio which are paralleled for miles by electric roads.

In its complaint the electric-railway company says that it entered into an arrangement last November with the Elgin, Joliet and Eastern and the Illinois Central railroads for a through tariff on cabbages in carloads, to the South and Southeast, and the Illinois Central promised to furnish the cars for loading. The cars were not furnished and the 2,000 carloads shipped from Racine County in 1906 were forwarded via other lines.

It is alleged that the Illinois Central arbitrarily filed a cancellation notice with the commission, but that the tariff with the Elgin, Joliet and Eastern is still in effect.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Society of Mechanical Engineers (spring meeting), Indianapolis, May 28th to 31st.

Illinois Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), Willard Hotel, Washington, D. C., June 4th to 7th.

IN CHICAGO the noise made by the switching of railroad trains at night constitutes a great annoyance in several neighborhoods. The same trouble is experienced elsewhere, although not, perhaps, in such an aggravated degree. The amount of switching which may be done in the daytime is restricted by the necessities of passenger traffic. In some places it is restrained by regulations limiting the hours for such work. Business houses must have their cars available for loading during the day, and the shifting of these cars is done at night, to the destruction of sleep of those living within a distance of half a mile or more. The principal source of noise is the exhaust of the locomotive—the puffing of the engines—and this would be done away with entirely by the substitution of electric locomotives. This evil thus adds another potent argument to the others advanced to show cause why all terminal and suburban railroad traffic in Chicago and other large cities should be conducted by means of electric power.

ELECTRIC SIGNS add so much to the cheerfulness of city life that we trust that the mayor of Chicago will give the subject careful consideration before recommending any drastic legislation on the subject to the City Council. We do not know to what extent the mayor and corporation counsel are impressed with the alleged danger of falling signs that extend over the sidewalk, or whether the alarm that is said to exist is largely newspaper-made. But it will be a great pity if any action is taken that will seriously curtail the number or brilliance of the electric signs. Taking the city as a whole, the streets of Chicago are poorly lighted, but in business localities, particularly in the "Loop" district, the signs and store-window illumination add a brightness after nightfall that would be sorely missed. Of course the signs should be very securely fastened if suspended over the sidewalks; no one wishes to run the danger of being injured by a falling sign weighing several hundred pounds, perhaps, but neither would one welcome being hit by a cornice or street clock or any other projection from a building. There should be reasonable regulation as to size and position and strict regulations as to strength of suspension; but we hope that the good sense of the city authorities will prevent anything like a "campaign" against the electric sign in Chicago or any other city.

ONE EXPLANATION given for the recent increase of telegraph rates is that the competition of the long-distance telephone has cut into the receipts of the telegraph companies to an appreciable extent, so that with the increased cost of doing business more revenue is necessary to make what the telegraph companies consider a fair profit. Unquestionably the telephone has diverted considerable business from the telegraph, and the proportion of interurban electric communication transacted by telephone is pretty sure to increase with the improvement of the art of long-distance telephony.

When conditions are right a long-distance telephone, even up to a thousand miles or more, is a very satisfactory thing. Views can be interchanged, questions answered or confidential communications made over the long-distance telephone in very comfortable fashion under usual conditions. But the rates are high, and sometimes the atmospheric or other untoward conditions make talking over the telephone for even a couple of hundred miles a trying experience. So that, after all, the competition, while considerable, is not so great as it might appear; both the telegraph and the telephone are needed in the present state of the art. Then, too, each kind of communication creates business for the other; many telegraph messages begin or end their journey by telephone, while nearly all appointments for long-distance conversations are made by telegraph.

It is not likely, therefore, that a very serious decrease in telegraph revenues has been caused by the telephone. The telephone largely has created a field of its own, and perhaps by familiarizing people with the advantages of instantaneous communication has really helped the cheaper telegraphic service. A further consideration is that the relations of the principal long-distance telephone company with at least one of the telegraph companies are supposed to be rather intimate, while the two telegraph companies themselves do not compete in price, so that it would be a pretty shrewd guess that the whole subject of telegraph-telephone competition had been threshed out at headquarters long before the recent increase of telegraph tolls was made.

THE BRENNAN single-rail railway system, in which the cars are balanced by the application of the gyroscopic principle, seems to be taken quite seriously by some of the English engineers who have given it attention. Reference has already been made in the Western Electrician, from accounts cabled to this country, of the exhibition of Mr. Brennan's model before the Royal Society on May 8th. Commenting on the apparatus the London Electrician says: "As to the future of the device, it would appear that there should be a large opening, at least where the difference in cost in laying a single rail and the ordinary track is of importance. This, of course, is essentially the case in War Office transport, and we are therefore not surprised to find that a full-sized vehicle is being built for the War Office to see what its capabilities really are." There is only one line of wheels, placed centrally along the length of the truck, and the car is fitted with gyroscopes to maintain stability. In the model which was shown at the conversazione of the Royal Society the effectiveness of these gyroscopes was shown. The model, which was four or five feet in length, was equipped with two gyroscopes running at 7,000 revolutions per minute, and appeared to be equally at home on the tight rope on which it was raised off the platform or upon the track surrounding the room on which it subsequently ran. The whole model was worked electrically. In actual practice, whether electric or steam driving be adopted, it is presumed that the gyroscopes would be electrically operated in either case. But it is not likely that the model at the Royal Society was subjected to any appreciable wind stress, and it remains to be seen, in practice, whether a broadside gale of wind would not overturn the car in a cross-country run.

ONE OF several good papers read before last week's convention of the Southwestern Electrical and Gas Association at San Antonio, Tex., was that by Arthur Curtis Scott, professor of electrical engineering of the University of Texas at Austin. Professor Scott took as his subject the "Value of Scientific Tests to Public-service Corporations." He made a plea for closer co-operation between what may be termed the research end and the practical end of technical undertakings. "Evidence is sufficient to show that our modern industrial life, in bringing men into contact with an entirely unprecedented array of complex engineering problems, demands a great and increasing amount of dry and impartial scientific thinking which shall be wholly unhampered by financial embarrassment or political coercion. The value of such thinking to public-service corporations is two-fold, in that it must add, on the one hand, increased quantity and improved quality of service at the same cost to them, and, on the other, the continued confidence of the public, which is of no small moment, particularly with respect to municipal corporations."

The author pointed out that every state in the Union has at least one technical school or college, while, in addition, there are many finely equipped research laboratories maintained by private corporations or individuals. The public-service companies should actively co-operate with the technical schools of their states in their own interest. Often these companies benefit financially from the results of scientific tests of their apparatus to an extent much greater than is represented by the amount paid in fees. In addition, the technical schools should conduct scientific investigations.

Urging the public-service companies to consider the desirability of co-operating in the matter of making tests of power plant equipments, as well as apparatus which may be sent to the laboratories, Professor Scott concluded his excellent paper by showing that scientific tests should reveal the truth concerning the tested material, while they may indicate possible improvements in economy.

Developments at Gary, Ind.

The town or city of Gary, Ind., created by the Indiana Steel Company on the shore of Lake Michigan a few miles from Chicago, now has a population of over 4,000. Preparations are being made for the commencement of actual work on the huge steel mills which are to be the making of a large city, with a population, the company says, of 200,000 by the time the mills and other industries are in full operation, within a few years.

Many large contracts for material and machinery to enter into the buildings and equipment of the steel mills are now being let by the Indiana Steel Company. A village board has been organized to look after the affairs of the town and already work is in progress for the construction of sewers, waterworks, lighting and street-railway plants, etc. Franchises for these public utilities were granted a few days ago to the Gary Land Company, the Indiana Steel Company and the Gary Electric Railway Company, all subsidiary corporations of the United States Steel Corporation.

At present and during the preliminary stages of construction of the city and the steel mills electric current for light and power is furnished from the central station at South Chicago. This service will be replaced by the large gas-engine electric power plant which is to be centrally located for supplying light and power for the steel mills and for lighting the town.

The power and lighting plant is to be gas-engine driven and will consist of about 15 units. The total electrical generating capacity will be 36,000 kilowatts. Contracts for these machines were let some time ago. To take care of the power and lighting load in the immediate vicinity of the power plant provision has been made for a generating capacity of 4,000 kilowatts in direct current at 250 volts. The remaining 32,000 kilowatts will be alternating current at 6,600 volts, three-phase, 25 cycles.

Among the contracts recently let for machinery and equipment at the Gary plant is one of a storage-battery equipment to take care of both the alternating-current and direct-current generators. On account of the widely fluctuting load to which both the alternating and direct-current generators will be subjected two large storage batteries of Chloride accumulators, manufactured by the Electric Storage Battery Company of Philadelphia, will be installed. These two batteries have a capacity of 2,160 kilowatts at their one-hour rate of discharge. The batteries will be connected directly to the direct-current bus-bars in the plant and will also be connected through suitable transforming devices to the alternating-current system, so that they will be able to relieve both the alternators and direct-current generators of heavy load fluctuations. This arrangement, although quite recently worked out, has recently been installed in a number of large plants in the steel industry.

The franchises for gas and electric light in Gary call for the operation of plants within a year. Street cars also are to be running within a short time. It is said that already 1,000 residences are in course of construction, for the most part owned by the company. These cost from $2,000 to $15,000 each and will be ready for occupancy by winter.

Caseine Produced by Electrolysis.

In the new electrolytic process invented at Paris by Mr. Gateau the caseine instead of being formed as usual by treating milk with different substances for curdling it is produced in an electrolytic bath. The inventor was granted a French patent not long since. The essential features are as follows:

In the center of a tank filled with skimmed milk heated to about 80° C. is placed a porous vessel containing a solution of caustic soda, about five per cent. strength, in which is dipped an iron cathode. The anode is made of carbon and placed in the milk with about four inches distance between the two electrodes. When a current having a density on the anode plate adjusted at 0.01 ampere per square centimeter of surface is passed it is found that phosphoric acid is set free in the milk and this causes the caseine to be precipitated. With a current of 160 amperes and a voltage of 11 volts the apparatus will take all the caseine from 100 liters of skimmed milk within 20 minutes.

In place of an alkaline solution the whey coming from a preceding process can be used in the porous cup, this being kept at the same degree of concentration which it has after the precipitation of the caseine. The electrodes are disposed as before and it is possible to precipitate within 10 minutes all the caseine from 100 liters of milk by passing a current of 160 amperes and 18 volts.

Another variation of the process consists in surrounding the anode by a porous vessel so as to collect the phosphates and phosphorous acid as by-products, or again, if this arrangement is not used the current may be allowed to pass after all the caseine has been precipitated so as to have a greater proportion of phosphoric acid. The new process has several apparent advantages. In the first place it gives a better yield of caseine than the usual methods, and again the expense for current is less than for the products used generally for curdling the milk, at least in cases where cheap current can be had from a hydraulic plant or a windmill. As it does not introduce any foreign products into the milk, it is better adapted for giving food products. The method is well adapted for giving the caseine which is used in the compressed product known as galalith, which forms a hard block and can be turned in the lathe. It is used for various purposes in manufacture and can often replace celluloid to advantage.

New Officers of the General Electric Company.

At the annual meeting of the General Electric Company on May 14th the following-named directors were elected:

Gordon Abbott, Oliver Ames, T. Jefferson Coolidge, Jr., Frederick P. Fish, George P. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, all

B. E. SUNNY, VICE-PRESIDENT OF THE GENERAL ELECTRIC COMPANY.

of Boston; C. L. Coffin, J. Pierpont Morgan, S. L. Schoonmaker, Charles Steele, all of New York; W. M. Crane, Dalton, Mass.; Marsden J. Perry, Providence, R. I.; J. P. Ord, Albany, and E. W. Rice, Jr., Schenectady, N. Y.

The new directors are S. L. Schoonmaker and Marsden J. Perry, succeeding Eugene Griffin, deceased, and T. K. Henderson.

On May 15th, at the directors' meeting in New York, the following-named officers were elected:

President—C. A. Coffin.

Assistant to the President—A. W. Burchard.

Vice-presidents—E. W. Rice, Jr., Hinsdill Parsons, B. E. Sunny, J. R. Lovejoy.

Secretary—M. F. Westover.

Treasurer and Assistant Secretary—H. W. Darling.

Second Assistant Secretary—I. S. Keeler.

Assistant Treasurer—H. P. Schuyler.

General Auditor—Edward Clark.

Assistant General Auditor—John Riley.

Assistant General Auditor—S. L. Whitestone.

The numeral designations of the vice-presidents as "first vice-president" and the like have been abolished. The duties of the various vice-presidents, it is said, will remain the same as before. Mr. Rice continues in charge of manufacturing and engineering and Mr. Parsons is at the head of the law and patent departments. The new vice-presidents are Mr. Sunny of Chicago, western manager, and Mr. Lovejoy of Schenectady, general sales manager. Both gentlemen have had long experience with the company and are men of conspicuous ability.

Mr. Sunny's election is particularly gratifying to the electrical men of the West, not only owing to his personal popularity but because for the first time a vice-president of the company will have his headquarters west of Schenectady. Although a native of Brooklyn, Mr. Sunny has been identified with the electrical interests of Chicago since he arrived at man's estate. His experience has been particularly wide and varied, and he has steadily advanced until for a number of years he has been one of the leading figures among the electrical men of the West. He has been a telegraph operator, a telegraph office manager, a telephone superintendent and president of a central-station company (the old Chicago Arc Light and Power Company). In 1888 he was appointed manager for the Thomson Houston Electric Company in Chicago, and when the General Electric Company absorbed that company he retained the position, with gradually amplified duties and the title of western manager. He has been conspicuously connected with the electrical development of the city in nearly every branch, and has also been active in civic affairs as a public-spirited citizen. He was a director of the World's Fair of 1893, a prominent figure in the old Chicago Electric Club, president of the Civic Federation of Chicago, a delegate to the convention that framed Chicago's new charter, and he is now president of one of the state boards at the insistence of Governor Deneen.

The Kern River Power Development.

By the completion of the Kern River plant No. 1 of the Los Angeles (Cal.) Edison Electric Company the problem of cheaper power for commercial purposes in Southern California has been solved. The big plant was formally put into operation on May 12th. Factories in Los Angeles are now said to be supplied with power at cheaper rates than exist in most sections of the United States.

The power which has wrought this change comes from far up in the lower Sierras of California, almost at the headquarters of the Kern River, whence through 20 tunnels water from the mountain snows and rains is led down 12 miles for a fall of nearly 1,000 feet and transmuted into 20,000 horsepower of electrical energy, which in turn is carried under a pressure of 75,000 volts a distance of 117 miles to Los Angeles, making the transmission line one of the longest in the world. The concrete-encased pressure main which leads the water from the tunnels to the power house is said to be the first of the kind ever put in use. Furthermore, the conduit which carries the water to this pressure main is probably the longest tunnel system in use for this purpose.

When plants Nos. 2 and 3 of the system are completed a capacity of 60,000 horsepower will have been attained.

Government Will Study Coal-mine Explosions.

The United States Geological Survey will establish soon, probably in the Pittsburg district, an experiment station for the purpose of testing explosives used in coal mining, the ultimate object being, if possible, a reduction in the number of mine disasters resulting from gas and coal-dust explosions. Miners' safety lamps will also be tested at this station, and explosives investigations conducted both in the laboratory and in the mines. The experiments will be under the direction of Joseph A. Holmes, chief of the technologic branch of the Geological Survey. Dr. Charles E. Munroe has technical supervision of the tests which will be conducted at the station. Clarence Hall, explosives expert for the Geological Survey, assisted by W. O. Snelling, will have immediate charge of the experiments. Mr. Hall has recently returned from Europe, where he made a study of the foreign government testing stations.

Utah Society of Engineers.

A meeting of engineers was held in Salt Lake City on May 13th to organize a Utah society of engineers. The membership will consist of electrical, mechanical, mining and civil engineers, as the object of the association is to foster and encourage engineering applications in the useful arts, to further the advance of the individual members and the profession as a whole. Among those present at the initial meeting were Oscar Lachmund; Joseph F. Merrill, Ph. D. of the State University; E. H. Beckstrand, M. M. E.; A. O. Gates of the A. I. E. E.; D. McNicol, A. I. E. E.; W. N. Tanner, R. R. Corey, George O. Chaney, J. C. Armstrong, Richard R. Lyman, Ph. D.; H. P. Saunders and other prominent engineers. A committee was appointed consisting of Messrs. Chaney, McNicol, Saunders, Armstrong and Dr. Lyman to draw up a constitution to be presented for adoption at the next meeting of the club.

Southwestern Electrical and Gas Association.

The third annual convention of the Southwestern Electrical and Gas Association which was held at San Antonio, Tex., May 14th, 15th and 16th was more largely attended than any convention of that organization that has yet been held. In addition to the 150 or more delegates present there were many electrical supply men in attendance.

The convention, which was held at the Menger Hotel, was called to order by H. S. Cooper of Galveston, president of the association. He introduced Reagan Houston, former counsel and manager for traction interests at San Antonio, who delivered an address of welcome. President Cooper, in the course of his remarks, discussed the relationship of the corporation interests with the people, and urged that a better feeling between the two be cultivated. In referring to the work of the association Mr. Cooper said:

"We are not competitors one against another as in most associations, and we are seldom competitors in any sense, especially in the old 'cutthroat competition' meaning. We are not a bad lot, and we believe there is no question that we are probably the most law-abiding, liberal and public-spirited concern in our community; that we give an honest equivalent for every cent or concession we get, and that we do it on a margin of profit and with an amount of work that would drive any mercantile concern into bankruptcy or the insane asylum; but with all this we have, as a whole, got the 'bad name,' and we have only missed hanging by a little. It is up to us, therefore, to start in and 'toot our own horn' so loudly and continuously as to drown out the noise of the unthinking, unreasonable, ignorant or malicious kicker, and to make the public, and through it its representatives, listen to us and hear our side of ourselves. It is up to us to keep at this steadily, concentratedly and unitedly, and if we do this we will get a hearing and a standing. We must do it, however, with no false notes; the tune must be the old one of 'the truth, the whole truth, and nothing but the truth,' and if we do that we can secure and hold our footing."

H. M. Moore, manager of the Austin Gas and Electric Company, submitted a paper on "Education of Legislators with Reference to Public Service Corporations." His views were along the same line as those presented by President Cooper. Following the reading of Mr. Moore's paper there was some discussion on its salient features. The question box, which was devoted principally to the gas business, was opened and the different subjects discussed.

At the afternoon session V. W. Berry read a paper on "Labor-saving Tools and Devices; Central Stations and Car Barns." He discussed the handling of heavy machinery and the fitting of machine shops. He favored the pneumatic hoist for handling heavy machinery with safety and dispatch. After a general discussion of Mr. Berry's paper the delegates were escorted by the local reception committee to points of interest about the city. At night they were tendered a Mexican supper and entertainment at Electric Park.

The forenoon session of the second day's proceedings was devoted to the reading and discussing of two papers. One, by Arthur C. Scott, professor of electrical engineering in the University of Texas at Austin, was on "The Value of Scientific Tests to Public Service Corporations;" the other, by F. C. Randall of the Galveston Electric Company, being on the subject of "The Getting Up and Trying Out of Forms." Mr. Scott urged that public utilities of whatever sort be so ordered as to elevate the intellectual and moral tone of the ignorant without meeting the disapproval of the educated. In concluding his paper he said: "It may be properly maintained that the general public which supports many of our best technical schools should be willing to provide facilities for scientific tests of public-service utilities and at the same time demand that the results of such tests be published. These results would be highly important, as they would aid in securing greater economy, a higher class of service and promote confidence in public-service corporations, because the scientific man would have no reason for withholding the truth concerning his work on account of his position, his politics or his religion." Mr. Randall urged the drawing up of forms in a careful and systematic manner to enable a company or its employes to obtain accurate information in the least possible time.

The afternoon session of May 15th was devoted largely to discussing various questions of the question box. These questions related to car sheds and shops, rolling stock, roadbed and maintenance of way, transportation, amusement parks, management and auditing. The following committee was appointed to nominate officers for the ensuing year: H. S. Potter of El Paso, J. P. Crerar of Denison, Samuel Kahn of San Antonio, and E. D. Kelly of Hillsboro. A committee was appointed to select a permanent secretary and to establish permanent headquarters at some place in the state. The committee was composed of the following: H. T. Edgar, Fort Worth; W. B. Head, Grandview; W. B. Tuttle, San Antonio; A. E. Judge, Tyler, and J. D. Oliger, Cleburne. Professor Arthur C. Scott was made an honorary member of the association. In the evening the Sons of Jove held a rejuvenation and initiated a number of new members.

At the last day's session of the convention D. N. Warwick of the San Antonio Gas and Electric Company read a paper on "The Application of Gas to Mechanical and Industrial Uses." In discussing the value of gas to the industrial consumer he said in part:

"The value of gas as a fuel to the industrial consumer cannot be figured on the basis of the cost per unit of heat as compared with the cost per unit of heat in solid fuel. Artificial gas containing 600 heat units per cubic foot and selling at $1.25 per thousand gives a cost of about $2.10 per million heat units, with coal or coke containing, say, 12,000 heat units per pound and selling at $5 per ton, gives a cost of about 21 cents per million heat units. It would seem s though a cost 10 times as great per unit of heat contained in the fuel would absolutely prohibit the use of gas, but properly constructed gas-burning appliances are so much more efficient than the appliances for burning solid fuel that this great difference is in many cases overcome. The gas flame can be applied just at the place where it is most needed at the time it is most needed, and the amount of heat used can be adjusted to the requirements with great nicety so that very little is lost by waste or by radiation.

"Even while the actual cost of the gas as fuel is somewhat greater than the cost of solid fuels, it can be frequently introduced at a saving to the consumer for the following reasons: (1) Less attention and labor are required. (2) Better regulation of heat is obtained, and consequently more perfect and more rapid work can be done. (3) Almost no space is required for the gas equipment. (4) There is no necessity of a stock of fuel being carried; a constant and unfailing supply is always at hand. (5) There is little danger of fire, and hence insurance rates are not high. Less heat escapes and consequently in hot weather employes are more comfortable and can accomplish more.

"It is not therefore necessary to give up the idea of converting an industrial prospect to the use of gas, even when the gas will cost somewhat more than solid fuel. Some of the other considerations may be more important. In developing the industrial fuel business the most efficient appliances should be installed. It is to the interest of the gas company to see that the consumers get the greatest possible results for their money."

The forenoon session was turned over to the supply men in attendance, and a general discussion between them and the delegates took place. The object of this interchange of views was to reach a general understanding on various phases of the business. Following the reading of Mr. Warwick's paper in the afternoon it was resolved that the association recommend to the executive committee the establishment of a permanent office to be located at present in the city of Dallas, which shall be the headquarters of the secretary of the association. It was further resolved "that the secretary be instructed to keep in his office all books, records, etc., of the association, and that he shall immediately upon taking office proceed to collect from the member companies data concerning rates charged by each for gas, electric light, power, etc., special street-car rates, the amounts paid by each company for taxes, for city, county, state franchise, special, etc., amounts paid for bridges, paving, street sprinkling, inspection fees, and special fees for excavating and such other charges as may be levied from time to time by the city, county and state, and to obtain copies of laws governing the erection of poles and wires in city streets, and state laws governing public-service corporations and such other useful and valuable information as in his opinion may be of value, all such data to be for the use of member companies only."

The San Antonio Traction Company and the San Antonio Gas and Electric Company were the recipients of appreciation from the association for courtesies extended. W. B. Tuttle, a member of the advisory committee, received due thanks for his efforts to entertain the ladies, and Samuel Kahn of the San Antonio Gas and Electric Company won the association's appreciation for his work as editor of the "Question Box."

The selection of a place for next year's convention was then taken up. H. S. Potter of the El Paso Electric Railway Company placed that city in nomination for the convention in 1908 and it received a unanimous vote.

The nominating committee then presented its selection of officers and committees for the ensuing year. By a rising vote these selections were made unanimous as follows:

President—H. T. Edgar, Fort Worth.
First vice-president—W. B. Tuttle, San Antonio.
Second vice-president—J. P. Crerar, Denison.
Third vice-president—J. D. Oliger, Cleburne.
Secretary—R. B. Stichter, Dallas.
Treasurer—A. E. Judge, Tyler.

Executive committee—H. S. Cooper, Galveston; W. B. Tuttle, San Antonio; J. D. Oliger, Cleburne; H. M. Moore, Austin; J. P. Crerar, Denison; P. Z. Stichter, Dallas; M. M. Phinney, Dallas; J. F. Strickland, Dallas.

Finance committee—W. B. Head, Grandview; C. H. Dunbar, Houston; Edward T. Moore, Dallas.

Advisory committee—J. E. Farnsworth, Dallas; W. J. Jones, Austin; A. A. Hauser, Beaumont; W. H. Chapman, Houston; Arthur B. Porter, Huntsville; T. C. Brown, San Antonio; J. A. Myler, Dallas; A. W. Guthrie, San Angelo; William Broyles, Palestine; Fred M. Lege, Galveston.

H. T. Edgar, the new president, made a few appropriate remarks, pledging the association his best efforts. W. B. Tuttle and H. M. Moore briefly addressed the convention, lauding Mr. Edgar for the work which he had already done on behalf of the association.

The membership of the association shows a healthy increase, and the annual report of the secretary, R. B. Stichter of Dallas, was well received. An extraordinary effort is to be made during the ensuing year to increase the interest in the association and to add to its membership.

Programme of the Coming Chicago Telephone Convention.

The annual convention of the International Independent Telephone Association will be held in the Auditorium Hotel, Chicago, June 3d, 4th, 5th and 6th. The convention proper will begin at 2:30 p. m. on Tuesday, June 4th. The forenoon of Tuesday and all day Monday will be devoted to the final meetings of the various committees and the advisory board. Those in charge of this convention have planned for the greatest gathering of telephone men ever held. The programme contains papers and reports by some of the leading Independent telephone men, and opportunity will be afforded for discussion of important matters which have developed during the last year.

Provision has been made by a competent committee for the entertainment of the delegates and their friends. On Tuesday evening there will be an outing at Sans Souci Park, and on Wednesday evening the annual informal banquet will be held at the Auditorium banquet hall. Mr. C. W. Kline of Hazelton, Pa., will be toastmaster.

On Monday committee meetings will be held as follows: 10:30 a. m., physical standards; 1:30 p. m., executive; 2:30 p. m., advisory board. Tuesday, 10 a. m., committees in charge of arrangements, entertainment, registration, etc.

The advance programme of the convention is as follows:

TUESDAY, JUNE 4TH, 2:30 P. M.

Convention called to order.
Address of welcome—F. A. Busse, mayor of Chicago.
Response—H. D. Critchfield, Milwaukee, Wis.
President's annual address—James B. Hoge, Cleveland, Ohio.
Officers' reports.
Appointment of committees.
Short talks on practical subjects—"Construction Problems," "Shield Advertising," "Collection Methods."
Open discussion.
Question box.

WEDNESDAY, JUNE 5TH, 10 A. M.

Committee report—Entertainment—Discussion and action.
Written reports of state, territorial and provincial associations.
"The Long-distance Business—How to Handle It," Frank Hart, Pittsburg, Pa.
"Independent Improvements and Possibilities," C. E. Tarte, Grand Rapids, Mich.
"Long-distance Advertising," W. J. Stadelman, Sioux City, Iowa.
"The Toll-line Clearing House," J. M. Plaister, Fort Dodge, Iowa.

WEDNESDAY, JUNE 5TH, 2 P. M.

Committee reports:
Standard forms of accounting.
Standard operating rules and regulations.
Discussion and action.
"Lest We Forget," Colonel J. D. Powers, Louisville, Ky.
"Compulsory Interconnection of Bell and Independents," J. B. Earle, Waco, Tex.; J. Walter Barnes, Fairmont, W. Va.; O. C. Snider, Kansas City, Mo.
"Postoffice Telephones and the Washington Situation," Charles E. Sumner, Portland, Ore.
"Telephone Securities as an Investment," W. L. Moellering, Fort Wayne, Ind.
"Frenzied Finance in the Telephone Field," Dwight E. Sapp, Mt. Vernon, Ohio.
"Where the Copper Comes From," J. S. Haley, Livingston, Mont.
Question box.

THURSDAY, JUNE 6TH, 10 A. M.

Committee report—Physical standards.
"Rural Telephony—Its Value to the Community and Relation to the Independent Movement," C. H. Schweizer, La Crosse, Wis.
"Making History in the Canadian Northwest," Francis Dagger, Winnipeg, Man.
"The Strength of the Chain," James S. Brailey, Jr., Toledo, Ohio.
"The Indiana Situation," Charles S. Norton, Indianapolis, Ind.
Question box.

THURSDAY, JUNE 6TH, 2:30 P. M.

Committee reports—Miscellaneous; nominating.
Election and installation of officers.

Transaction of miscellaneous business.
Presentation of new business.
Question box.

The committee on arrangements for the convention is as follows: P. C. Burns (chairman), Chicago; E. R. Conklin, Aurora, Ill.; W. B. Woodbury, Detroit, Mich.; W. Gilbert Thompson, Hamilton, Ohio; W. C. Harper, Madison, Wis. The entertainment committee consists of: Frank W. Pardee (chairman), Chicago; Howard S. Baker, Sioux City, Iowa; George H. Ihmsen, Chicago; James F. Crook, Chicago; L. G. Parker, Louisville, Ky.

Other committees and their chairmen are as follows: Reception, Theodore Gary, Macon, Mo.; registration, H. L. Gary, Macon, Mo.; sergeant-at-arms, Frank G. Hoge, Elkton, Ky.; press, G. W. Weippiert, Cleveland; physical standards, Edward E. Clement, Washington, D. C.; standard forms of accounting, Charles West, Allentown, Pa.; standard operating rules and regulations, John F. Casey, St. Louis, Mo.

Indiana Independent Telephone Association.

The annual convention of the Indiana Independent Telephone Association was held at Indianapolis May 15th and 16th. The 11 district branch organizations were well represented, and the attendance was the largest in the history of the association. President A. C. Lindemuth introduced Mayor Charles A. Bookwalter, who assured the telephone men of their welcome to the city and commended them for their enterprise and business, which he said had done as much as any one industry to make Indianapolis famous.

The report of Secretary-treasurer C. S. Norton showed that the association was in a prosperous condition and that 27 new companies had been admitted to membership during the year. The report also showed the association to be in a good financial condition, the income being, in round numbers, $2,300, and the expenditures $1,800.

There was much interest manifested in the annual address of President A. C. Lindemuth. He spoke in praise of the elaborate exhibits as a commendable feature of the convention and assured the manufacturers and supply men that the importance of their exhibits as an educational feature was highly appreciated. He said the progress of the Independent telephone interest in Indiana has been steady and important. There have been no serious deflections from the ranks of the Independents; on the contrary, a number of companies that had tired of the Bell sub-license experience cut loose and returned to the strictly Independent relation. A large number of new Independent companies have constructed and equipped plants, the president said, and there are now 182,000 Independent telephones in use in the state, against 45,000 operated by the Bell company. Mr. Lindemuth said that to make success permanent rates must not be reduced below a point commensurate with the greatly increased service, neither must the companies as they grow stronger forget the rights of the people or the people forget their benefactors.

President Hoge of the National association made a very pleasing and encouraging talk relative to the present conditions throughout the several states. He assured the convention that the Independents all over the country had been placed on a substantial basis and are giving satisfactory service at remunerative rates.

Very close attention was given to the reports from the district vice-presidents. The reports from the eleven districts were very satisfactory.

Frank L. Beam, president of the Ohio Independent Telephone Association, was introduced and assured the convention that the reports of Independents going over to the Bell in Ohio were not true. He referred to the obligation one state owed to another and one company to another, and urged the necessity of the states and the companies standing together.

An address on "The Magnitude of the Independent Telephone Business" was made by Theodore Gary of Macon, Mo., president of the Home Telephone Company of that city. Mr. Gary said the Independents had the best business in the land. He related many experiences had in buying up plants and improving them and said that the only way to conduct satisfactorily a telephone business was to constantly bear in mind that the public has an interest in the business. He urged the telephone men to have confidence in each other and thereby preserve the great business already built up.

E. B. Fisher of Grand Rapids, Mich., president of the Michigan Independent Telephone Association, spoke of conditions in Michigan and assured the Indiana Independents that Michigan bore a very close relation to Indiana and that they had been greatly inspired to emulate the enterprise shown in Indiana.

The banquet at the Claypool Wednesday night, given by the Indianapolis Telephone Company and the New Long-distance Telephone Company, was a very enjoyable occasion to the 308 members of the association and their guests. Thos. E. Davidson of Greensburg acted as toastmaster. The following responses were given: "The Strenuous Life," J. D. Powers, Louisville, Ky.; "Think Back," James S. Brailey, Jr., Toledo, Ohio; "Repairing Fences by Telephone," James P. Goodrich, Winchester; "Buckeye Philosophy," W. E. Sapp, Mount Vernon, Ohio; "Changes and Exchanges," A. J. Payton, Rockport; "Words of Good-bye," A. L. Tetu, Indianapolis.

The closing session of the convention was given up to a general discussion of the possibility of any merger or working agreement between the Independent companies and the Central Union company. Notwithstanding that the executive committee reported that the proposition had been made by field agents, who disclaimed official authority in the matter, and that there was nothing to consider, the delegates insisted on discussing the matter thoroughly, but the committee's report was unanimously adopted. The constitution and by-laws were so amended as to make a company connected with the Bell company ineligible and likewise cause a company found connecting with the Bell company to forfeit its membership in the association.

The election of officers resulted in the selection of the old officers, viz., A. C. Lindemuth of Richmond, president, and S. C. Norton of Indianapolis, secretary. Twelve delegates were elected to attend the convention of the International Independent Telephone Association in Chicago.

Illinois Independent Telephone Association.

The annual meeting of the Illinois Independent Telephone Association was held in Springfield on May 15th and 16th. W. H. Basset of the Kinlock Telephone Company of St. Louis, Mo., presided at the opening, in the absence of both President Conklin and Vice-president Savage. Mayor Griffiths of Springfield gave the address of welcome. Competition in the telephone business was a good thing, the mayor said, as it tended to keep the rates down and also was a factor in getting better treatment from the companies. On behalf of the association, Vice-president Savage replied.

Colonel Hackett of Jacksonville read a paper on the "Past and Present Conditions of the Telephone Business." He spoke of the rates being maintained and in some cases increased in the country and that the success of the Independent companies was in a large degree due to the shortcomings of the old companies. The marked degree of politeness which the girls at the switchboard show is one reason for the success of the Independent companies in securing and holding subscribers. The speaker also took occasion to state that the old policy of fighting between the different companies is now a dead issue.

J. S. Dailey spoke on "The Fallacy of Free Exchange and Cheap Switching." He said that in getting something for nothing someone must suffer a loss. In order to accomplish this free exchange there is a waste of energy and property connecting the two or more systems without compensation; there is a waste of investment without adequate returns. There is a robbery of profit-producing terminal systems to maintain a series of exhaustive connecting links which should in themselves be self-sustaining. It is pertinent that the usual free-exchange advocate is not a busy man, and that any old kind of service will do if it does not cost him anything. Cheap switching encourages cheap construction, the root of poor service.

Miss Barnes, chief operator of the Interstate Telephone Company at Springfield, gave a school of instruction for the operators who attended the convention. In the evening a theater party was given by the association in honor of the visiting delegates. An illustrated lecture was given by J. H. Shoemaker of Waterloo, Iowa, on "Fighting the Octopus."

Manford Savage of Champaign, the vice-president, was elected president; William H. Basset of St. Louis, vice-president, and Charles B. C. Cheadle of Joliet, secretary. C. S. Hankins of Decatur was re-elected treasurer. The executive committee was re-elected, and but one change was made in the list of vice-presidents. The matter of selecting a meeting place for the next convention was left to the executive committee.

After the election of officers Miss Barnes of the Springfield exchange read a paper on exchange operating, placing particular emphasis on the manner of answering calls; that a cheerful answer should be given. George H. Glass of Pekin read a paper on "The Manager; His Duty to Patrons and Employes." He described the ideal manager and gave the qualifications that he is supposed to have. A. J. Sands of St. Louis read a paper on "Operating Methods."

A resolution was adopted declaring it to be the sense of the convention that the growing tendency of permitting the Bell company to connect its toll wires to Independent switchboards is a practice detrimental to Independent telephony, and should not be countenanced by the association.

A committee to establish toll rates between the various companies was named by the president. The parlors of the hotel were well filled with the displays made by exhibitors.

Transportation Arrangements for Washington Convention.

A special train will leave the Union Station in Chicago on Sunday, June 2d, at 3 p. m., over the Pennsylvania lines, to carry western visitors to the Washington convention of the National Electric Light Association. It will arrive in Washington about noon on the next day. The convention dates are June 4th to 7th.

The train will run via the Fort Wayne route, passing through Fort Wayne, Lima and Pittsburg, over the beautiful Alleghenies and around the famous Horseshoe Curve. Equipment on this train will consist of library, club car, compartment observation car, standard sleepers and dining car, and will be electric-lighted throughout and high class in every respect. The fare, Chicago to Washington, D. C., is $17.50. Sleeping-car fare, for double berth, is $5; section, $10; stateroom, $14, and drawing room, $18. Those desiring to visit the Jamestown Exposition can purchase excursion tickets to Norfolk, which are good for stopover at Washington, on deposit of ticket with the ticket agent immediately upon arrival. The excursion fares from Chicago to Norfolk and return range from $22.25 for 15-day tickets to $30 for season tickets. Tickets via New York in one direction may also be had at $32.05 for 60-day tickets. Between New York, Baltimore, Washington and Norfolk, passengers have choice of steamboat or rail lines, and there will be day boats between Baltimore and Norfolk and Washington and Norfolk during the season.

The Pennsylvania train is known as the official train. Arrangements for it were made by Frank L. Perry, 507 Marquette Building, Chicago, assistant master of transportation, acting for George F. Porter, 29 West Thirty-ninth Street, New York, master of transportation for the National Electric Light Association. Requests for sleeping-car space on this train must be addressed to the Pennsylvania city ticket office in Chicago, 248 South Clark Street, or to C. L. Kimball, assistant general passenger agent.

The New York special train will go by the Central Railroad of New Jersey and the Baltimore and Ohio. It will leave the foot of West Twenty-third Street at 8:50 a. m. and arrive in Washington at 2 p. m., passing through Philadelphia at 11:15 a. m. Mr. Porter can give further information.

A rate of a fare and one-third, on the certificate plan, has been secured from all points in territory of New England Passenger Association, Trunk Line Association (except points in West Virginia), Southeastern Passenger Association, Southwestern Excursion Bureau and the Eastern Canadian Passenger Association, for those attending the Washington convention.

San Francisco Strike Situation.

San Francisco, May 16.—The street-railway strike, which is now well into its second week, continues, with the advantage apparently in favor of the United Railroads Company thus far. Over 100 cars are being operated daily with unarmed strike-breakers imported from the East. Policemen are stationed at the corners along the lines that are in operation, and very little violence is reported. The labor leaders now realize that unless good order is maintained for a good while to come the state authorities will order the militia thrown into the city and martial law will supersede the present city government.

The telephone strike is prolonged, although several announcements have been made that a settlement is near. A remarkably good service is given, considering the great reduction in the number of operators at work. Many of the strike-breaking operators sleep in improvised dormitories in the telephone exchanges so as to avoid danger of molestation in going to and from work. A.

Telegraph Companies Reported to Have Working Agreement.

The report recently circulated that the Western Union Telegraph Company and the Postal Telegraph Company have entered into a working agreement is reported to be generally accepted in New York commercial and financial circles as true. A newspaper despatch says: "There has been plenty of circumstantial evidence during the last few months in the form of increased rates, reduced forces and closed competing offices to indicate that the two corporations have established at least a 'community of interest' compact." By the alleged agreement into which the two companies have entered it is said an annual saving of $2,400,000 will be effected. The working agreement involves decreased rentals for booths in hotels and other public places, consolidation of offices, increased rates and a wage saving by cutting down operating forces.

It is alleged that only 55 per cent. of the operators of the Western Union Telegraph Company received the promised 10 per cent. increase in wages on March 1st last and that there may be a strike. But it is probable that the dispute will be submitted to arbitration.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XVII.—Electrical Measurements.

Voltmeters, Ammeters, Wattmeters.

In addition to the galvanometers and Wheatstone bridge already described the most commonly used [illegible] instruments in laboratory work are ammeters, voltmeters and wattmeters. These instruments may, [illegible] identical in their general design, the only difference between them being variation of the details necessary to adapt them to reading either amperes, volts or watts.

Precision instruments in general have a much higher degree of accuracy than portable or service instruments, and as they are generally used on a testing table portability is of no special value. They are, therefore, made considerably larger than the portable instruments and are generally much heavier. Their construction, moreover, may be considerably more delicate than portable instruments, because they are not subject to rough handling and usage to which the latter are incident.

Voltmeters are instruments for measuring the difference of potential between two points in an electrical circuit. Some of the most accurate voltmeters are similar in general principles to galvanometers, their action depending upon the mutual attraction between two sets of coils. Voltmeters are built with a very high resistance so that only a small current will pass through the instrument, even when there is a great difference of potential between the two points of the circuit being measured. The current will vary directly as the difference in potential, so that the needle attached to the movable system of coils will be deflected proportionally to this difference.

There is no essential difference between a voltmeter and an ammeter, except that they are built with different internal resistances, and the scales are graduated differently. The ammeter, in order to measure the intensity of the current, must be connected in series in the circuit, and in order that it should not consume too much energy it is necessary that its resistances should be very low. In most of these instruments the movable coil is connected in parallel with a shunt through which the main current passes, and the amount of current passing through the ammeter is proportional to the current passing through the shunt. The scale is graduated so as to read directly in amperes.

The wattmeter differs but little from the ammeter and voltmeter, but combines the functions of both of these meters in one. The wattmeter measures energy, which is equal to the product of the amperes and volts of the circuit, and it has two systems of stationary and movable coils, one set serving the purpose of a voltmeter and the other that of an ammeter. These two systems of coils are arranged in inductive relation to each other, so that the mutual action between them will be proportional to the products of the volts and amperes. The indications of the wattmeter give direct readings in watts in both direct-current and alternating-current circuits, and are principally useful in alternating circuits because the instrument reads the true watts directly, irrespective of the power factor.

Precision instruments are generally arranged for zero reading, that is to say, when the movable coils are deflected through a certain angle, the indications are read from deflection, and a spring is required to return the movable coils to zero position. They are also provided with a vernier so that the very small fractional part of one division can be read accurately.

Portable Instruments.

Portable instruments are used for general testing purposes, such as the measurement of current, voltage and energy consumed by motors, lamps, etc., and in central station work they are also largely used for testing the accuracy of service meters. Portable instruments may be built upon several principles, but those giving the most satisfactory performance on direct current work are made with [illegible] magnets, while for the alternating-current [illegible] induction type of instruments are the most [illegible] and satisfactory. For some purposes [illegible] to have instruments which can [illegible] both direct and alternating current.

[illegible] important requirement of portable instruments is that they should be built to withstand the [illegible] rough usage to which all portable instruments are necessarily subjected. An instrument which is carried around and used for all kinds of testing work will unavoidably receive more or less hard knocks, and unless it is very substantially constructed it will eventually give trouble.

Another important requirement of portable instruments is that they should have long scales, so that the divisions are fairly large. In the case of short scales the divisions at both ends of the scales are generally crowded closely together, and it is impossible to read the indications accurately except in the central or working part of the scale. This makes the readings at light load and at full load of the instrument very unreliable, so that if accurate readings are required only from one-half to two-thirds of the scale can be relied upon. In order to secure accurate readings it is necessary that the range of the instrument should not be too great; otherwise the divisions on the scale become so fine that little accuracy of reading is possible.

To avoid the use of a number of instruments it is desirable to have one instrument of only a moderate range, provided with auxiliary arrangements for varying the range of measurements. In case of direct-current work a number of shunt or series resistances may be used in connection with the voltmeter or ammeter, and knowing the multiplying power of the shunts, readings can be taken with a single instrument over almost any range of values.

In the case of alternating-current instruments, small transformers perform a similar function. For the ammeters series transformers are used, and for voltmeters potential transformers. In measuring the energy of direct current it is necessary to measure both the amperes and the volts, as the energy is equal to the product of these two factors. To read this product directly, wattmeters are used, which are provided with two coils, one of which serves the purpose of a voltmeter and the other that of an ammeter, the voltmeter coil being connected in shunt across the circuit to be measured, and the ammeter coil being in series with the circuit. The mutual action between the two circuits is proportional to the products of the volts and amperes.

Integrating and Recording Meters.

The meters heretofore described are of what is known as the indicating type and are used merely for reading momentary electrical values. For service meters, however, and for some kinds of testing work, what is known as integrating meters are required. These are instruments which record, by means of dials, the total consumption of energy during a given period, or, in other words, the element of time is included in the readings.

On direct-current circuits wattmeters are not so essential, as a record of ampere-hours would permit the total energy to be computed. This is because the voltage is presumed to remain constant and the product of the volts and amperes represents the true energy.

In alternating-current circuits the product of volts and amperes must be multiplied by the power factor in order to indicate the true energy, so that the use of ammeters is not so convenient. The wattmeter, which is built upon the principle of the induction motor, indicates the true energy of the circuit upon the dial, regardless of the power factor. The best integrating wattmeters are fully as accurate as high-grade indicating meters.

Another class of meters, used principally in central-station switchboard work, are known as recording meters. These meters are provided with clockwork, which unrolls a strip of paper at constant speed, and an indicating pointer of the instrument consists of a pen which travels on the paper and traces a line which gives a continuous record of the readings of the instrument. These machines, while accurate enough for all general purposes, cannot be made quite as sensitive in their indications as instruments which have no recording feature, and, moreover, they consume somewhat more energy from the circuit, owing to the extra work performed.

Care of Meters.

In using any type of meter the most important items to be considered are, first, that the case be dust proof and moisture proof, and second, that the moving elements be extremely light and the bearings so constructed as to eliminate friction to the utmost possible extent. If the moving element is at all heavy, more or less wear in the bearings will soon take place and the friction due to the increasing wear will soon impair the accuracy of the motor.

It is also important that the movable element should have a high torque. This high torque, however, should be attained by decreasing the friction rather than by increasing the weight of the movable element, as the friction causes a fixed loss in the readings at all loads, and its effect on an integrating meter is to make it record too slowly by a constant amount, thus making the meter much less accurate on light loads than on full loads. The most important combination of features to assure permanency in calibration is high torque, with very light moving elements and ball or jewel bearings, which practically eliminate wear and reduce the friction to an inappreciable quantity.

[To be continued.]

Note.—This series of articles, intended to serve, briefly, the [illegible] of applied electricity for light, power and heat was [illegible] in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

The Rotary Condenser.

J. E. W., Cleveland, Ohio: What is a rotary condenser and to what part of the electrical business is it applied?

Answer.

"Rotary condenser" is a term sometimes used, more particularly in England, to denote a synchronous motor which operates as an idler in parallel with an alternating-current bus system to correct lagging currents. The relative kilowatt capacity of such a device to the capacity of the units supplying the bus with energy is about 1 to 10. The corrective factor is obtained by the usual method of over-excitation of the fields.

Dimming of Lamps.

R. H. L., Oakland, Cal.: How are electric lights turned down, as in a theater?

Answer.

There are three ways of accomplishing this in practice, each of which employs the same electrical principle. One way is to have the lamps made with two filaments, one of which has a high resistance and will not light up to full brilliancy on the voltage of the mains. The connections can then be so arranged that either filament of the lamps can be used according to whether a bright or dim light is desired. The above method admits of only two degrees of illumination, and is therefore not adapted for some uses. It is, however, used extensively for halls, closets and places of like character.

The second way is to connect the lamps in such a manner that different resistances graduating in value can be connected in series with the circuit. This cuts down the proportion of the power utilized by the lamps. It gives a perfectly gradual reduction of the light, but a certain amount of power is wasted in the resistance.

A third way, which is more economical of power than the second, but not quite so flexible, is accomplished by having different combinations of connections. For instance, if a lamp has full brilliancy on 110 volts, two such lamps have one-half brilliancy, three have one-third brilliancy, etc. The wiring for illumination variation by this method is more intricate than in either of the above.

Generation of Electricity.

M. N., San Francisco, Cal.: In how many ways can electricity be generated?

Answer.

If this question refers to fundamental methods, it is only necessary to name over a few; but if "ways" includes kinds of steam generating plants, of waterpower generating plants, etc., the answer would become quite involved.

Fundamentally speaking, electricity can be generated magneto-motively, chemically, by heating the junction of dissimilar metals, and by friction on certain substances.

Electricity generated in dynamos driven mechanically is produced in the first manner. From storage or primary batteries it is chemically produced (in storage cells the charging is usually done from an electro-magnetically generated source; the discharging, however, is a purely chemical action). Thermopiles and all devices which use heat acting upon junctures of certain metals to produce electricity are in distinctly a third class. Frictional or static electricity was the first sort discovered, but is a method which generates high pressures but small quantities. Flannel on sealing wax, sparks on the back of a cat, and the electricity generally

used for therapeutic purposes is generated in this way.

Atmospheric electricity and lightning are generated in several of these ways—just how it is difficult to tell. The atmosphere is a medium for all forms of energy—light, heat, sound, electricity—and these forms are interconvertible, as much so naturally as artificially.

Proposed Railroad Merger in New England.

An important statement on the plans of the New York, New Haven and Hartford Railroad Company was recently made in New Haven, Conn., by a high railroad authority in connection with the future control of the Boston and Maine system.

He pointed out the fact that since President Mellen became the head of the New Haven, some four years ago, there have been between 40 and 50 consolidations of various kinds in this system, including steam lines and trolley lines, in Connecticut and Massachusetts. To these will be added at the end of the present month the merger into the parent steam company of its holding company—the Consolidated Railway Company. The next step will be the progressive merging of the intricate system of corporations holding the street railways of Rhode Island, these ultimately being taken into the parent corporation.

This consolidation policy of President Mellen as applied to Connecticut corporations indicates the final plan during his presidency of consolidation into one management of all properties under the New York, New Haven and Hartford Company's control, successively merging steam roads outlying in Rhode Island and Southern Massachusetts, including the Old Colony system, parts of which are the Boston and Providence and the Providence Worcester roads, and then the consolidation of the Boston and Maine system.

A final feature in the situation is the vesting in a Connecticut corporation of practically the entire railroad system and a large part of the street railways of New England, which will mean a considerably larger representation in the New Haven corporation of the local interests of five other New England states. Another subject of uncertainty is believed to be President Mellen's policy when in control of the Boston and Maine in regard to street-railway rivalry and the acquisition of the rival roads. In taking up the Boston and Maine, it is said, he will in less degree face the same problem of street-railway rivalry as he found in Southern New England.

Specifications for Electric Signs.

At the recent meeting of the Underwriters' National Electric Association in New York the following specifications, covering construction and equipment of electric signs, were accepted. They will be finally presented, together with any alterations or additions which seem desirable for adoption as requirements of the National Electrical Code at the next annual meeting:

1. Wires carried on the outside of sign structures must be run in approved metal conduit or approved armored cable.
2. Wires within structure of sign must be double braided, rubber covered, and may be carried within one-half inch of each other and of surrounding metal. Where such spacing is impracticable, such wires may be cabled if one-half-inch spacing is maintained, and if cable contains wires of only one polarity.
3. Must be constructed entirely of metal or other approved non-combustible material, except that wood may be used on the outside for borders if kept at least two inches from nearest lamp or socket. In case of ornamental scroll work or similar design, where impracticable to support wires as above provided, they may be separated from such metal by sections of porcelain or glass not less than one-eighth inch in thickness.
4. Sheet metal must not be less than No. 26 B. & S. gauge.
5. Must be braced by angle iron of such thickness and so placed as to secure sufficient strength and rigidity.
6. All metal must be galvanized or enameled, or treated with at least three coats of anti-corrosive paint or compound.
7. If the terminals of receptacles are not the enclosed type, the receptacles must be so constructed that the terminals will be at least one inch from surface wired over. Wires must be soldered to such terminals and exposed parts treated to prevent corrosion.
8. Bottom of sign must have at least a one-quarter-inch drainage hole for each square foot of its surface.
9. Where wires cross each other, pass out of letters or into cut-out boxes, they must be protected by approved tubes or bushing.
10. Must have maker's name or trademark permanently attached to the exterior.

Electric Railway Consolidation in Southern Michigan.

A report from Jackson, Mich., says that there is a scheme on foot to consolidate the Michigan United Railway Company with the Detroit United, which would give control of all the interurban railroads of Southern Michigan. The Michigan United controls about 15 traction lines and the Detroit United about as many. This announcement is the result of the absorption of the Jackson Consolidated by the Michigan United Railway Company for $1,250,000. The Everett-Moore syndicate practically controls the Detroit United Railway as well as the network of lines extending into the interior of Michigan, and they are said to be busily engaged in acquiring control of the interurban lines entering Toledo, Ohio.

"The Isle of Jove."

The large audience which attended the two-act operetta "The Isle of Jove" at the Association Auditorium, Chicago, on the evening of May 16th, had a pleasant evening's entertainment and enjoyed a performance of much higher grade than the average amateur show. The affair was under the direction of the Chicago Jovian Club and was attended by a large proportion of the gentlemen prominent in Chicago electrical affairs, many accompanied by ladies. The plot of the show was ingeniously adapted to introduce a variety of vaudeville "stunts." The curtain rose on a construction gang building an electric railway in Texas. An "Isle of Jove" troup of theatrical performers becomes stranded near by and wandering down the track is welcomed by the workmen. But hostile Indians capture the whole party, and in the second act every Thespian has to do a "turn," as the condition of his release by "Big Chief Bob Crouse," who is the leader of the tribe of "Co-ops" from the Cuyahoga reservation.

Among those taking leading parts were W. P. Crockett, F. F. Skeel, Charles E. Gregory, Frank L. Perry, H. P. Wayman, M. M. Wood and Miss Wood, Norman P. Willson, Francis Raymond, Mrs. Raymond and Mrs. C. A. S. Howlett, George S. Searing, G. H. Erich and Mrs. Erich, Thomas Bibber, Warren Ripple, Mr. and Mrs. E. A. Burrows and Mrs. Andrews, Miss Bessie Keane Doyle, Master Henderson Pinckard and Mademoiselle Ernestina Rood. The whole entertainment was given under the management of A. D. Blocker, with the co-operation of a committee consisting of Mr. Crockett, Perry Boole, S. A. Rall, Mr. Erich, W. S. Taussig, C. A. S. Howlett and Mr. Perry. It was staged by Mr. Wayman, with Mr. Howlett in charge of the music. The operetta and programme were written and arranged by "Playwright" Frank L. Perry. The stage properties were in charge of Mr. F. F. Finney.

Mention should also be made of A. O. Einsten, Morgan P. Ellis, C. N. Thorpe, O. M. Bicknell, W. B. Weinsheimer, B. L. Mockenhapt, Edgar Switzer, E. W. Kerns, Julian Jackson, R. G. Cratty, H. H. Smith, W. P. Bear, S. M. McFedries, H. S. Greene, Miss Mary Kelly, Miss Rhoda Turner, Miss Mabel Ghislin and Miss Alice Turner, all of whom took part.

The programme was liberally interspersed with good-natured "roasts" and "gags" on Chicago electrical men and was received with continued shouts of laughter and applause. For instance, an urgent "wireless" message was received at the construction camp (the wireless outfit, from Mr. Perry's laboratory, was real, by the way), stating that there was grave danger that Miss Alice Chalmers would be captured by the Indians and appealing for old General Electric and his troops, with an earnest request also for George Westinghouse to "brake" the wild horses. There was a burlesque Edison storage battery, "light direct from coal," the "one-half watt lamp," and so on. The various specialties were all good. Especially mirth-provoking was the burlesque mind-reading of Mr. Crockett, costumed as "Anna Eva Fake," under the management of Mr. Raymond. Mr. Wood's electrical skull and trunk trick and other sleight-of-hand work were excellent, and so was the dancing of Mademoiselle Rood—a dainty miss of eight—and of Master Pinckard, son of W. R. Pinckard. The Indian maidens—Misses Doyle, Skelly, Ferguson and Noonan—were pleasing in their song and dance; Mr. Bibber gave a laughable monologue and Mr. Erich made a hit as the clown "Buttinski." F. F. Skeel's impersonation of "Con-Dooley," the gang boss, was excellent; it was a feature of the first act.

After the last curtain all the performers enjoyed a tastefully arranged banquet at a downtown restaurant. Mr. Blocker was the toastmaster, and about all the ladies and gentlemen in the cast responded to toasts.

The operetta was well staged and finely costumed and a great success. It has brought the Sons of Jove into prominence in Chicago more effectively, perhaps, than could be done in any other way. It is reported that the whole show will be taken to Dallas, Texas, the center of Jovianism, and repeated at a future day.

High-voltage Transmission Affects Telegraphs and Telephones.

The engineers of the New York, New Haven and Hartford Railroad, who are installing its new electrical overhead system between New York and Stamford, Conn., have discovered that when the high-potential alternating currents of electricity are turned on the telegraph and telephone wires within 50 feet of the company's tracks become affected by induction to such an extent that it is almost impossible to use them.

This interference is noticed most in the railroad telegraph offices along the line. In New Rochelle it was so bad the other day that New York business had to be sent by way of Boston. The telegraph wires suffer more than those of the telephone company, and it is reported that unless the company can find a way of remedying the difficulty the Western Union and Postal companies may take steps to restrain it, if possible, from using such a powerful current.

Similar interference between high-voltage transmissions and near-by telephone and telegraph wires has been encountered in other places, notably in Western New York and in Indiana.

More About England and the Wireless Conference.

The radio-telegraph committee of the House of Commons, says the London correspondent of the Western Electrician writing on May 10th, has been hearing contrary views from experts like Sir William Preece and Prof. J. A. Fleming, F. R. S. The latter is the technical adviser to the Marconi company and he has put forward the most telling argument of any witness against the principle of intercommunication. Dr. Fleming admits that it is possible, but that the essential and peculiar features of rival systems will have to be sacrificed in consequence and that the efficiency will suffer thereby. Sir William Preece followed on the lines of other official witnesses in desiring the Berlin convention ratified, but a certain amount of inconsistency seems to exist when this argument is put forward, and the committee will have no easy task, it is said, in coming to a definite report, although on the other hand there is a predominance of government supporters on the committee, and the government is believed to be "anti-company" to a certain extent. The questions put to witnesses for the Marconi company by the postmaster-general, who is a member of the committee, seem to indicate a mild hostility to the Marconi company. One hesitates to believe offhand that the companies owning rival systems have technical and public interests so completely at heart as their expressed views would imply, and it should rest with such a tribunal as this select committee to correct the balance between the two, with the aid of the official delegates to the convention.

Indiana Interurbans Exempt from Two-cent-fare Law.

In response to a request from the Railroad Commission, Attorney-general James Bingham of Indiana has given an opinion to the effect that the two-cent-fare law passed by the last General Assembly of Indiana does not apply to interurbans but only to steam roads. The opinion says: "It is a part of the history of legislation that amendments to the bill were offered at the time when it was on its passage and under discussion in the General Assembly, by which it was sought to extend the same to interurban railroads, and limit the passenger rate of such interurban railroads to one cent a mile, and these amendments were defeated on the theory that the act should not be made to extend to interurban railroads; and it is also a matter of common knowledge that interurban railroads are able to operate at much less expense than steam railroads, and to carry passengers at a lower rate a mile than can steam railroads, and it is in view of these facts that the interurban railroads have been enabled to give the cheap passenger rate which has made them popular thoroughfares for the local travel. It is, therefore, my opinion that the act in question has no reference to the interurban, electric or street railways of the state."

If the attorney-general is wrong, as many lawyers contend, and the law applies to both, it will be incumbent on the interurbans to reduce many of the short-haul charges. Most of the roads charge more than two cents a mile for short distances; between stations, for example. On the longer trips the rate on the interurbans is now less than two cents a mile.

First Single-phase Railway in Germany.

For the first time in Germany, it is said, a simple alternating-current system will be employed for an interurban line soon to be completed between Blankensee and Ohlsdorf, near Hamburg. It is thought that if this single-phase railway proves to be a success the German government may be induced to adopt this system for numerous interurban lines.

The choice of the single-phase system on this line is believed to be the outcome of the favorable results obtained since 1903 on an experimental track, 2½ miles long, between Niederschönweide and Spindlersfeld, where a single-phase collector motor has been employed.

The normal train unit will consist of two cars, each with three axles. The front car will contain two motors and a transformer. The second car will have one motor and an air pump driven by it, which will furnish compressed air for the brakes and for raising and lowering the bow taking up the current. Each motor will develop 115 horsepower. Trains can be made up of three such units, each being capable of seating 118 passengers.

The Sterilization and Preservation of Telephone and Telegraph Poles.

At the convention of the Ohio Independent Telephone Association, held in Columbus, Ohio, on March 28th, Mr. H. P. Folsom of Circleville presented a paper on a method of preserving poles with which he and his associates have been experimenting for some years. Following is a condensation of Mr. Folsom's address.

In the maintenance of telephone, telegraph, electric-light and interurban-railway systems one of the greatest problems that confront the management is the inevitable depreciation of the outside construction of the plants. One of the largest items of this depreciation account, is that caused by the rotting of the poles.

The importance of this subject will be appreciated when we say there are about 250,000 miles of telegraph-pole lines and about 500,000 miles of telephone lines in the United States, making a total of 750,000 miles of pole line. It is safe to say that these lines average 37 poles per mile, thus making 27,750,000 poles. The poles used for electric railways and electric-light plants will make an addition to this amount of 5,000,000, or a grand total of 32,750,000 poles, according to the government report for 1902. There are now 40,000,000 poles in use by all companies. The value of these poles, placed in the ground ready for use, will average more than $5 each, or about $200,000,000.

The average life of a white-cedar pole is said to be from 12 to 15 years. It varies, however, according to its condition when placed in the ground and the nature of the soil and climate. All poles and posts rot off at or near the soil line. The decayed portion extends a few inches above and about three or four inches below the soil line, the depth below being governed largely by the nature of the soil surrounding the pole. The portion of the pole from the soil line to the top will last many years. Indeed there is reason to believe that it will last three times as long as the portion that goes into the ground. Again, millions of poles are being used each year to replace the ones that have rotted off. The Bell Telephone Company used over 500,000 poles in one year to replace old ones.

In experimenting on the preservation of poles the great trouble has been that the experimenters have been endeavoring to sterilize the pole before placing it in the ground. Our endeavor has been to sterilize and protect the pole already in the ground. It has been proved beyond question that the decay which takes place at or near the soil line of the pole, is caused primarily by living organisms, namely, bacteria or fungi, and in some rare instances by insects. Bacteria and fungi are both low forms of life; they multiply, when once they attack a pole, with great rapidity, and their action on the fiber of the wood is practically the same. They attack either dead or living timber; on dead timber they attack the walls of the cells, and the result is decay or rot.

There are two conditions necessary for the existence and rapid growth of these living germs of destruction: First, there must be a certain amount of dampness or water, and second, there must be a certain amount of heat, and, some scientists claim, a certain amount of oxygen. This, they claim, is shown by the fact that bacteria and fungi do not ordinarily affect the pole more than a few inches below the soil line, unless the soil surrounding is very loose or porous. It has been observed that a line of poles running through a pasture field, where there is grass growing, will be more quickly attacked than in any other situation. Again, a line of poles situated on the north side of a hill, will be more quickly attacked than on the south side, provided the soil is loose and porous. A pole under water will not be attacked by fungi nor bacteria, neither will it when surrounded by soil containing certain chemicals. It may be observed in passing, that the great enemy of the telephone pole is the same that attacks railroad ties. The conditions surrounding a railroad tie are more favorable for the rapid growth of the bacteria and fungi than in the case of the pole. The ties lie flat on the ground, constantly absorb moisture, and, being exposed to the rays of the sun, have the two necessary conditions for rapid growth. The problem of protecting and sterilizing railroad ties is a much more difficult one than we have to contend with in the case of telephone poles, although it is generally supposed by experimenters that this is not the case.

Realizing the great importance of the subject of pole preservation, we began an experiment six or seven years ago, using antiseptics, although some of our experiments in the preservation of posts and poles have extended over a period of nearly twenty years. We directed our attention to poles that were in the ground and that were already infected. We believed if it were possible to save the life of a pole which had already been attacked and was partially rotted off, it would be a comparatively easy task to sterilize and protect a pole which had lately been placed in the ground. We believe we have found a means to sterilize poles in the ground that is practical and certain, and that, too, at a cost which is reasonable and much less than the natural depreciation will amount to. It having been demonstrated that the cause of decay at the ground line was a bacteria and fungus growth induced by a certain amount of moisture and heat from the sun, and that in order to sterilize and save the life of the pole we must use an antiseptic that would penetrate the pores of the wood, we selected a class of poles that had been in the ground for about eight years and which were thoroughly infected with germs; indeed, some of the poles upon which we experimented, were over half rotted through and would not have lasted two years under the most favorable conditions. We dug down around the pole about 18 inches and with a pointed instrument scraped away all the rotted wood. We then applied our antiseptic chemicals with a trowel, filling all the holes and depressions even with the surface of the pole. We next placed around the pole a specially constructed jacket made of pliable and specially prepared asbestos that would resist the action of the elements, such as rain, snow, freezing and thawing. We filled in around the poles the antiseptic material to the top of the jacket in the space between it and the pole. We allowed the top in some instances to remain open, so that it received all the rain and snow that fell and which might run down the pole. In others we placed a cap over the top of the jacket. We were careful in mixing our antiseptics to use none that would cause the pole to become brittle and thus weaken it. We found that in all instances after a period of over six years our antiseptics had completely sterilized the poles where applied, and the decay was entirely arrested. In fact, the poles were in as good condition as when the treatment was first applied. We carried our experiments further and treated a class of poles that had not been in the ground more than two or three years, the surface indications showing only slight infection, but the sappy portion had begun to scale, and the cracks exhibited unmistakable signs of decay. We did not attempt to clean off the decayed portion of this class of poles, but treated them by placing the jacket around the pole and depositing between it and the jacket our antiseptics and then sealed and fastened the collar above referred to. The jacket on these poles was about 18 inches wide, extending below the ground about 14 inches, and above the ground about four inches. Upon examination of this class of poles nearly six years after treatment they were completely sterilized and free from the effects of the bacteria and fungi. There was no evidence of them under a powerful microscope.

We are fully aware that the success of our process depends very largely upon the question of expense. We have made some figures based upon our experiments which show that the cost is within the reach of all companies and can easily be paid out of the depreciation account and still leave a handsome surplus. Suppose we take a plant of 5,000 poles, costing $5 each, in the ground fully equipped. Their original cost would be $25,000; at the end of 12 years they will have to be renewed, at a cost of $25,000; interest for 12 years on the last $25,000 equals $18,000, making a total cost for 24 years of $68,000. Suppose we take the same plant and apply the treatment, the original cost of 5,000 poles is $25,000; the cost of sterilizing after they have been in the ground two years at $1.25 each (and it can be done for less) would be $6,250; interest on this amount for 22 years amounts to $8,250, making a total cost for 24 years of $39,500. The cost for 24 years without treatment would be $68,000, and the cost with treatment, $39,500, leaving a profit in favor of treatment of $28,500.

It will be observed that in our calculations we have not taken into account the increased amount of trouble that always accompanies the use of old poles the last few years of their lives. This item of the maintenance account always increases as the poles grow older and weaker, and should be placed on the credit side where our process is used.

BOOK TABLE.

STRAY CURRENTS FOR ELECTRIC RAILWAYS. By Dr. Carl Michalke. (Translated and edited by O. A. Kenyon.) New York: McGraw Publishing Company. 1906. Pp. (5¼ by 7½ inches), viii, 101, with 32 illustrations. Price, $1.50.

The author has given the results of quite an extensive study of the subject, under the following headings: "Stray Currents with a Uniform Current Load at the Rails," "Stray Currents with Uniformly Increasing Current Load on the Rails," "Resistance Values," "Distribution of Potential," "Corrosion Currents," "Corrosion measurements," "Preventive Measures."

The descriptive matter is reinforced by a considerable amount of mathematical treatment of the subject. This enables one to determine readily whether certain electrical conditions are dangerous to underground structures, and how dangerous. A number of preventive measures are presented and discussed. The book is successful in enabling one to get quickly a general idea of what stray currents are and how they are produced, as well as aiding one in making an extensive study of some particular problem involving these disturbances. The translator has added to the usefulness of the work by including occasional notes referring to data observed in American practice. By compiling a quite extensive bibliography, he has increased the value of the book to those who wish to make a thorough study of the subject.

Modern Train Dispatching on Interurban Railways.[1]

By H. H. POLK.

The managers of electric railways until recently have given but very little attention to that most important part of train operation, i. e., the dispatching of trains. There are three important factors in train operation to be taken into consideration: (1) First and above all others, safety both to passengers and property; this must be had regardless of cost. (2) The speedy operation of trains over the road, giving them all possible dispatch commensurate with safety. (3) The economical operation of trains, keeping them "on the go" all the time, and not lying "dead" on some side track waiting to meet something.

In order to obtain these very important results it is absolutely necessary that trains be operated on train orders issued from a central office, directing train movements in addition to those provided for in rules and time-tables. The printed time-tables, showing the meeting places and time of all regular trains, with rules directing how these trains are to proceed with relation to each other, if studied by all trainmen, and faithfully carried out, will prevent collisions. If, however, it becomes necessary to issue special orders for trains not on the time card, then the train order is absolutely necessary. There must be only one dispatcher issuing orders on a division at a time. This is one of the few cases where one head is better than two, for two dispatchers to issue train orders on the same division involves very serious risks, also contributing largely to the lack of confidence on the part of all trainmen.

When a time card is issued a receipt should be taken therefor from all persons concerned, making sure that it has been received. After the order has been prepared by the dispatcher it is then transmitted to the desired persons either by telegraph or telephone, as the case may be. The telephone is almost universally used by interurbans for dispatching trains, while the telegraph is used by steam railways; however, in my opinion, the telephone is far superior for transmitting train orders on interurban lines. All stations and sidings can be equipped with telephones, where a train crew may communicate with the train dispatcher at any time, thus avoiding serious delays.

We are very particular in having the conductor deliver the order to his motorman before boarding his train, absolutely to avoid any start without a thorough understanding on the part of the motorman. A conductor is required to report at all stations where agents are located, and should his train become delayed between stations, he must call the dispatcher from the nearest telephone booth, thus giving him the opportunity to change the order, if desirable. Our sidings are about two miles apart, but trains must report at only such sidings as are designated on the time card, and must never leave these designated sidings without a clearance or train order. By reason of the almost constant use of the telephone line by the dispatchers, it was impossible for us to transact our general business without seriously interfering with the safe dispatching of trains. We had therefore either to build a second telephone line, or install what is known as a composite system. We chose the latter, it being much cheaper, meaning only the cost of installing telegraph instruments. By so doing we have doubled the capacity. In the installation of the telegraph we had the choice of two general methods, one being what is known as the European or open-circuit method, the other being the American, or closed-circuit method. The European, or open-circuit system, is essentially a multiple system, while the American, or closed-circuit, is a series system. With the European open circuit no power is used except when the instruments are actually in use. Another advantage is that in case the line should break, instruments may be used on each side of the break. As no switches are used on the keys, it is impossible for the operator to go away and leave the line open by leaving his key open.

The telegraph instrument is connected between both sides of the telephone line and the ground by means of a suitably balanced super-wound impedance coil, connected in such a manner as to offer impedance to the alternating-current telephone voice and signaling current passing from one side of the line to the other, but offering little impedance to the direct telegraph current passing from both sides of the telephone line through the telephone instruments to the ground. The success of the composite system depends upon both sides of the telephone line having the same resistance, impedance, capacity and inductance. In other words, the telephone line must be perfectly balanced, preventing the direct intermittent telegraph current impulses from passing from one side of the telephone line to the other through the re-

1. Abstract of a paper read at the Iowa Street and Interurban Railway Association convention at Clinton, April 20, 1907. The author is president and general manager of the Interurban Railway Company of Des Moines.

ceivers. In a perfectly balanced line there is no disturbance or interference between the telegraph and telephone instruments.

The use of the telegraph on the telephone line does not necessitate any more care than would be necessary for a satisfactorily operating telephone circuit, paralleling high-tension lines. The energy used to operate the telegraph instruments is obtained at each station direct from the 600-volt direct-current feeder by shunting one 16-candlepower lamp in a series of five. A composite system not only doubles the amount of business that can be handled over a single line, but is much more reliable and convenient than either a telephone or telegraph line alone. The telephone and telegraph are not affected by the same cause. What would disable one might not affect the other.

Two Dynamos Act as a Magnetic Clutch.

Something of a novelty in electromagnetic transmitting devices has been invented by Max Johannet of Paris and patented in this country. The means of transmission comprise an electromagnetic clutch serving to transmit the movement of a motor shaft to a driven shaft arranged in line

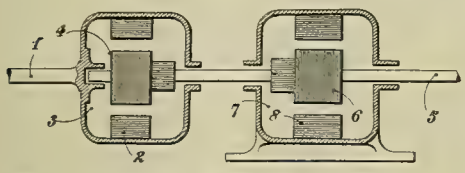


FIG. 1. ARRANGEMENT OF DRIVING AND DRIVEN DYNAMOS AS MAGNETIC CLUTCH.

with it by means of two dynamos, one acting as generator and the other as receiver. Whether practicable or no, the application is an interesting one.

Fig. 1 shows an arrangement of the motor shaft in line with the driven shaft. Fig. 2 shows a method of connection intended for progressively throwing the driven dynamo into circuit. In Fig. 1, a shaft (1) driven by a motor of any suitable kind drives the field magnets (2) of a generator (3), the field magnets replacing the flywheel of the motor, if desired. The armature (4) of this generator is keyed upon the driven shaft (5), as is also the armature (6) of a receiving machine (7), the field magnets (8) of which may be fixed.

Fig. 2 illustrates the electrical connections. The same numerals of reference represent the same parts; but in addition it will be seen that the field magnets of the receiving machine (7) are divided in such a manner that an automatic-regulator electromagnet (9) causes the current of the generating machine to pass into a greater or less number of field-magnet coils of the receiving machine, consequently increasing its magnetic field to a greater or less extent. Finally, a starting rheostat with interrupter (21) completes the circuit. The dy-

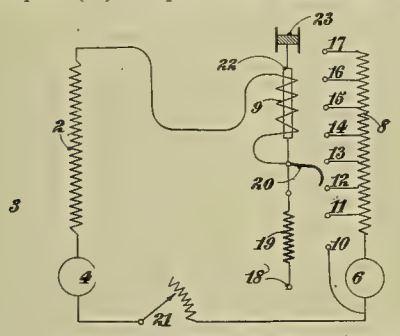


FIG. 2. METHOD OF CONNECTION TO THROW (PROGRESSIVELY) DRIVEN DYNAMO INTO CIRCUIT.

namos are both wound in series in such a manner that the total current traverses all the appliances or else traverses none of them, according to the action of the automatic-regulator electromagnet. This automatic regulator comprises a solenoid (9) attracting a core (22) which carries the movable current-conducting finger (20). A spring (19) attached to a fixed point (18) tends to move the core in the opposite direction to that of the action of the solenoid (9).

The spring (19) is given such an initial tension that it balances the attraction of the solenoid (9) when this latter is traversed by a current of given value i. It is also sufficiently sensitive in order that a slight increase of the current will cause the finger (20) to move toward the contact (17), and for this the current will be i′, differing but little from i. Let us consider an intensity of circulation I comprised between these two extreme values, i and i′. It will be seen that an increase of I will cause the movement of the finger (20) toward the contact (17), introducing into the circuit a larger number of field-magnet coils of the receiving machine, while a diminution of the intensity of circulation I will cause the finger to move toward the contact (10), cutting out of the circuit a larger or smaller number of these coils of the receiving machine, or even cutting this latter entirely out of circuit. To sum up, an increase of the intensity of circulation will produce an increase of the field of the receiving machine, while a diminution of the intensity of circulation will produce a diminution of the field of the receiving machine, or in the extreme case will cut it out of circuit. In order to damp the excessively rapid oscillations of the apparatus, a damping air piston (23), adjustable at will, may be arranged on the core (22).

The operation may be described as follows: On the stoppage of the system the spring (19) in Fig. 2 maintains the finger (20) on the contact (10). The shaft (5), shown in Fig. 1, is stopped and likewise the two armatures (4) and (6). The motor shaft (1), shown in Fig. 1, is placed in movement. The starting rheostat (21), in Fig. 2, is closed. At this moment the generating machine is closed upon the solenoid (9) and becomes energized in proportion to the rotation of its field magnets (2) around its armature (4).

In normal operation the circulation current attains the special value I, or, more particularly, is comprised between i and i′. The attraction of the solenoid (9) is then counterbalanced by the spring (19) in such a manner that a variation of intensity produces a variation in the same sense for the field of the receiving machine. In this case the shaft (5) is driven both by the action exerted by the field magnets (2) upon their armature (4) and by the ordinary action of the magnetic field (8) of the receiving machine (7) upon its armature (6). The resistant couple is then greater than the motor couple by the whole value of the couple of the receiving machine, except the output in the dynamos of the electromagnetic couples relatively to the mechanical couples.

Assuming an increase of the resistant couple, its immediate action translates itself into a diminution of the speed of the shaft (5), and consequently by an increase of the speed of operation of the generating machine, of its electromotive force and of its intensity, which increases have for their consequence increases of the field and of the intensity of the receiving machine, which in their turn result in increasing the couple of the receiving machine. In the same manner a diminution of the resistant couple results in a diminution of the couple of the receiving machine. Any variation of the resistant couple is therefore borne wholly by a variation in the same sense of the couple of the receiving machine and does not exert any appreciable action upon the motor couple, which remains constant, since the intensity I of the generating machine, and consequently its electromagnetic couple, remains substantially constant, owing to the automatic regulator. The exactitude of this result will be greater according as the spring (19) is more sensitive to the small variations of the intensity I or as i and i′ are closed together.

In extreme cases of operation a momentary variation of normal running conditions is admissible, and suitable provision is made. It is contended that means are provided for utilizing under the best conditions, as regards operation and efficiency, any kind of motor which may be connected to the shaft (1).

The transmission may be defined by a self-energizing electromagnetic clutch, in which any loss of work occasioned by slip is recuperated apart from internal losses in the receiving machine, which is itself of variable field arrangement, in such a manner as to maintain the motor work constant.

When it is desired to cause the speeds of operation of the driven shaft to vary, all that is necessary is to diminish the available motor work by the means appropriate to the motor employed. The result of the variations of the motor work is the variations of speed of the driven shaft if the resistant couple has remained the same. The starting rheostat may also be introduced more or less into the circuit. The electromotive force of the generating machine being intended to balance the counter-electromotive force of the receiving machine and the losses of charge in the circuit, the introduction of the rheostat increases the total resistances of the circuit, and as the resistant couple has remained the same, the intensity should remain constant, and consequently the counter-electromotive force of the receiving machine diminishes, which entails the diminution of its speed, and consequently that of the driven shaft.

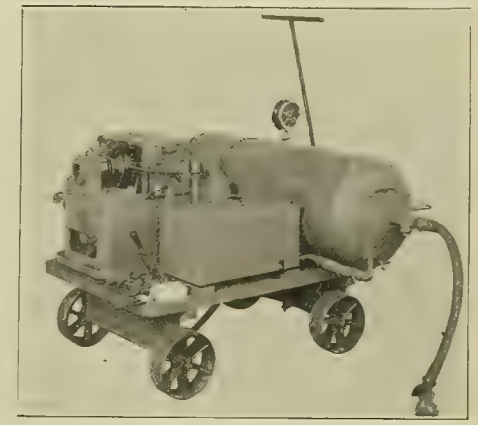
In cases in which the rotation of the field magnets of the receiving machine are not utilized for increasing the couple the electro-regulator may be replaced by a simple switch, which places the receiving machine in the circuit of the generating machine or out of this circuit.

Electrical Imports of Spain.

The importation of incandescent lamps and globes and electric-light fixtures into Spain has reached considerable proportions and is growing steadily. In spite of the fact that several small factories are now manufacturing these goods in Spain, imports in 1906 are presumed to have increased at least 25 per cent. Arc lights, electric-light meters, switches and other similar electric-light appliances were imported in 1905 to the amount of $302,000, as follows: From Germany, $189,856; France, $83,145; Austria, $10,067; Switzerland, $5,985; the United States, $5,429, and other countries, $7,518. The Spanish customs duty on incandescent filaments mounted is $1.93 per 2 1-5 pounds; unmounted, $2.89. The duty on arc lights, electric-light meters, etc., is 48 cents per 2 1-5 pounds.

Motor-driven Portable Air Compressor.

A late application of the principles of the well-known Christensen motor-driven air compressor for operating Christensen air brakes, built by the Allis-Chalmers Company of Milwaukee, is found in the portable air compressor exhibited at the Jamestown Exposition (Section No. 8, Machinery and Transportation Building), with a number of the other products of Allis-Chalmers Company. In the car houses, power plants, and in track work, compressed air can be put to use in blowing out motors and generating apparatus, and can be used to advantage

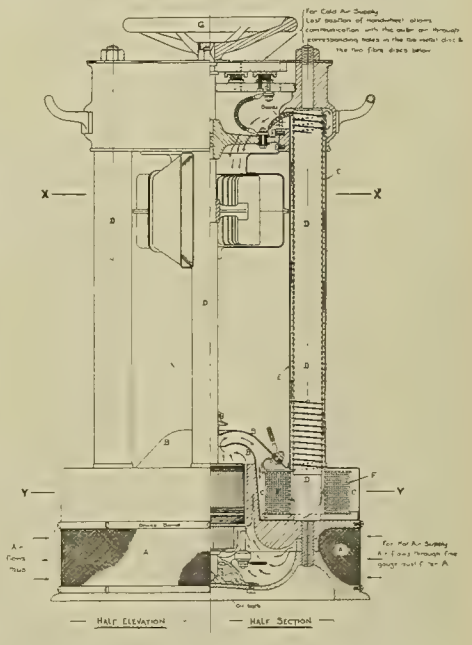


MOTOR-DRIVEN PORTABLE AIR COMPRESSOR.

for driving pneumatic drills, riveters and other air-operated tools. The equipment exhibited at Jamestown consists of the following parts, shown in the illustration: Motor-driven compressor, automatic governor, switch and fuse, necessary reservoir capacity, air gauge, connection pipe and pipe fittings.

Combined Electric Heater and Ventilator.

A rather interesting English invention, intended to supply hot, cold or warm air for heat and ventilation, by electrical means, is shown in the ac-



COMBINED ELECTRIC HEATER AND VENTILATOR.

companying drawing. When hot air is required the air first passes through a gauze filtering screen, then up through the motor armature and air gap of a ventilating motor. The air-cooled motors and heater coils with forced-air cooling are very light and compact. The air is now guided between light zinc spinnings and up circular passages in which lie the hot magnet coils wound on refractory insulating sleeves and faced by a special enamel on the outer brass tubes. Shorter magnet cores can be secured by employing a tubular air-duct winding, directly in series or as a secondary. But the form of the invention here shown is preferred. When cold air is required the armature takes much less current and the field is obtained by ordinary cop-

[illegible] coils which are switched in at another position of the [illegible] on top. Air then enters on top also, through an aperture opened by the revolving disk attached to handle.

There is a [illegible] series-parallel arrangement of the [illegible] controlled by the switch on top and marked "Hot, Warm, Tepid, Cold." When maximum heat is being developed the series motor speeds up and blows harder on the hot coils. More heat, more speed of dissipation. The process is semi-automatic. Four connections and speeds facilitate a graduation of heat from cold to hot. The blades of the fan are so formed as practically to take the weight off footstep bearing at maximum speed.

This outfit is also applicable to use, with or without distributing tubes, on electric cars. It is also contended that a combination of this nature, which makes for a flattening of the station load peak—since it is usable at all times of day and all seasons of the year—would find an advocate in the central-station manager.

The Telephone Wire Plant.

At a meeting of the American Institute of Electrical Engineers held in New York city on April 26th, Mr. Sergius P. Grace, chief engineer of the Central District and Printing Telegraph Company of Pittsburg, presented a paper on "The Telephone Wire Plant."

The most important considerations in connection with the wire plant were summarized by Mr. Grace in the following terms:

1. The development plans must be carefully worked out by the engineer, so that not only the first cost of the plant will be a minimum, but also that the plant can take care of increases in business from time to time without unnecessarily large expenditures for redesign and reconstruction.

2. The transmission must be carefully studied, so that there will be a good volume of talk between any two connected subscribers. The circuits, whether in cable or in open wire, should be graded and, if necessary, loaded, so that while the transmission is sufficiently good it will not be given over unnecessarily expensive trunk lines.

3. The underground system must be extended as rapidly as it is economical to do so, and direct terminal or interior block connections made with the maximum number of subscribers.

4. In the outlying districts, where pole lines will still be resorted to, every effort must be made so to design and construct these lines as to have them of low first cost and annual charges. They must be but slightly affected by the elements and free from interference from electric-light and power circuits. These aerial systems must be made sightly to avoid the criticisms of the public.

5. The engineer must constantly seek for new and improved types of material and construction methods to be used in the wire plant, so that the first cost and maintenance can be reduced.

Discussion (in Part).

J. J. Carty, New York: The telephone wire plant of the city of New York and suburban territory consists, in round numbers, of 1,000,000 miles of copper wire. Most of this wire is enclosed in lead-covered cables. The superficial area of the lead pipes covering one of these cables amounts to 7.6 acres. The superficial area of the lead pipes covering all of the cables in this system of 1,000,000 miles of wire, amounts to 190 acres. All of these 190 acres of lead pipe must therefore be maintained free from punctures even as small as that which would be produced by a pin. The underground telephone cable of today is composed of copper wires covered with paper, all enclosed in hermetically sealed lead pipe. This type of cable seems to answer its purpose so well that telephone engineers, as a rule, are fairly well content with it. The tendency in cable construction and in telephone line construction generally has been to drive rubber insulation out of the field, which it formerly dominated. It is now restricted to distributing wires, inside wiring and certain special switchboard wiring.

H. V. Hayes, Boston: The placing of cable lines in cables cannot be applied to our long-distance circuits to any great extent, for the reason that the cables tend to cut down the efficiency of service, and what we must do is to get a wire plant of the system not only the best possible for maintenance reasons, but one which is capable of enabling us to talk over the wide range of material.

G. M. Yorke, New York: The cable system described by Mr. Grace is designed to contain a minimum amount of open wires, and is mainly used for connecting the subscribers' stations with the nearest central office. This portion of the plant is used for a large percentage of the time merely for communications between stations only a very few miles apart. Now, when we come to consider that other very important portion of the telephone plant used for connecting central offices together [illegible] hundreds of miles apart, such an extensive [illegible] cable is absolutely impossible. The reason [illegible] that the cable circuit has always been [illegible] in transmitting speech. That inefficiency still exists in spite of the improvements in [illegible] manufacture that have been touched upon [illegible] also in spite of general improvements in a general way. As an example of the inefficiency of cable circuits we might take the type of circuit used for the longest distances in this country. These circuits are about 50 times as efficient as the form of cable circuit described by Mr. Grace and used for subscribers' lines so largely. In other words, one of the regular lines from New York to Chicago talks as well in volume and in quality as a cable circuit of the sort described by Mr. Grace only 20 miles long. The further point is that if we connect only 10 miles of such cable to this long open-wire circuit, it is necessary, in order to keep the transmission efficiency at the same point of loudness and quality, practically to double the weight of copper in the long line circuit. It is necessary to bring the open wires as near to the center of the terminal cities as is practicable and to keep all cable out of intermediate cities if we can. That becomes more and more necessary in view of the increasing amount of cable that it is necessary to use in subscribers' lines.

F. L. Gilman, New York: The great effort in recent years has been to get more wires and more conductors into a given amount of space without increasing the electrical characteristics of the cable which are harmful to the transmission, and without getting down to the size of the wire that cannot be handled easily. In the telephone line there is constantly a difference of tension which exists between the two sides of the line and one side of the line and the ground, and the telephone line throughout its entire length, in the account of distribution that Mr. Grace has been speaking of, is composed of twisted wire. That is true of the rubber-covered wire. The two wires are twisted together to keep outside disturbances from affecting the telephone service. Of course, you are all familiar with the braided rubber-covered wire. The rubber compound itself will not last unless it is propery protected. The usual method is the cotton braid; but that won't stand the heat and rain and snow unless it is properly protected, so the whole gist of the proposition is the protection of the braid.

K. B. Miller, Chicago: There are some who have contended that there should be absolutely no bare wire in a telephone plant, and several plants of considerable magnitude have been constructed in which, I understand, there is not a foot of bare wire in the local plant. To say that there shall be absolutely no bare wire in the plant simply for a boast, is in the nature, I think, of riding a hobby rather than in the nature of engineering practice. There is no other form of cable than the paper cable that we know of that can in any reasonable way be used. Whatever may be said of the paper cable, it is true that it is subject to one very serious drawback, and that is any slight puncture of the sheath, that is, with moisture present, is liable to put all the wires out of business. In other systems of communication such wires as rubber wire or guttapercha insulated wire, are feasible to use, but in such systems as fire-alarm telegraphs, where reliability is of extreme importance, the paper cable has very little place.

Modern Telephone Equipment in University of Michigan.

For years the University of Michigan has felt the need of more and better facilities with which to prepare its students in telephone engineering. Accordingly a modern Bell equipment has been secured. The equipment of the central office consists of a section of three positions of standard No. 1 switchboard and complete auxiliary equipment. It has an ultimate capacity of 300 lines and a present equipped capacity of 100. The power plant consists of a mercury arc rectifier for charging, a fully equipped power switchboard and a standard storage battery of 11 cells. A fully equipped wire chief's desk has also been provided.

One of the most unique features of the installation is a skeleton circuit specially designed by the engineering department for demonstration purposes only. This circuit is enclosed in a mahogany cabinet 6 by 6 by 2 feet, equipped with glass doors and a number of shelves for holding samples of the various parts which enter into the construction of the switchboard. These shelves also hold two volumes of blue prints, one containing working drawings of the apparatus and the other blue prints and specifications for outside plant construction and distribution. But the greater part of the cabinet is devoted to the skeleton circuit which is so designed that the complete operation from the time the subscriber removes his receiver from the hook to the time the conversation is finished, including the clearing of the line, can be seen in detail.

Net earnings of the Michigan State Telephone Company in the quarter ended March 31st were 80 per cent larger than those of the corresponding period of 1906. On March 31st the company had 95,246 exchange subscribers, as compared with 80,642 a year previous, and a total of 126,146 subscribers of all classes. Gross earnings for the March quarter were $726,724.

Telephone News from the Northwest.

Captain F. S. Kidder, who has been with the Twin City Telephone Company in Minneapolis in various capacities for six years, has resigned to go with the new Twin City and Lake Superior Railway Company, which proposed a direct electric line to Duluth and Superior.

The Waseca Telephone Company of Waseca, Minn., advertises $5,000 of new stock for sale, issued for building new lines and making improvements.

F. K. Crippen of Superior, Wis., succeeds F. J. Garske, resigned, as local manager for the Duluth Telephone Company office at Cloquet, Minn.

The Sheyenne Telephone Company of Pekin, N. D., has been incorporated with $50,000 capital stock by F. W. McDougall and others.

The Hawkeye Telephone Company is planning extensive improvements on its system at Perry, Iowa, which will cost about $15,000. These include a 600-drop switchboard.

William E. and H. I. Jenison have purchased the controlling interest in the Green County Telephone Company of Sac City, Iowa.

The Hamburg (Wis.) Telephone Company has been organized with Charles Emmerich as president and H. Kreutz, secretary; capital, $3,000. R.

Indiana Telephone Items.

The Grayford and San Jacinto Telephone Company has filed articles of incorporation to build an exchange in Grayford, with lines throughout the southern part of Jennings County. E. A. Grimes, D. H. Ziegler and Joseph Rodgers are directors.

At a mass meeting of the farmers of Hancock County, held at Greenfield, plans were adopted for the organization of a new company to take charge of the Hannah Jackson telephone plant, recently purchased at receiver's sale, by Charles Hannah. It is proposed to reconstruct the line and purchase new instruments, those now in use being the property of the Central Union Telephone Company. It is proposed to make the new company purely Independent. The Morrison company (Independent), operating in this county, has connection with the Bell and also receives a toll from subscribers in the country in calling into the local board. This is not satisfactory to the farmers.

Word comes from Kokomo that an enterprising grocery and market company contemplates putting into customers' houses at the firm's expense about 50 telephones as an experiment. The idea is to do all the ordering over the telephones, and thus do away with a number of clerks and teams now required to go out and take orders. S.

GENERAL TELEPHONE NEWS.

The Acton (Texas) Telephone Company has been organized.

R. P. Webb and others will establish a telephone system at Alvord, Tex.

The Rochester (Minn.) Telephone Company will build a new telephone exchange.

Frank Kruft and others have organized a telephone company at Dorset, Minn.

C. A. Hooper has been granted a franchise for a telephone system at St. Hilaire, Minn.

E. M. Stange has purchased the business of the Alton (Kan.) Mutual Telephone Company.

The People's Telephone Company of Sardinia, Ohio, has increased its capital stock to $15,000.

The Polo (Ill.) Mutual Telephone Company has increased its capital stock from $5,000 to $10,000.

The London (Ind.) Telephone Company has been incorporated for $5,000 by W. B. Heeth and others.

The Citizens Telephone Company of Berea, Ohio, has increased its capital stock from $50,000 to $65,000.

The Union Telephone Company of Wellington, Tex., has been incorporated by H. A. Jones and others.

The Indian Creek Telephone Company of Woodward, Okla., has received a charter for $5,000 capital.

The following telephone companies have recently been incorporated: Mount Pleasant Mutual Telephone Company of Butler, Mo.; Wichita Falls (Tex.) and Northwestern Telephone Company, capital stock, $10,000; German Northwestern Telephone Company of Eustis, Neb.

The management of the Bell Telephone Company of Canada has announced that the telephone rates of Winnipeg, Man., are to be largely increased. At the inquiry into telephone business now being held before the Dominion Railway Commission at Montreal, General Manager C. F. Sise stated that on account of a new multiple system having to be installed in Winnipeg the subscription rate would have to be greatly increased. At present the amount of money invested in telephones in Winnipeg is $1,136,000.

CORRESPONDENCE.

Continental Europe.

Paris, May 6.—According to a recent agreement between the municipality and the principal electric-lighting companies the price of current for the city of Paris has been fixed at the following rates, covering a period from November 1, 1907, to December 31, 1913: For the lighting current the consumer will pay $0.014 per hectowatt-hour, and for motor current $0.007. After January 1, 1914, the price of lighting current will be lowered to $0.01 and the motor or other current to $0.006. It is proposed to extend the underground wiring over certain sections of the city, but the mains will be far from reaching what might be desired, seeing that not more than half the town will be able to use electric light. Two new electric stations are to be built, according to the present programme. One of these will be toward the north of town and the second to the southwest, and each will be connected by side track with the railroad lines. Two-phase alternating current will be produced in both the plants, working at 12,300 volts. Transformer sub-stations throughout the city will receive the high-tension mains and the distribution will be carried out on the two-phase or the direct-current system. The new stations will have a capacity of at least 25,000 kilowatts each, and it is expected to have them running by January 1, 1914.

What is known as the trackless trolley system will be used in Switzerland on an interurban line which it is expected to run in the neighborhood of Bale. This locality will be connected with Huningen by the new line, and it will take in other communes along the route. As to the cars, they resemble in general a large omnibus and carry a trolley of special construction which works upon an overhead wire and will allow the car to be shifted to one side for nearly four yards distance, all the while keeping up the contact with the line.

A project is to be presented very shortly before the Swiss Federal Parliament relating to the immediate construction of the second tunnel of the Simplon. Should the project be accepted the necessary credit will be voted at the same time, very probably. Work on the new Lötschberg Tunnel is progressing very rapidly, and at the end of March there were 390 meters finished on the north side and 190 on the south side. On the latter section the work was hindered to some extent by avalanches which shut off the connection with the railroad leading to Gappenstein for about 10 days. Some further details are now obtained about the large hydraulic plant which the municipality of Geneva proposes to erect. It will be located on the Rhone at La Plaine, about six miles below town. A head of water of 35 feet will be secured by the dam which will be built at this point, and the hydraulic plant will take about 300 cubic meters per second. The Muncipal Council has advertised for bids from the leading constructors, which are to be presented before August 31st.

At Dresden a concourse was held not long ago for the best system of safety apparatus for tramways, and among these was noted an electrically operated sand-box apparatus which took one of the prizes. The sand valve of each box is here worked by a rod going to the platform and connecting with a pedal or hand lever. Another rod is likewise connected to the armature of a strong electromagnet. The latter is put in circuit by the action of the controller itself, when the handle is put in the position for braking by short-circuiting the motor. Using a 10-ton car at 12 miles an hour the distance needed for stopping was reduced from 10 to 6 meters on a clear and wet track and from 25 to 8 meters on a muddy track.

The Italian government recently made a contract with the French Westinghouse Company for applying electric traction upon a railroad line running from Pontedecimo to Busalla. This line is known as the Giovi Railroad and lies in the neighborhood of Genoa. As regards the system of traction which is to be used in this case it was decided after some consideration to use the three-phase system, working upon 3,000 volts on the trolley wire and at a frequency of 15 cycles. The central plant which will be soon erected for operating the road will be of some size, and at first it is to contain two main turbo-alternator sets of 5,000 kilowatts each, working at a standard speed of 900 revolutions per minute. A voltage of 13,000 volts will be furnished by the alternators at the above-mentioned frequency. There will be three sub-stations erected along the railroad line which will be used for lowering the main voltage of 13,000 volts to 3,000 volts for the trolley wire. In each of the sub-stations will be installed four converter groups of the Westinghouse pattern. Each group will have a capacity of 750 kilowatts, and one group is to be used as a reserve. Locomotives of a newly designed pattern will be used for the railroad. This type of locomotive weighs 65 tons and it can be ballasted so as to increase the weight if need be to 80 tons. Upon the locomotives are mounted two motors of the eight-pole three-phase type, rated at 1,000 horsepower each. According to the connections of the motor circuit by the controller the locomotives can be run at the two standard speeds of 27 and 14 miles an hour. The locomotives are designed so as to draw a train of 410 tons (not counting the weight of the locomotive) upon a 3.5 per cent grade at a speed of 27 miles an hour. At the start of the new system there will be at least 15 of these locomotives in use on the road, and this number may be even increased to 25, seeing that there is a considerable amount of traffic upon this line.

A. DE C.

Great Britain.

London, May 10.—At last a definite decision has been arrived at by the London County Council concerning its policy regarding the electric power bill introduced by its predecessor. It is to go forward with the measure with the insertion of a definite clause leasing the undertaking to private enterprise in some form or other, details of which are not given, nor, indeed, do they appear to have been yet considered. From the report issued it is evident that the council intends to retain control over the undertaking, and the cautious attitude adopted has produced really an amusing state of affairs in political circles. There are Tories objecting because it is proposed to retain some interest in the business and Tories agreeing because the council has abandoned the idea of spending a huge amount of capital. Again we find Liberals objecting because it is not proposed to work the business direct, and others agreeing on account of the suggested control over the "trust." The report of the council was issued on Tuesday in order to allow the second reading debate on the bill to be taken last night. The debate fully revealed the state of things I have indicated, for it occupied the whole evening, with speakers expressing continually varying views, and was ultimately adjourned, so that further assistance has been given to the possibility of no decision being arrived at this session, due to want of time. One little point should be emphasized which is being badly misrepresented, viz., that the late council, strongly progressive, included in the bill as originally deposited the power to lease the undertaking, so that the proposition now is merely an extension of a principle already enunciated by a London County Council.

A new electric railway has been sanctioned between Euston (London) and Watford. It is to be constructed by the London and North Western Railway Company and will run partly in tube and partly on the surface over a total distance of 20 miles. The estimated cost is over $10,000,000. The tunnel portion of the line will have a diameter greater than any existing tube railway here, viz., 13 feet 6 inches. There has been no opposition to the undertaking, which will be carried out on land belonging to the railway company.

A curious reversal of the order of things is taking place as between municipalities owning electricity works and several of the bulk electric power supply companies in the provinces. Since 1900 and the few following years when municipalities were fighting all over the country to prevent inclusion in the areas of the power companies even the friends of the power companies—with one or perhaps two notorious exceptions—have perforce to admit that little or no progress has been made to give that universal supply of electric power that was so picturesquely foreshadowed in the parliamentary committee rooms. So apparent is the belatedness of the companies becoming, that the more influential corporations are taking heart of grace, and, having succeeded in being excluded from the predations of the power company, are now actually invading the territory of the latter. Two examples have happened only this week—one at Coventry—where the corporation had a strong case for extending its supply area, and the other at Sheffield, which was not successful, owing to the Yorkshire Electric Power Company being more or less in a position to supply. In connection with the Coventry case, however, the Leicestershire and Warwickshire Electric Power Company has built a framework to its power house and apparently allowed it to become derelict, for it was not denied that the interior was filled with water and grass. It is a striking object lesson that the ideals of a few years ago have distinctly failed to be realized.

An ordinary observer traveling about London cannot fail to have been struck with the trend of events upon the District Railway. To put it in an inoffensive spirit, from the very inception of electric traction on this line, it has been distinctly American. It came into being, electrically, with American money, the doors of the electric trains were operated in a manner hitherto unknown, i. e., pneumatically, signals were given to the driver by a succession of bells from car to car, and there were certain other little peculiarities characteristically American, and which its partner, the Metropolitan Railway, did not adopt. No one complained, except at being sandwiched between the doors, but one by one have purely old-fashioned English methods prevailed. The center pneumatically operated doors will in future be opened by the passengers themselves, the signal bells have been discarded for hand or flag signaling, and altogether there is a general dropping back to the methods that prevailed before the days of electric traction. It is not suggested that any moral is to be drawn, but it may be due to the predilections of a purely English manager.

I mentioned a week or two ago that the postmaster-general was endeavoring, by means of a clause to be inserted in tramway bills, to secure the use of trolley standards for erecting telephone and telegraph wires. An agreement has now been come to by which the telegraph and telephone wires so placed on trolley standards shall be below the trolley wire and the postoffice will bear all incidental costs and damages.

The Hull municipal telephone accounts have been published for the second year of working ended March 31, 1907. There is a profit of about $7,000 after payment of interest and sinking fund, but without any allowance for depreciation. There are 2,150 subscribers. The corporation's license expires in December, 1911.

G.

Dominion of Canada.

Ottawa, Ont., May 18.—It had been proposed to generate electrical power from the lake on the mountain at Glenora, Ont. H. C. Kennedy of Wiarton formed a company with $100,000 capital, but the scheme has fallen through because not enough money was subscribed.

Henry Holgate, hydraulic engineer, of Montreal, and Alex. McDougal, C. E., of Ottawa, have accepted the offer of the City Council of Ottawa for the sum of $1,000 each to investigate and report upon the several waterpowers in the neighborhood of the city. It is the intention of the city to develop an independent power for its lighting plant and for the general supply of power. This step has been initiated as a preliminary to the proposal of purchasing a power outright, to cover the cost of which the city has been empowered, subject to ratification by the ratepayers, to borrow the sum of $500,000.

It is stated that the Grand Trunk Railway Company intends to use electricity for power purposes in its car shops at London, Ont. The company expects Niagara power to be delivered in London soon, and that electrical energy will cost far less than steam power to operate the shops. The company's car shops in Hamilton are operated for about one-half what it costs to operate the London shops, the former shops being operated by electric power and the latter by steam.

The long struggle over the right to generate power at Kakabeka Falls, on the Kaministiquia River, near Port Arthur, Ont., has at last been settled by the Ontario government confirming the Kaministiquia Power Company in the rights which it took over as assignee of Edward S. Jenison of Chicago, who originally pre-empted the waterpower. The conditions, which have been made a sine qua non of the present arrangement, are that the company is to pay the government at the rate of 25 cents per horsepower per annum on all power in excess of 10,000 horsepower. In return for this the government undertakes to build, maintain and control the dam at Dog Lake for storage purposes.

W.

Winnipeg, Man., May 18.—F. E. Cambridge, city electrician, has drawn the attention of the Winnipeg City Council to the alleged fact that a large amount of damage is being done to water mains in the city by electrolysis. In an elaborate report he states that a four-inch main near the car barns of the Winnipeg Electric Street Railroad Company has been damaged to such an extent that it had to be abandoned. A 12-inch main on the west side of Main Street was also examined and 80 amperes found to be flowing from the rails to the pipe. The report stated that such a current would "eat up" 1,800 pounds of iron in a year. Mr. Cambridge recommends that the city compel the street-railway company to introduce a heavier bonding of its rails on Main Street, including the rebonding of the entire system.

Hon. J. H. Howden, minister of telephones for the province of Manitoba, announces construction will be started on June 1st on the government telephone systems for Winnipeg and Manitoba. Mr. Howden is in favor of having automatic systems installed in Winnipeg and Brandon.

The Brandon Electric Light Company, Brandon, Man., has decided to spend $21,000 this summer in extending its electric-light system. A large addition of modern machinery will be made.

C. H. Mitchell, hydro-electric engineer, is making an examination of the river at Saskatoon, Sask., for the purpose of determining the cost of electrical development.

The taxpayers of Wolseley, Sask., are considering the advisability of installing a municipal telephone system. R. A. Magee may be addressed.

The taking over of the Cascade Power Company of Nelson, B. C., by the West Kootenay Power Company renders the latter the second largest power company in Canada. It now has a total capacity of 30,000 horsepower, with a plant so constructed that other generators can be added without much difficulty or expense, and it is understood the company will shortly make some important additions to its plant.

G. H. Althem, who has been employed by the Lethbridge Electric Company, Lethbridge, Alb., has been engaged to superintend the installation of the electric-light plant at Macleod, Alb.

The city of Victoria, B. C., is trying to arrange for all wires in the city to be placed underground, and negotiations are now being carried on with the British Columbia Electric Street Railroad Com-

pany and the British Columbia Telephone Company.

W. S. Weeks & Co. have made a proposition to the City Council of Prince Albert, Sask., for a franchise to operate an electric street railway in that city, but the council appears to favor municipal ownership. Address R. S. Cook. R.

New England.

Boston, May 18.—The Worcester Polytechnic Institute has received two revolving-field alternators from the General Electric Company for its electrical laboratory. They each have a capacity of 7½ kilowatts, 220 volts, and they are designed to deliver either single, two, three or six-phase current.

The Western Electric Company has given a fine lot of telephone apparatus to Harvard University. It includes the equipment for a common-battery telephone exchange, a magneto automatic exchange, a four-party line and an assortment of switchboard and lead-covered street telephone cable. The American Bell Telephone Company contributed outfits of transmitters and receivers.

A. L. Kavanaugh of Lewiston, Me., and John T. Burnett of Boston have been appointed receivers of the Auburn and Turner Electric Railway Company of Maine. The company's property will be sold to the highest bidder.

The Stanley Electric Company has prepared plans for a large foundry building in Pittsfield, Mass., which will cost $300,000. A large amount will also be expended for cranes and pattern-making and casting machinery.

The Massachusetts Legislature has passed the bill permitting the purchase of the Conway Electric Railway by the Fitchburg Railroad Company, whose railroad lines are leased and operated by the Boston and Maine Railroad Company. There are strong rumors that the New York, New Haven and Hartford Railroad Company will soon obtain control of the Boston and Maine company.

Frank M. Corey, Edward H. Deavitt and J. M. Frost have bought control of the Barre and Montpelier Traction and Power Company which operates an electric railway 12 miles long connecting Barre and Montpelier, Vt. J. J. Flynn and A. O. Humphrey of Burlington, Vt., were the owners of the controlling interest. B.

New York.

New York City, May 18.—John F. Kearney of Brooklyn has started an action against the Brooklyn Rapid Transit Company to test the legality of the restricted transfer system which recently went into effect. C. D. Menesly, secretary and treasurer of the company, says the route named being a composite one, consisting of the lines of two distinct and separately operated companies, neither is under any legal obligation to transfer a passenger to a line operated by the other company.

Only two bids were received for the building of the second section of the subway loop between the terminals of the Brooklyn and Williamsburg bridges. The Cranford Company of Brooklyn offered to build the section of subway for $2,150,000 and the pipe galleries for $60,000. The Degnon Contracting Company bid $2,800,000 for the subway and $75,000 for the pipe galleries. As in the case of the first contract, the bids were considerably higher than the estimates which had been made by Chief Engineer Rice of the Rapid Transit Commission. Mr. Rice figures that the subway would cost between $6,000,000 and $7,000,000, but on the basis of the recent bids the cost will probably exceed $9,000,000.

The third rail on the line of the Brighton Beach road is being laid in a continuous stretch over the ties so as to assure its being perfectly straight. The various sections of rail are now being welded together. When the welding process is completed a gang of 500 men will be put to work to lift the third rail, a mile section at a time. Then it will be spiked to the outside of the ties.

Prof. Charles L. Harrington, A. M., supervisor of lectures for the Brooklyn Institute, gave the fourth lecture of his course on electricity at the Polytechnic last Wednesday evening and continued his explanation of the application of the electron theory to electrical phenomena. The topic was "Electric Lamps." The resistance of incandescent lamps of several varieties under various conditions were measured and the amperes required to form the incandescence required was shown. Images of the filaments were thrown upon the screen and the tantalum, tungsten and other lamps explained. Arc lights, both the common arc and flaming arc, were illustrated and described. Altogether this lecture was the most interesting and instructive of the course and was listened to attentively by a large and appreciative audience.

Shortly after 5 p. m. on May 16th the wall of rock separating the two sections of the north tube of the Belmont Tunnel running from Long Island City to Manhattan was broken through, and the two gangs of workmen who have toiled for months through rock and gravel met and exchanged greetings. The shields of the two sections met in about the middle of the river, showing that the progress from the Long Island City shaft and that made by the men from the shaft on Man-o'-War Rock was about the same. Despite many legal and other obstacles the work on the Belmont Tunnel has been going on night and day since 1905, and it is expected to have the north tube ready for the operation of trains by the New York and Long Railroad Company by August 1. D. E. P.

Southeastern States.

Charlotte, N. C., May 18.—A contract involving $25,000 has been closed between the Fox River Shipbuilding Company and the Florida Electric Company at Jacksonville, Fla., for the construction and equipment by the electric company of generating plants at the terminals of the Atlanta, Birmingham and Atlantic Railroad.

The city of Wilmington, N. C., has granted a franchise to the Tidewater Power Company, a subsidiary company to the Hugh MacRae & Co. interests, developing a large waterpower on the Pee Dee River, 100 miles distant.

The Warrior River Power and Electric Company is the result of some interesting agitation on the part of Nashville (Tenn.) citizens, proposing another railway to Huntsville, Ala., from Nashville. It is proposed to develop electric power on the Warrior River about 27 miles north of Birmingham. M. C. McGannon and Alberto Hudson are the prime movers in the newly launched plan.

To develop 4,000 horsepower at Fish Dam on the Holston River, near Bristol, Tenn., is planned by Eastern capitalists, who propose to invest $750,000, building a 75-foot dam and distributing the power to the section surrounding. A stock company to distribute power and build a sub-station near Bristol has been organized with $50,000 capital.

J. S. Hodges, L. B. Cox and E. J. Hocutt have secured a charter for the Pamlico Washington Railway Company, headquarters at Washington, N. C., to operate electric lines in the town and within a 50-mile radius.

The Stone-Webster interests, recent purchasers of the electric lines, street-lighting and gas plants at Baton Rouge, La., are making extensive improvements in the railway system. It is also reported that the same interests are investigating the feasibility of an interurban line from Baton Rouge to New Orleans.

The town of Houma, La., has made a contract with C. H. Jenks of Fayette, Miss., for plans for an electric-light plant which will cost about $20,000 completed. Work will be inaugurated shortly.

The Maryland Electric Company of Baltimore has started negotiations with the Baltimore and Ohio Railroad for the use of certain trackage into the city and the continued use of the Camden Street terminals after it has electrified its line to Annapolis. This road was formerly the Baltimore and Annapolis Short Line, but was absorbed by the Maryland company last summer, when it was announced that this road would be electrified. The Short Line has been using its own tracks to Westport, thence into the city over the Baltimore and Ohio tracks. The Short Line has contracted with J. G. White & Co., electrical engineers, to supervise the electrification of its lines to Annapolis.

The new bid of the Georgia Railway and Electric Company to light the streets of Atlanta will save the city $17 annually on each light, the former price being $75 and the new average rate $58.

The Georgia Terminal Company of Atlanta has given a mortgage to the Old Colony Trust Company of Boston, Mass., to secure $4,000,000 25-year bonds, the property of the Terminal company in Atlanta and Howells, and its roads and other equipment being conveyed to the mortgagee. L.

Ohio.

Toledo, May 18.—A carload of steel ties and poles has been received at Defiance, and work on the Columbus, Indiana and Eastern Traction Company is coming forward at a rapid pace.

The council at Mansfield passed ordinances last week providing for the issuance of $5,000 worth of bonds for the erecting of electric arches around the square and on Main Street from South Park Street to the Erie tracks. This will give 740 additional electric lights in the center of the city.

The Lima-Toledo Electric Railway Company has appeared before the council of Toledo asking for franchise to come into the city. Later on another franchise will be requested to enable the company to reach the interurban depot in the heart of the business section.

If the moneyed interests of Fremont will subscribe for the bonds of the Toledo, Port Clinton and Lakeside Railway to the amount of $60,000, there will be constructed a belt line in Fremont, and the line from Fostoria to Fremont, and from Fremont to Port Clinton, which were talked of some little time ago. Men interested in these propositions are satisfied that the lines will be paying propositions.

Incorporation papers have been filed for the Fremont Street Railway Company. The present street railway in Fremont will be acquired and put in condition to handle interurban traffic.

The stockholders of the Toledo Gas, Electric and Heating Company have been in receipt of a circular letter asking for proxies to vote on the question of the sale of that property to the Toledo Railways and Light Company. In the circular the chairman of the board of directors of the gas company makes a statement to the effect that there will be a smaller amount of stock of the purchasing company outstanding than the amount of the combined stock of the two companies at this time, as the purchasing company agrees to pay for the gas company's property $1,875,000 in the stock of said company on the basis of its par value. On that basis the present holders of the gas company will receive three shares of stock of the purchasing company for four shares of stock of the present company, and the purchasing company will be permitted to issue only $1,875,000 par value of new stock for the purchase of the gas company's property.

The Fremont, Tiffin, Marion and Southern Interurban Railroad Company of Tiffin has been incorporated with a capital stock of $10,000. The incorporators are Donald McKenzie, William H. Kildon, Alex Kiskadden, James D. Watson and W. W. Keller.

The Mansfield Railway, Light and Power Company has been sold to Cleveland interests and will probably be absorbed by the Cleveland Southwestern and Columbus Railway Company, which already reaches Mansfield from the west and is building a line into Mansfield from the east. The Mansfield properties are said to represent an investment of about $1,500,000 and consist of the street railway, lighting and power plants of the city. The company also operates an interurban line to Shelby.

The Toledo Light and Equipment Company has been incorporated with a capital stock of $100,000. The company will act as sales agent for a newly invented device which consists of an electric bulb with reflector attachment which increases the power of the light. The company intends later on to build its own plant and manufacture the bulbs in Toledo. The incorporators are W. C. Miller, D. A. Howell, John E. Nicks, A. P. McArthur and A. A. Buck.

The Tuscarawas County Electric Light and Power Company is soon to be incorporated to take over the property of the A. Beyer Electric Light Company of Canal Dover and New Philadelphia. Considerable improvement is expected to be made in both plants as soon as the change of ownership takes place.

The Ohio Electric Railway Company was incorporated last week for $100,000 by E. H. Berry, D. J. Downings, S. H. Murray, W. H. Shubert and C. W. Wilson. This company is organized to operate the Schopf lines. The cities traversed by the lines of the company are Richmond, Ind., Cincinnati, Toledo, Columbus, Washington C. H., Springfield, Dayton, Lima, Defiance, Van Wert, Fort Wayne, Hebron, Buckeye Lake, Newark and Granville. It is understood that this company is to make a fight for commercial lighting and power work in all the cities it will touch, and in Northwestern Ohio it is looked upon as a hard rival for the Everett-Moore syndicate. H. L. S.

Indiana.

Indianapolis, May 18.—The Terre Haute and Merom Traction Company will be incorporated today. The company will build a road from Terre Haute to Merom, a distance of 30 miles. The capital stock will be $750,000. The survey has been completed and deeds to nearly all the right-of-way have been obtained. The incorporators are headed by Lafayette Brown.

The Town Board of the new city of Gary has granted a franchise to the Goshen, South Bend and Chicago Electric Railway Company to enter the city. Franchises were also granted for water, light and gas.

The newly organized local of the Amalgamated Association of Street and Electric Railway Employes are on a strike, and rioting and bloodshed have occurred. The men are demanding increased pay and that there shall be no difference in the pay of a first, second and third-year man, as is the company's plan.

The right of the Indiana Railroad Commission to exercise judicial power is involved in a suit now pending before the commission. The Terre Haute, Indianapolis and Western Traction Company is suing the Big Four Railroad Company for the privilege of extending its high-tension line across the latter's right-of-way. The assistance of the railroad commission is asked in order that the steam road might be compelled to consent to the crossing.

Officials of the Fort Wayne and Wabash Valley Traction Company have concluded not to change the fast through Fort Wayne-Wabash-Indianapolis service.

Eastern capitalists are said to have taken hold of the Educational Traction Company's route and will push the enterprise to a speedy completion. The line as surveyed will connect Lafayette, Crawfordsville, Green Castle and Bloomington, all college towns.

The Seymour and Brownstown Motor Line Railway Company has been incorporated by Joseph I. Irwin and Z. T. Sweeny of Columbus. The purpose is to build and equip a concrete road between Seymour and Brownstown upon which to operate automobiles for common carriage of passengers. This will be the first road of the kind in the state.

Articles of association have been filed by the

Central Indiana Lighting Company with a capital stock of $3,000,000. William M. Wherry, Jr., John W. Tobin and Ivan L. Meloon, all of New York, are the incorporators. The company is a branch or subsidiary of the National Heat, Light and Power Company of New York city, whose business is establishing, leasing or buying electric-light and power plants, and it is financed by the Knickerbocker Trust Company of New York. Mr. Wherry, it is stated, is a director in the National company, and Mr. Tobin is a junior partner of A. H. Bickmore & Co. of New York city, brokers for the stock of the National Heat, Light and Power Company. In Indiana the company has options on the lighting plants at Shelbyville, Columbus, Elwood and Fairmount. It has figured some on buying the leases and light plants of Summitville and Alexandria. It was explained, however, that the Central company is most concerned in Indiana in getting a central power station to supply its light plants in Indiana and Eastern Illinois, and it is probable an immense power station will be built in the Indiana coal fields to supply electricity to the various plants that the Central company will control or own.

The Greenfield Light and Power Company of Greenfield, capitalized at $25,000, has been incorporated by R. S. Ashe, F. E. Barrett, C. E. Barrett and others. The organization of this new company is thought to be the first step toward taking over the municipal plant in Greenfield.

Articles of incorporation have been filed by the Indiana and Michigan Electric Company, which proposes to furnish electric lights, power and heat for South Bend, Mishawaka, Elkhart, Bristol, Goshen, Laporte, Michigan City and some towns and cities in Michigan. The headquarters of the company will be in South Bend. The capital stock is placed at $1,915,000. The company proposes to generate electricity by means of hydraulic plants in the St. Joseph River. The directors are Charles A. Chapin, H. K. Chapin, Charles L. Crawford, F. L. Denis, C. B. Calvert and F. A. Bryan.

S. S.

Michigan.

Grand Rapids, May 18.—The Legislature seems determined to limit the power of the electric power companies in the state. The companies have a right to enter any city or village without a franchise except in six counties, which were exempted when the law was passed. Now amendments have been proposed for exempting three new counties, which will require the securing of franchises, and prevent the consolidation of gas, electric-light and power companies. Kent County is among the number. Inasmuch as the power companies of the state, or a number of them, have been securing control of such corporations, they are now being limited only to the selling of power.

The Grand Rapids-Muskegon Power Company, as soon as the Croton dam is in operation, will commence the erection of another power line to this city. This will be about 10 miles east of the present right-of-way, and is to be put in so that the company, in case of trouble, will have two lines for the entire distance. Steel towers 50 feet high and 575 feet apart will carry the cables.

The Detroit, Jackson and Chicago Railway has made a contract with the Commonwealth Power Company to furnish the power for operating the line and is building sub-stations at Chelsea and Grass Lake. This will do away with the substations at Lima Center, Michigan Center and Francisco and will not only be more economical, but tend to better and more regular service along the line. The Commonwealth Power Company has a dam at Lyons, Mich., and the power will be transmitted from that point.

The Michigan Power Company has notified customers at Lansing that it would not furnish them with light, as it is in violation of the franchise. The corporation was lighting 14 or 15 manufacturing establishments and stores, and the city threatened to start suit. The city is still furnishing electricity for power, which is prohibited by the city charter, but Secretary Kirby says it is only for a few electric motors, and it is quite likely that the city will continue to sell electricity for that purpose.

The New Holland City Mills at Holland will be operated by power from the Grand Rapids-Muskegon Power Company.

The Michigan Thumb Electric Railway Company has been formed for the purpose of constructing a railway from Detroit to Bay City, touching Memphis, Richmond, Sanilac, Capac, etc. E. W. Mills of Detroit is promoting the project. Fred S. Bennett of Chicago, president of the Chicago, Kalamazoo and Eastern Railway, is the latest to take up the project of building a railroad from Kalamazoo to Benton Harbor.

L. W. B.

Illinois.

Peoria, May 18.—The Peoria Railway Terminal Company will, on May 20th, discontinue to run its cars up to the center of the city; instead they will run only to Western Avenue, there connecting with the Peoria Railway Company's city lines. The Terminal is now paying four cents for each passenger carried in the city and has offered to pay three cents, which the Peoria Railway Company will not accept, hence the desire of the company for an entrance to the city on its own tracks.

The Illinois Traction System is building a belt line around the city of Springfield and will have to cross several steam roads. To oppose the state board of railway and warehouse commissioners granting the necessary permit, the steam roads had a large array of legal talent before the board. According to the estimates of the engineers the overhead crossing that the roads demand will cost $150,000.

In Springfield, the Chicago and Alton, together with the street railway and the city, will build a subway to avoid a dangerous grade crossing. The subway will cost $50,000; of this the railroad company will pay $22,000, the city $5,000, and the street railway the remainder. This will make a shorter route to the State Fair grounds for the car line and also do away with the delay necessary when crossing the steam road.

The City Council of Pana has granted the Springfield and Southeastern a franchise. The franchise calls for paving one-third of the right-of-way and lighting the streets along which the road runs, work to commence at once.

The Chicago and Alton will test three gasoline motor cars, commencing June 1st. The cars are of the Strang type tested at Kansas City. They will be put on local passenger runs where the smaller type of locomotives are now used. The cars cost $18,000, and will seat 80 people.

The Illinois Traction Company is planning an hourly service between this city and Bloomington. Beginning this week, trailers will be attached to be used for baggage and express until the regular express cars are received. At Litchfield the company has purchased ground and will erect a freight and passenger station for its own use. Contracts have been signed by the company calling for the installation of an automatic stoking plant at the company's power house at Riverton. Two contracts were let, one for the bunkers, that will hold 1,000 tons, and the other for the conveyors and stokers. The company will build an extension to the State Fair grounds at Springfield, the line to be used for the transportation of fair visitors, and will parallel the Chicago and Alton road.

The plans for the new shops of the Illinois Traction Company at Decatur have been completed. Congressman McKinley, president of the company, was in Springfield this week, together with Manager Fischer and Superintendent Harry, making an inspection of the various interests there and also the road. Much money is being spent on improvements in Decatur on the lighting and power plants.

V. N.

Pacific Slope.

San Francisco, May 16.—The Geary Street Railroad Company, which was put out of business by the strike at the same time as the United Railroads, was on the point of starting up its cable road in this city this morning, but action was deferred pending the result of a directors' meeting in the afternoon. Secretary Shepard had made an agreement with the Carmen's Union to grant the eight-hour day at $3 which they demanded, but the directors refused to ratify the arrangement at once and Mr. Shepard resigned. The Board of Supervisors had demanded that the company at once resume the operation of its cars or forfeit the right to run cars in future. The company's franchise expired more than two years ago and during the last year a monthly rental has been paid to the city for the privilege of operating. It is claimed that the rails belong to the company, which demands the right to remove them. The supervisors are considering plans to change the road into an electric road as soon as possible. It is estimated that it could be changed over to a trolley line in four months. An underground conduit system would cost $750,000.

The San Francisco Railway and Power Company has filed articles of incorporation with a capital stock of $1,000,000. The directors are B. F. Clarke, F. C. Boeckmann, George K. Ford, George E. Bennett and J. R. Sloane.

The city of Santa Clara, Cal., has called for bids for municipal bonds in the sum of $25,000 for the reconstruction and repair of the light and power plant and waterworks.

It is announced that on the completion of the survey for the British Columbia Electric Company from Vancouver, B. C., to Sumas, Wash., a line will be surveyed from the latter point and Bellingham, Wash. An electric railway will be constructed to a connection with the line that Stone & Webster are building from Bellingham, Wash., to connect with the line to be built south from Bellingham.

Seattle street-railway and gas companies are finding it difficult to keep pace with the rapid growth of the city. The Seattle Electric Company, which operates the street-car service, reports an increase of 20 per cent. in the number of passengers carried last year. The line from Seattle to Tacoma is being double-tracked and it is expected at least 20 miles of track will be added to the city system during this year.

The board of capital building commissioners has called for bids for supplying the state institutions at Salem, Ore., with electric light after March, 1908, when the present contract with the Portland General Electric Company will expire. Proposals must be submitted by June 4th. In case the state cannot secure satisfactory terms a plant will be installed at the penitentiary and the state will make its own electricity for the capital, prison, asylum, blind school, mute school, reform school and asylum farm.

A.

PERSONAL.

Frederick P. Fish, ex-president of the American Telephone and Telegraph Company, sailed for Europe on May 9th, to be gone two months.

The New England Telephone and Telegraph Company's directors have elected Theodore N. Vail as director and member of the executive committee to succeed Frederick P. Fish, resigned.

P. Barnhard, Jr., formerly superintendent of the Central Kentucky Traction Company at Lexington, has been appointed secretary and general manager of the New Tuscarawas County Electric Light and Power Company of New Philadelphia, Ohio.

Carl D. Knight, B. S., and Francis J. Adams, E. E., have been appointed instructors in electrical engineering at Worcester Polytechnic Institute. Mr. Knight graduated at Worcester in 1903 and then went with the General Electric Company. Mr. Adams graduated in 1904 and has since been in the engineering department of the Westinghouse Electric and Manufacturing Company.

W. McLea Walbank, vice-president and chief engineer of the Montreal Light, Heat and Power Company, has been elected president of the Canadian Society of Civil Engineers. Mr. Walbank is a native of Newfoundland, and is well known in Canada and the United States as a mechanical and electrical engineer of ability and resource as well as a man of business foresight and executive ability.

Charles Frederick Cutler of Morristown, N. J., president of the New York Telephone Company, died suddenly a few days ago from heart disease at the Saranac Inn, Saranac Lake, New York. He was born in 1841. He organized the New York and New Jersey Telephone Company, of which he was made president. Later he became associated with the New York Telephone Company and was chairman of the board of directors of a number of eastern telephone companies.

C. H. Worcester, president of the C. H. Worcester Company, Chicago, producer of cedar poles, recently returned from a trip to Europe and Northern Africa. Mr. Worcester was gone about four months and visited the principal countries, including Egypt, Italy, Spain and others. His journey was in the nature of a vacation, being the first in a number of years which his many duties would permit him to take. Mr. Worcester returned in improved health and is well prepared to resume his labors. He left last week on a trip to the Pacific Coast.

Albert S. Richey, B. M. E., has been appointed professor of electric-railway engineering at the Worcester Polytechnic Institute at Worcester, Mass. Mr. Richey graduated from Purdue University in 1894 and from then until 1905 held a leading position as engineer in the mechanical and electrical development of some of the large street and interurban railway systems in Indiana. In 1905 he resigned as chief engineer of the consolidated electric railways in the Indiana Union Traction Company to become assistant professor of electric-railway engineering at Worcester. He is a member of the American Institute of Electrical Engineers.

George R. Olshausen, Ph. D., has been appointed assistant professor of theoretical electrical engineering at Worcester Polytechnic Institute. Mr. Olshausen graduated from Washington University in 1890. Until 1896 he was chief engineer of the Union Depot Railroad Company, St. Louis, and gave instruction in astronomy at Washington University. From 1896 to 1901 he took a course in advanced mathematics at the University of Berlin, where he received the degree of Ph. D. He was assistant professor of mechanical engineering and professor of physics at Armour Institute of Technology in 1901 and 1902, and then, for a year, was engineer on power-station work in Omaha. Since 1903 he has been in the department of physics at Cornell University.

Edward G. Acheson of Niagara Falls has been awarded the Rumford medal by the American Academy of Arts and Sciences for the application of heat in the electric furnace to the industrial production of carborundum, graphite and other new and useful substances. Notice of the award was received by Mr. Acheson from Prof. Charles R. Cross of the Massachusetts Institute of Technology, Boston, Mass. The Rumford premium was established by Benjamin Thompson, Count Rumford, in July, 1796, who set aside a fund of $5,000, the interest on which sum is to be devoted every two years to medals to be awarded for useful discoveries along the lines mentioned. In England the medal is conferred by the Royal Society. The medal is struck in both gold and silver. Up to 1905 the medal had been awarded 20 times, so that Mr. Acheson is the twenty-first person in the United States to receive it. Among the famous men on

whom it has been conferred in this country are John Ericsson, George Henry Corliss, Henry A. Rowland, Simon P. Langley, Thomas A. Edison, Charles P. Steinmetz and Elihu Thomson. The medals will be prepared during the summer and Mr. Acheson will go to Boston to receive them next fall or early winter.

H. J. Gille of St. Paul, Minn., for a number of years connected with the St. Paul Gas Light Company, will take charge of the contract department of the Minneapolis General Electric Company. Mr. Gille is the inventor of a number of electrical devices, and with Dr. A. W. Miller he is credited with constructing the first alternating-current dynamo built in Minnesota.

Benjamin Ide Wheeler, president of the University of California, has been offered the presidency of the Massachusetts Institute of Technology. The corporation will hold a meeting on May 29th, when it will vote on confirming this appointment, if Mr. Wheeler accepts it. Mr. Wheeler was born in Randolph, Mass., on July 15, 1854. He graduated from Brown University in 1875. He was a teacher in the Providence High School and Brown University until 1881, when he went to Germany for a course in German universities. In 1886 he was elected professor of comparative philology in Cornell University. Dr. Wheeler is the author of a number of educational works. He was editor of the department of philology in Johnson's Cyclopedia and Macmillan's "Dictionary of Philosophy and Psychology."

A. L. Tetu, general manager for the New Long-distance Telephone Company and the Indianapolis Telephone Company, both of Indianapolis, Arthur A. Berridge, auditor for both companies, and C. J. Langdon, superintendent for the Indianapolis Telephone Company, have resigned and will go to Portland, Ore. Mr. Tetu, who has been general manager for the two companies for more than a year, will become general manager for the Home Telephone Company at Portland, with charge of the business of the company in a number of neighboring cities. Mr. Berridge will be auditor and Mr. Langdon superintendent of the Home Telephone Company. The Home Telephone Company is an Independent company. Mr. Tetu will be succeeded by James E. Brailey of Toledo, Ohio, a cousin of James S. Brailey, Jr., of Toledo, president of the Indianapolis and New Long-distance companies.

ELECTRIC LIGHTING.

The town of Westbend, Wis., has voted for a municipal electric-light plant.

The Havelock (Neb.) Electric Light Company has been incorporated for $15,000.

The Commonwealth Light and Power Company of Scranton, Pa., has been organized.

The Spring Valley (Wis.) Light and Power Company has been incorporated for $15,000.

The Pecos (Texas) Light and Ice Company has been incorporated with a capital stock of $20,000.

The Coatesville (Pa.) Supply, Light, Heat and Power Company has been incorporated for $5,000.

The City Council at Sioux Falls, S. D., is investigating the feasibility of establishing a municipal electric-lighting system.

The Bloomville (Ohio) Light and Heating Company has been capitalized at $10,000 by D. W. Fellers, J. E. Sherck and others.

The Toledo (Ohio) Light and Equipment Company has been capitalized at $100,000 by W. C. Miller, D. A. Howell and others.

The Ashland Light, Mill and Power Company's plant at Ashland, Neb., has been totally destroyed by fire. The loss was about $10,000.

The Portales (N. M.) Waterworks and Electric Light Company has been incorporated for $15,000 by George Howard, W. H. McDonald of Portales and others.

The Wythe Electric Light, Power and Warehouse Company of Brooklyn, N. Y., has been incorporated for $300,000 by Arthur Islin, Lincoln Cromwell and others.

The People's Light and Power Company of Baker City, Ore., has been capitalized at $250,000 by Ray Nye of Fremont, Neb., John Thompson and I. Fuchs of Baker City.

The plant of the A. Beyer Electric Company at Canal Dover, Ohio, which furnishes light and power for that town and New Philadelphia, has been purchased by the Tuscarawas County Electric Light and Power Company, a newly organized concern. The purchase price was $100,000. The plant will be rebuilt and greatly enlarged.

An ouster suit was filed on May 18th in the Circuit Court against the Laclede Gas Light Company and the Union Electric Light and Power Company, both of St. Louis. The companies are charged with violation of the anti trust laws of Missouri, it being alleged they have formed a combination giving them a monopoly on the lighting utilities of St. Louis. It is considered probable that a special commissioner will be appointed to hear the evidence in the case.

The Northern Illinois Gas, Electric Light and Water Company of Chicago has been incorporated by L. D. Condes and associates. The capital is $250,000 and the company intends to operate heat, light, power and water plants.

The electric-light plant of the Laramie (Wyo.) Light and Power Company has been sold to a company represented, it is said, by J. A. Arbogast of Waynesburg, Pa., and E. A. Phinney of Ouray, Colo. The plant will be enlarged.

The Central Heating and Lighting Company and the Canton Heat, Light and Power Company, both of Canton, Ohio, have filed articles of consolidation. The new company will be known as the Canton Electric Company, and the capital stock is $2,500,000. Henry L. Doherty of New York is president of the new company.

Bids will be accepted until June 1st for installing an electric-lighting system and for furnishing electric current for illuminating and for small-motor purposes at Columbus Barracks, Ohio. Tenders should be addressed to Captain H. B. Chamberlin, constructing quartermaster.

The Wilmington (Del.) Light, Power and Telephone Company began to furnish current October 25, 1906. In December of the same year it decided to use the Nernst lamp for commercial lighting, and in four months' time succeeded in placing over 1,500 Nernst lamps, the total number of glowers installed to April 12th amounting to 5,265.

The city lighting plant at Seattle, Wash., will be doubled in capacity. Bids are asked for two turbines or impulse waterwheels; two 4,000-kilowatt 2,300-volt 60-cycle three-phase revolving-field alternating-current generators; nine 1,500-kilowatt 2,300-35,000-volt transformers for the generating station and eight transformers for the sub-stations.

The municipality of Rome, Italy, is said to be considering a scheme for the establishment of a municipal electric-lighting service. It is proposed to raise a loan of $695,765 for this purpose. Of this sum, $373,889 would be devoted to the building and equipment of the plant and to laying down wires—private tenders to be invited for these works.

The city of Marshfield, Wis., has practically finished the building for housing its new electric-light and waterworks plant, and has now begun the installation of equipment. Concrete foundations have been prepared for supporting two engines, which will be used to drive two alternating-current generators, one of 225 kilowatts capacity and the other of 100 kilowatts. Three new 150-horsepower boilers will generate steam. In a sub-station, some distance away a new pump will be installed 17 feet below ground, by means of which water will be pumped into the standpipe. The engines and generators were supplied by the Allis-Chalmers Company.

ELECTRIC RAILWAYS.

It is reported that the Chicago Great Western Railroad will electrify that portion of its line between Rochester and Winona, Minn.

The Jefferson (Tenn.) Electric Railway, Light and Power Company has been incorporated for $15,000 by W. T. Russell, J. B. Huff and others.

The Panhandle Electric Railway and Power Company of Spokane, Wash., has been incorporated for $1,000,000 by Thomas W. Payne, A. J. Smith and others.

The Spokane and Inland Electric Railway Company has completed its $10,000 depot at Garfield, Wash. The poles have all been set from Spokane to Garfield, and electric cars on this line are now running within 12 miles of Garfield.

It is reported that the final disposition of the Chattanooga (Tenn.) Southern Railroad, which is owned by the Louisville and Nashville Railroad and which went into the hands of a receiver recently will be turned into an interurban electric railway when the Hale's bar lock and dam power plant is finished. As proposed this plant will generate 50,000 horsepower.

The Ohio Electric Railway Company of Cincinnati has been incorporated with $100,000 capital stock by E. H. Berry, D. J. Downing, S. M. Murray, W. H. Schubert and C. W. Wilson. It is proposed to construct a line running from Zanesville to the Indiana line near New Paris, Preble County, and extending thence to Richmond, Ind., Cincinnati, Toledo, Columbus, Springfield, Dayton, Defiance, Lima and Fort Wayne.

The impression that life is held rather more lightly in many well-populated parts of America than in other civilized countries has gained a strong hold throughout Europe, and it has been brought about mostly through the heavy annual crop of traffic accidents; but we do not doubt for one moment that the street-railway companies over there are just as anxious to avoid personal accidents as we are, and it would be the height of impertinent self-righteousness to suggest that we have keener instincts of humanity. However, the fact remains that the percentage of fatal accidents on, or by, public vehicles of every kind in England sets a pattern to the world, not excluding North America. —London Electrical Review.

Mr. R. Duckworth of Preston, England, has patented a new "third-rail" system for railroad purposes, which is to be tried on the new line of the London and Northwestern Company from London to Waterford. The invention provides for the fixing of a depression rail under the running rail. The moment the train's weight is placed on the running rail the depression rail is forced down and the current is applied to a short section of the line, which is thus "alive." Immediately the train passes off the section the rail becomes normal and "safe."

The Ravenswood extension of the Northwestern Elevated Railroad, Chicago, was opened on May 18th. The run from the suburb to the Loop district is to be 30 minutes. The extension is built on a private right-of-way, which leaves the main line at North Clark and Roscoe streets, turns westward across the Northwestern Railroad tracks near Gross Park station, parallels the tracks northward to Ravenswood, where at Wilson Avenue it turns west again. Its present terminus is at North Western Avenue, near Lincoln Avenue, and is three and a half miles from the main line. A further extension as far as Irving Park is planned this summer. It is proposed to run the trains to the ground just west of North Western Avenue and extend it on the surface across the north branch of the river to Kimball and West Wilson avenues on the northwest side, near Irving Park.

PUBLICATIONS.

The Trumbull Electric Manufacturing Company of Plainville, Conn., is sending out an attractive little booklet entitled "The Power of Persistent Effort." Needless to say, the subject of Trumbull switches was not overlooked in its preparation.

In Bulletin No. 17 The Arnold Company of Chicago gives a well illustrated description of the Elgin and Belvidere electric railway, which it built. The road was opened on February 2d and in construction and equipment well represents modern practice. An interesting feature of the bulletin is a map showing the electric interurban railways in the Central States. The Arnold Company is prominent in the engineering and constructing of electric railways, light, power and industrial establishments, and the new bulletin will be of value to engineers and railway men.

The 1907 year book of the Engineers' Society of the University of Minnesota contains, among other things, articles on "Commercial Temperature Measurements with the Thermo-electric Couple," by Anthony Zelleny; "Portable Traction Dynanometer," by E. N. Stacey and O. B. Bjorge; "An Electrical Method of Depolarizing Primary Batteries," by Frank W. Springer; "Centrifugal Electric Driven Fans," by John Howatt. A technical article on the "Calibration of a Wheatstone Box Bridge," by B. E. Smith, also appears, together with miscellaneous information relative to the affairs of the society.

A description and price list of "Fancleve" electrical specialties, in pamphlet form, is being distributed by the manufacturer, John L. Gleason, 290 South Street, Jamaica Plain, Mass. Among the specialties described are offset boxes for rigid conduit; switch and junction boxes for exposed conduits; outlet boxes for non-metallic flexible conduit; switch, receptacle, or junction boxes for non-metallic conduits; Universal switch mounts for snap switches, receptacles, or wall sockets; blank and universal molding taps; reduction boxes; and molding boxes, regular and angle pattern. Gleason's electrical specialties, it is asserted, are approved by all municipal boards in the United States.

"Forest Planting in Illinois" is the subject of an interesting paper by Mr. R. S. Kellogg, forest inspector. It constitutes Circular 81 of the Forest Service of the United States Department of Agriculture. The paper gives the results of a recent extensive study by the Forest Service of forest plantations to determine the kinds of trees best adapted to planting in the prairie sections. On the whole, both climatic and soil conditions are favorable to tree growth. There are in the state over one hundred native tree species, and a large number of foreign species which have been introduced are thriving. Suggestions for planting and information as to commercial returns are among the subjects treated in the circular.

The Jeffrey Manufacturing Company of Columbus, Ohio, has issued Bulletin No. 12 on "The Care of Electric Mine Locomotives in Service," by F. L. Sessions. Besides going into details on the care and operation of electric mine locomotives, the book gives a brief description of their equipment and presents much information which should prove of value to mining men and electricians generally. The book is replete with illustrations and contains several interesting diagrams and a number of tables, the latter dealing specifically with the capacities and equipment of the various types of Jeffrey locomotives. The company will be pleased to mail the

bulletin to mine managers, engineers and others interested. It also invites users of electric locomotives to write freely about questions upon which information or advice is sought.

Bulletins Nos. 4394B, 4494, 4497 and 4500, have recently been issued by the General Electric Company. The first is devoted to a description of form P belt-driven alternators. These machines constitute a new line which the company has placed on the market to meet the demand for small alternators having good regulation, delivering their output at low temperatures, and carrying a load of mixed character. They are built with two bearing housings, forming part of the bearing brackets, securely bolted to the frame. The alternators referred to are of the revolving-field type, with stationary distributed armature winding. Bulletin 4494 deals with Edison Gem high-efficiency incandescent units, which are a combination of high-efficiency Gem filament lamps of high candlepower with Holophane reflectors. These lamps are made in various sizes. A new line of Holophane reflectors is used, known as the form "B" or Bowl Holophane, from their resemblance to an inverted bowl, are said to greatly increase the effectiveness and range of application of incandescent lamps. Security snap sockets are described in Bulletin 4497. In place of the two screws which have been used in fastening the shell to the cap, the cap and shell of these sockes are held together by three bayonet-joint catches, forming a rigid connection between the two parts of the socket covering. In bulletin 4500 are described constant-current transformer panels for series arc and series incandescent lighting systems. These panels have lately been redesigned and embody several improvements over the panels which have been in operation for a number of years. In the description the panels are divided into two classes, namely, isolated arc panels and isolated incandescent panels. Short descriptions are given of wattmeter sub-bases, recording wattmeters and primary and secondary plug switches, etc.

SOCIETIES AND SCHOOLS.

Prof. Elihu Thomson of the Thomson-Houston Electric Company of Lynn, Mass., in a lecture recently given by him before the Schenectady branch of the American Institute of Electrical Engineers, is credited with saying that the mosquito problem was the cause of the failure of the French to complete the digging of the Panama Canal.

An enthusiastic meeting of men interested in the formation of a branch of the American Institute of Electrical Engineers in Toledo, Ohio, was held last week in Toledo. A temporary organization was effected, with W. G. Nagel as chairman and George E. Kirk as secretary. By unanimous vote of those present it was decided to seek authority from the Institute to establish a Toledo branch of that society.

At the semi-annual meeting of the American Society of Mechanical Engineers to be held in Indianapolis, Ind., May 28th to 31st, a wide range of subjects will be taken up and discussed, as may be judged by the partial programme recently published in the Western Electrician. An automobile symposium has been planned for the evening session of May 30th, at which a number of papers illustrated by lantern slides will be presented. Accommodations for transportation and Pullman-car service can be arranged for by addressing the secretary of the society, C. W. Rice, 29 West Thirty-ninth Street, New York city.

Prof. H. E. Clifford of the electrical-engineering department of the Massachusetts Institute of Technology, Boston, will next year extend his lectures on alternating currents into a graduate course. These lectures have hitherto been restricted to the required work in alternating currents of the undergraduate students, but during the next college year Professor Clifford will deliver an advanced course, which will be particularly intended for graduate students who are attending the Institute for the purpose of spending a fifth year in the engineering school, or for the purpose of there obtaining a second degree. These lectures are expected to be among the most brilliant and complete that have yet been presented on the subject in any of the engineering schools of America.

At a meeting of the Institution of Electrical Engineers held in England on April 25th Chairman Dr. R. T. Glazebrook announced the names of the council nominations for election of council and honorary officers for 1907-8. The nominations were as follows: President, Lord Kelvin; vice-presidents, F. Gill, Colonel H. C. L. Holden, Prof. G. Kapp and C. P. Sparks; treasurer, Robert Hammond; auditors, H. Alabaster and Sidney Sharp; members of council, W. Duddell, S. Evershed, H. E. Harrison, Dr. E. Hopkinson, J. W. Jacomb-Hood, Walter Judd, W. M. Mordey, J. E. Kingsbury, M. O'Gorman, G. W. Partridge, W. H. Patchell, S. L. Pearce, W. Rutherford, A. A. C. Swinton and C. H. Wordingham.

TELEGRAPH.

The Spanish government has just laid a submarine cable from Barcelona, Spain, to Palma de Mallorca, in the Balearic Islands. The cable was laid by a London company in less than two days and is 117 miles long. The contract price for the work of laying was $150,000. In the new cable there are six copper wires.

The Central and South American Telegraph Company at a stockholders' meeting in New York authorized an increase of the capital stock from $8,000,000 to $12,000,000. Half of the increase covers expenditures for the Chorrillos, Iquique and Valparaiso duplicate cable, and other extensions and betterments. The remaining $2,000,000 is to be issued as the directors may determine for capitalizing future improvements, which will include the New York and Colon cable and extensions in South America and Argentine.

MISCELLANEOUS.

Mayor Busse of Chicago has appointed a commission of business men, city officials, engineers and furnace combustion experts who will co-operate in working out a plan for eliminating smoke and soot from Chicago.

The Evansville Electric Plow and Traction Company has sold the electric-light plant at Owensville, Ind., to Owensville men. The plant was built originally for the purpose of testing an electric plow invented by C. H. Roberts and promoted by Evansville men. The plant was constructed and equipped at considerable cost, but the plow was not successful and the plant was converted into an electric-light power house, from which the town has been receiving service ever since.

For the first time in Cleveland, it is said, electricity is to be used to do interlocking. A plant for this purpose is being built near the Newburg steel mills at the point where the Pennsylvania, the Wheeling and Lake Erie and the Newburg and South Shore lines converge. The improvement will cost about $100,000. The tower just completed will be equipped with 98 levers. Electricity will make it possible to interlock for a much greater distance than by means of the ordinary plant, where levers are moved by hand.

One feature of considerable interest in the construction of the Pennsylvania Railroad Company's tunnels under the East River at New York was the method employed in reducing "on the spot" the stone excavated from the tunnels to materials suitable for concrete by means of a complete rock-crushing plant installed at each end of the excavation. The Jamestown Exposition Company has found an opportunity of placing on exhibition in the Machinery and Transportation Building a crushing machine identical with one of those used by the Pennsylvania company in its famous work, namely, a No. 5 style K Gates breaker, built by Allis-Chalmers Company of Milwaukee.

TRADE NEWS.

The Overland Electric Company, incorporated with a capital stock of $100,000, proposes to manufacture car-heating devices and to establish a plant in Syracuse, N. Y. The patents secured by the company cover a device which, it is said, will heat a car in 15 minutes. It is a combination system of water and electricity. T. Arthur Whitaker, Albert H. Bremer, William F. Buck and George E. Meigs are the directors.

The Hite Electric Company of Philadelphia has been incorporated for $1,000,000 to deal in electrical supplies. The incorporators are F. R. Hansell, Philadelphia; George H. B. Martin and S. C. Seymour, Camden, N. J.

Fred. D. Tiffany, formerly connected with the Jamestown (N. Y.) Lighting and Power Company, and Norman Jones, at one time with the Hanson Electric Company of Jamestown, have formed a partnership under the name of Tiffany & Jones, to engage in the electrical contracting and engineering business in Jamestown.

At the directors' meeting of the General Electric Company on May 15th the need of new capital to provide for increasing business was provided for by the vote to issue approximately $13,000,000 of five per cent. 10-year convertible debenture bonds. The bonds are to be dated June 1, 1907, and will be convertible after June 1, 1911, into stock of the company at par. They will be redeemable at 105 after the same date upon 90 days' notice, subject, however, to the stockholder's right of conversion. Rights will accrue to shareholders of record on June 20th, and subscriptions will be closed on July 20th. The subscription price will be par and interest, and payments will be due one-half on July 20, 1907, and one-half on January 20, 1908, the stockholder having the privilege of making full payment on July 20th, whereupon bonds or negotiable receipts therefor will be delivered to him.

BUSINESS.

The Roper Lumber-Cedar Company of Menominee, Mich., is distributing colored souvenir postal cards giving a view of its Menominee yard, and also lead pencils bearing the company's name.

The Benjamin Electric Manufacturing Company of Chicago has moved its assembling room to the sixth floor of the building it occupies in order to enlarge its shop and office quarters. This was found necessary in order to meet the growing demands of the business. The shop capacity has been increased and new office furniture has been installed. A number of valuable devices are under way which will soon be placed upon the market.

In arranging for exhibits which would show the latest developments in modern industrial practice, whether on a large or small scale, the Jamestown Exposition Company found itself precluded both by the enormous size of the units and the fact that the builders are unable to turn them out fast enough to meet the present demand from obtaining a large gas engine such as the great steel companies of the country are now installing. In section 8, however, of the Machinery and Transportation Building, where Allis-Chalmers Company of Milwaukee has an exhibit, visitors to the exposition may see a photograph of one of these engines and will be put in the way of obtaining such information concerning them as they may desire.

Sales Manager C. R. Wood of the Moline (Ill.) Incandescent Lamp Company announces that Mr. D. W. Moor has just been appointed manager of the company's New York office, and that Mr. S. J. Stewart has just been made manager of the company's New Orleans office. Mr. Wood has only recently left Moline for an eastern trip, and the above-mentioned appointments were made while he was in the East. The Moline Incandescent Lamp Company, through Mr. Wood, has planned to bring from the Moline factory to the National electric-light convention a new type of incandescent lamp of a character that will show to lamp buyers that the company is strictly up-to-date, and, if anything, a little bit in advance, in so far as scientific improvement in incandescent-lamp manufacture goes. Mr. Wood received his advancement to the position of sales manager within the last few months. Since that time the company has shown by its increased output and satisfactory sales that the directors made no mistake in placing him in authority. Mr. Wood will be at the Washington convention prepared to present the new lamp for personal inspection and test.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 14, 1907.

853,216. Method of and Apparatus for Measuring Electric Currents. Otto T. Bláthy, Budapest, Austria-Hungary. Application filed August 10, 1905.

This method of approximating the effect of constant permeability of the field of a magnet having a core composed of magnetic material consists of varying the permeability of one portion of the core inversely to variations of permeability of other portions of the core by working the portions at different magnetic densities. The instrument comprises a rotatable portion, a magnetizing portion containing iron, and means for causing the field intensities produced by the latter to be proportional to the current over any desired range.

853,218. Electric Motor. William M. Bradshaw, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 1, 1905.

An alternating-current motor having shunt and series field coils, has separate cores for the coils, one of which has two aligned polar projections the end faces of which are in opposition, and a third polar projection that extends between and materially beyond the opposed projections from which it is separated by air gaps, and the other of which has two polar projections that are opposite the gaps in the first-named core. (See cut on next page.)

853,219. Terminal Block for Electrical Apparatus. William M. Bradshaw, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 28, 1906.

Combined with a pair of blocks having diverging openings and recesses between the openings, are two members each having diverging projections that extend respectively into the openings of different blocks, the projections being provided with clamping means that are accessible in the recesses in the blocks.

853,220. Electric Switch. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company, a corporation of Pennsylvania. Application filed February 20, 1905.

The device has stationary conducting parts, a number of movable conducting parts, independently movable carriers for the parts, and a common means for independ-

ently moving the carriers to establish or break the connections of the relatively movable and stationary conductive parts.

853,226. Alternating-current Electrical Apparatus. Frank Conrad, Edgewood Park, and William M. Bradshaw, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 27, 1904. Renewed January 26, 1905.

In an alternating-current motor, combined with shunt and series windings and a rotatable disk, are a core comprising a main polar projection for the shunt winding having its face adjacent to the disk, and projections parallel with the disk between which and the main projection there are air gaps. There are polar projections on the opposite side of the disk, the faces of which are adjacent to the disk and are respectively opposite the air gaps, the coils of the series winding being located thereon so as to produce a flux from one pole to the other.

853,231. Multiple Socket for Incandescent Lamps. Elias L. Elliott, New York, N. Y. Application filed May 18, 1906.

A socket for incandescent electric lamps comprises an insulating base carrying a contact piece for making electrical connection with each lamp, and an insulating body provided with a number of lamp-holding devices, the devices carrying means for detachably securing the base and body together.

853,238. Slack-adjuster for Electric Lamps. Harrison M. Groash, St. Louis, Mo.; Harry Troll, public administrator of Harrison M. Groash, deceased. Application filed October 10, 1905.

The device includes a vertically disposed shaft, a hollow drum arranged for rotation thereon, and a convolute spring on the interior of the drum.

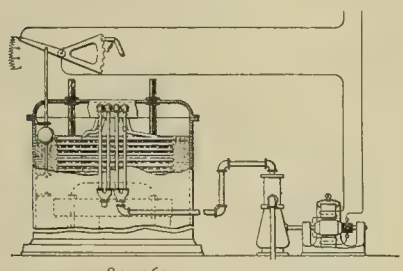
853,241. Step-by-step Electric Seam-welding Apparatus. Hugo Helberger, Munich, Germany. Application filed September 19, 1906.

The apparatus embodies electrodes having proximate work contacting faces located opposite to each other and forming positive and negative electrodes respectively. There are means for moving the electrodes toward and from each other and an intermittent work-feeding mechanism timed to feed the work between the electrodes when they are moved away from each other.

853,253. Means for Extinguishing Fires in Oil-filled Receptacles. Ralph D. Mershon, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 20, 1904.

Apparently referring to oil-insulated transformers, means are provided to replace the oil with water quickly if necessary.

853,263. Cooling System. Karl C. Randall, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 2, 1906.



NO. 853,263.—COOLING SYSTEM.

The system comprises a temperature indicator, pairs of contact terminals arranged to be electrically connected as predetermined temperatures are indicated, a fluid propeller, an electric driving motor therefor, and a voltage regulator for the motor. A number of electro-responsive devices determine the voltage applied to the motor and are energized as the indicating terminals are connected. (See cut.)

853,283. Commutator. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed March 10, 1904.

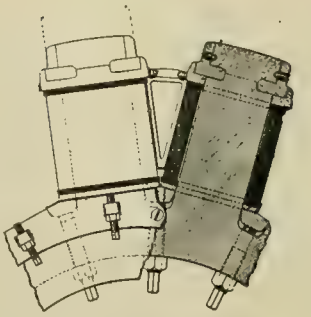
The commutator consists of like halves mounted side by side but separated from each other, commutator bars for each half and an integral shell for supporting each set of bars. There are thin plates of conductive material bridging the space between opposite bars and extending beyond the commutator surface, and longitudinal air passages through the shell communicating with the space between the bars.

853,285. Dynamo-electric Machine. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed September 5, 1905.

Combined with the rotatable part of a dynamo-electric machine are pole cores extending therefrom and integral therewith, the cores being of substantially uniform width, each core having a coil. There are keys engaging at the ends of each pole core for retaining the coil in position thereon and for resisting the centrifugal force of the coil as the frame rotates, the keys being shaped and arranged to form an effective magnetic part of the pole end and to increase the effective width of the pole face. (See cut.)

853,286. Telephone Trunking System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 1, 1902.

Combined with a trunk circuit extending between different switchboard sections and adapted to connect telephone lines together for conversation, are a guard signal for the incoming end of the trunk, a relay to place the signal in condition to operate and actuated by current sent over the trunk, and a relay actuated by current over a portion of the tip side of the talking circuit when connection is made with the called line for rendering the signal inoperative.



NO. 853,285.—DETAILS OF DYNAMO.

853,287. Supervisory Signaling System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed September 19, 1903.

In a telephone exchange system, combined with a telephone line extending from a sub-station to an exchange, are a line relay controlled by the line circuit, a local circuit at the central exchange controlled by the line relay, a signal in the local circuit, and main spring jack contacts at the central exchange connected with the telephone line. Means are provided for causing a supervisory relay to be connected with the source of current.

853,291. Telephone System. Garrison Babcock, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed July 17, 1903.

The system comprises a permanently continuous telephone line, a number of party subscribers connected with the line, and switching means at each sub-station whereby any subscriber may selectively connect himself with any other subscriber on the line independently of a central exchange operator.

853,292. Circuit-changing Apparatus. Jules A. Birsfield, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed March 22, 1905.

A relay provided with a core and a coil thereon has a rear pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of the front pole piece being shaped to offer a pivot edge, and an armature plate pivoted on the edge. There is switching mechanism for the relay serving to normally retain the armature away from the rear pole piece. Current flow through the coil causes attraction of the armature to actuate the switching mechanism.

853,296. Electric Fuse or Cut-out. Leonard B. Buchanan, Woburn, Mass. Application filed August 22, 1904.

An enclosed fuse is described.

853,301. Device for Controlling the Output of a Generator. Ethelbert T. Ford and William F. Bauer, St. Louis, Mo., assignors to the St. Louis Car Lighting Company, St. Louis, Mo. Application filed August 9, 1906.

The device comprises a generator, a number of contacts arranged in the field circuit of the generator, an electric machine which is supplied with current from the supply circuit of the generator, a device governed by the electric machine for varying the positions of the contacts relatively to each other, a carbon resistance, and means actuated by the electric machine for cutting more or less of the carbon resistance into the field circuit of the generator.

853,304. Telephone-exchange System. Arthur R. Kahl, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed January 31, 1906.

A central exchange has lines terminating in substations, a cord circuit at the central exchange for connecting subscribers for conversation, a source of ringing current at the central exchange, a relay for controlling the connection of the source with the cord circuit, and a second relay for controlling the circuit through the first relay, each of the relays directly controlling the continuity of the cord circuit.

853,305. Circuit-changing Apparatus. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 23, 1903.

Combined are a permanent U-shaped magnet, an armature adapted to swing between the poles thereof, means for polarizing the armature to cause its attraction by either of the magnet poles, and magnetic means for resisting the actuation of the armature in one direction.

853,309. Low-water Alarm. Clarence A. Lemen, Detroit, Mich. Application filed July 22, 1905.

In an electric low-water alarm combined with a water-jacketed steam pipe, are a bulb of a mercurial thermometer contained therein, wires blown in the glass of the thermometer connected with the electric circuit so that the expansion of the mercury closes the circuit and operates a signal device thereby, and compressible material contained in the casing fitting into the steam pipe and surrounding the bulb of the thermometer.

853,314. Combined Cigar Cutter and Lighter. Phil J. Nawn, St. Louis, Mo. Application filed March 12, 1906.

An electric spark ignites gas to provide the light.

853,322. Trolley Harp. Edward D. Rockwell, Bristol, Conn., assignor to the New Departure Manufacturing Company, Bristol, Conn. Application filed May 7, 1906.

Combined with a trolley harp having a chambered stem are a trolley-pole shank entered into the stem in which it is pivotally mounted, and formed with a spring recess, and a spring located in the recess and coacting with the chambered stem.

853,333. Coil Clamp for Rotary Magnets. Charles A. Backstrom, Milwaukee, Wis., assignor to the Backstrom-Smith Steam Turbine and Manufacturing Company, a corporation of Wisconsin. Application filed March 28, 1904.

In a rotary field magnet having polar projections partially covering the coils are a set of clamping members between adjacent coils, each having a wedge-shaped projection between a coil and the corresponding polar projection, wedges movably located between the clamping members, and means for actuating the wedges to separate the clamping members and press them in the direction of the coils.

853,337. Breast Transmitter. Jules A. Birsfield, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 13, 1905.

In a telephone transmitter are a front enclosing wall composed of two plates separated about their edges to form an annular groove, and a rear enclosing wall having its edge engaging in the groove.

853,340. Winding for Electromagnets. William M. Bradshaw, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 28, 1906.

The winding comprises a loop, a T-shaped piece one extremity of the body of which is joined to one side of the loop and the head of which is extended outwardly from the plane of and beyond the limit of the loop, and terminal pieces for the loop and the extension of the cross bar of the T-shaped piece.

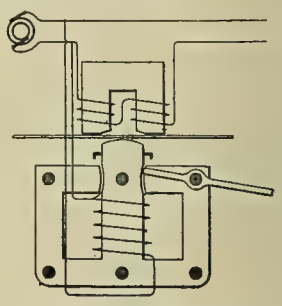
853,351. Electric Brazing Machine. Weston M. Fulton, Knoxville, Tenn., assignor to the Fulton Company, Knoxville, Tenn. Application filed August 11, 1905.

In an electric brazing machine are combined a pair of heating bars one movable and one fixed, heat-lagging clamp bars on one of which the fixed heating bar rests and a horn for supporting the clamp bar, a carriage movable in line with and under the heating bar, work-clamping jaws on the carriage, and operating means for the clamping jaws.

853,352. Portable Battery Lamp. Stephen W. Gibbs, Jr., Frankfort, Ky. Application filed June 5, 1906.

Details are described.

853,370. Spring-jack for Telephone Switchboards. Frank R. McBerty, Evanston, and Edward B. Craft, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed December 10, 1904.



NO. 853,218.—ELECTRIC MOTOR.

A sheet-metal blank for a spring-jack test thimble and connecting strip, consists of a front portion adapted to be rolled to form the tube. There is a rear portion adapted to serve as a connector, and two arms joining the front and rear portions, the arms branching from the front portion at a diverging angle and recurving to join the rear portion.

853,373. Registering System for Telephone Exchanges. Arthur R. Pollock, Piqua, Ohio. Application filed August 29, 1906.

The apparatus comprises in combination, a motor for moving a record-receiving device and a time mechanism for controlling the movement of the record-receiving device by the motor. There are means for controlling the operation of the time mechanism, the means being operative by the use of a subscriber's telephone to put the time mechanism into operation and by the operator at the exchange to put the time mechanism out of operation.

853,374. System of Distribution. Karl C. Randall, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 2, 1906.

In a system of alternating-current distribution are star-connected transformer primary coils and star-connected transformer secondary coils, and means for maintaining a substantially balanced voltage between the outgoing circuits that comprises auxiliary delta-connected coils.

853,375. Cooling and Ventilating System. Karl C. Randall, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 2, 1906.

Combined with transformers for electric energy and an electric motor-driven fluid circulator for cooling the transformer are means for automatically regulating the speed of the electric motor in accordance with the amount of energy delivered from the transformers.

853,389. Telephone Calling or Signaling Device. Klas Weman, Buffalo, N. Y. Application filed December 20, 1905.

The device comprises a core carrying two helices, a soft iron bar having an arm extending parallel over one helix, and a permanent magnet armature lying over the other helix and engaging the arm. Means are provided for regulating the intimacy of contact between the armature and arm, the means comprising a bracket supporting a jointed rod secured to the armature, and a helical spring surrounding a portion of the rod.

853,403. Electric Block System for Railways. Walter R. Fuller, Atlanta, Ga. Application filed January 19, 1907.

In a block system for railways are sectional conductors extending throughout the length of a block, a source of current upon each train for energizing the conductors, and signal indicating devices at the junction of the blocks in circuit with the conductors and indicating danger to the next block and safety to the occupied block.

853,425. Electric Igniter for Explosion Motors. Wilhelm Sander, Zurich, Switzerland. Application filed July 2, 1904.

The igniter described comprises a metallic plug, a concentric annular electrode surrounded by the plug and separated therefrom by a concentric annular space, a central electrode disposed within the concentric annular electrode and out of contact therewith, and a terminal disk for the central electrode.

853,444. Hanger for Incandescent Lamps. Maximillian J. Diemmer, Augusta, Ga. Application filed February 26, 1906.

Means for yieldably supporting a stationary contact in engagement with a movable contact are described.

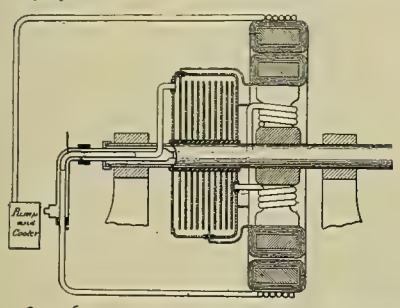
853,453. Trolley Retriever. Madison F. Hodge, Leavenworth, Kan., assignor of one-half to Herbert W. Wolcott, Leavenworth, Kan. Application filed December 18, 1905.

Details are described.

853,464. Commutating Electric Motor. Ralph D. Mershon, New York, N. Y. Application filed February 15, 1904.

A motor having stationary and moving elements has means for producing a desired distribution of magnetic flux in one of the elements by feeding the current or currents thereto at a number of points per pole, means for short-circuiting the winding or windings of the other element, and means for varying the number of poles in the primary element.

853,465. Induction Motor and Generator. Ralph D. Mershon, New York, N. Y. Application filed May 28, 1906.



NO. 853,465.—INDUCTION MOTOR AND GENERATOR.

In an alternating-current machine of the induction type are combined a primary element, a rotating secondary element, a shaft therefore and a number of condenser plates or electrodes rotating with the shaft and connected with the secondary winding or windings. A casing enclosing the plates is adapted to contain an electrolyte. Means are provided for circulating the electrolyte through the casing. (See cut.)

853,475. Electromagnetic Machine or Concentrator. John H. Ryan, Portland, Ore., assignor of one-third to O. B. Stubbs and one-third to Charles N. Ryan, Portland, Ore. Application filed July 14, 1904.

In a magnetic separator are a revolving shell having a smooth outer surface, a fixed magnet comprising a winding exterior to the shell and a cylindrical pole piece within the shell and arranged to produce a magnetic field substantially concentric thereto, and a scraper bearing on the shell.

853,477. Fan. Otto Selg, New York, N. Y. Application filed January 31, 1907.

The fan is provided with a corrugated air-distributing screen having openings, and projections at the sides of such openings.

853,491. Single-phase Alternating-current Motor with Commutating Poles. Engelbert Arnold, Karlsruhe, Germany, and Jens Lassen La Cour, Edinburgh, Scotland. Application filed October 9, 1905.

A single-phase alternating-current motor with a starting resistance and with a compensating winding lying in slots in the main poles and having the same ampere turns as the portion of the armature winding under these poles, has commutating poles carrying two windings, one being in series and the other shunt excited, being connected in parallel to the armature and starting resistance.

853,492. Process and Device for Controlling Electric Circuits. Heinrich Beck, Meiningen, Germany. Application filed January 27, 1906.

An electric regulating resistance for apparatus circuits has a resistance wire of material with a high coefficient of temperature. The wire is stretched out in a tube, the tube, which is made of metal, being thin-walled and blackened on the inside and outside. It is evacuated or filled with indifferent gases. Means are provided for keeping the wire in a stretched condition.

853,504. Regulating Valve. Arthur H. Eddy, Windsor, Conn., assignor of one-half to Charles E. Shepard, Hartford, Conn. Application filed January 6, 1906.

A thermostatic fluid regulator has an electrical contact carried by a lever, the lever being adapted to be moved by the expansion of a hollow diaphragm, and electrical contacts adapted to be engaged by the lever contact at predetermined degrees of expansion of the diaphragm.

853,521. Electrode. James H. Robertson, Arlington, N. J., assignor of one-half to John C. Klatzl, New York, N. Y. Application filed July 24, 1906.

An electrode for medical batteries is composed of a pair of flexible contacts divided longitudinally into narrow separate fingers, and means for automatically adjusting the contacts.

853,522. Cable-reel Apparatus for Mining Locomotives. Harry W. Shaver, Pocahontas, Va., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 7, 1906.

The flexible conductor is wound up by an electric motor.

853,550. Electric Machine. Coloman de Kando, Budapest, Austria-Hungary. Application filed December 13, 1906.

The machine described has a winding arranged in the grooves of the stator, portions of the winding projecting at the faces of the stator, and means forming circular casings including the projecting parts of the windings. A solid insulating mass is adapted to melt when the winding is heated above the normal point in the circular casing embedding the projecting parts of the windings. There are means allowing free escape of the mass when melted from the circular casings and suitable charging openings at the highest part of the circular casings.

853,552. Electric Tool. Otis A. Kenyon, New York, N. Y. Application filed October 23, 1906.

The appliance has a reciprocating part, a solenoid, means carried by the part for momentarily breaking the circuit of the solenoid, and additional means for breaking the circuit of the solenoid during the entire period of the return stroke of the reciprocating part.

853,556. Telegraph Transmitter. Charles W. Leiser, Salt Lake City, Utah. Application filed February 15, 1906.

A transmitter having an electric battery is provided with a flexible lever operated by electromagnets, an armature on the lever and sliding spring contacts, a vibration arrester formed of a support having a vertical recess, a cross pin in the recess and a ring loosely hung on the cross pin, a circuit break, a pair of operating keys and suitable connections.

853,578. Telephone Receiver. Abner F. H. Davis, Oakland, Cal., assignor to the National Telegraphone Company, Rochester, N. Y. Application filed November 23, 1905.

The receiver has a diaphragm formed of suitable nonmagnetic material, an exciting electromagnet with its poles positioned adjacent thereto, and a magnetic bridge-piece disposed beyond one side of the diaphragm opposite the poles of the electromagnet and in position to close the lines of magnetic force therefrom.

853,579. Alarm Signal. Ellsworth E. Flora, Chicago, Ill., assignor to the Zorge Safety Railway Equipment Company, Chicago, Ill. Application filed March 8, 1906.

In combination with a railway track having a movable switch point are a torpedo carrier, potential means for actuating the carrier and an electromagnet controlling the movement of the torpedo carrier. An electric circuit or circuits are provided for the magnet having a make-and-break device controlled with relation to the movement of the switch point and having also a train-controlled electric switch.

853,585. Controlling Device for Electrically Driven Machinery. Frederic O. Hunt, Darlington, England. Application filed February 28, 1906.

In an electric device for regulating a brake and connected in the circuit supplying the current to the electric motor, the contact maker of a rheostat magneto-electrically controlled by the amount of current required to move the load is designed to include a requisite resistance in the armature circuit during the period of applying the brake for the purpose of making the dynamic action of the motor, when stopping, a minimum or a maximum to suit requirements.

853,588. Door-releasing Mechanism. Edward Kauntze, Hanford, Cal. Application filed July 11, 1906.

The apparatus includes a destructible cord by which a weight is normally suspended, an electrically heated part by which the cord is maintained in contact, and means for completing an electric circuit whereby the heating of the part destroys the cord and releases the weight.

853,618. Circuit-closing Device. Rollin A. Baldwin, New Haven, Conn., assignor to the Baldwin & Rowland Switch and Signal Company, a corporation of Connecticut. Application filed July 19, 1906.

The device comprises a series of spring blades supported to depend adjacent to the trolley wheel, a resilient strip fastened to the blades and lying in the path of the trolley wheel of a car, a magnet and means operated thereby, and a circuit to ground including the magnet and leading from the strip.

853,645. Vibratory Apparatus for Ear Treatment. Eugene Meyer, New York, N. Y. Application filed December 24, 1906.

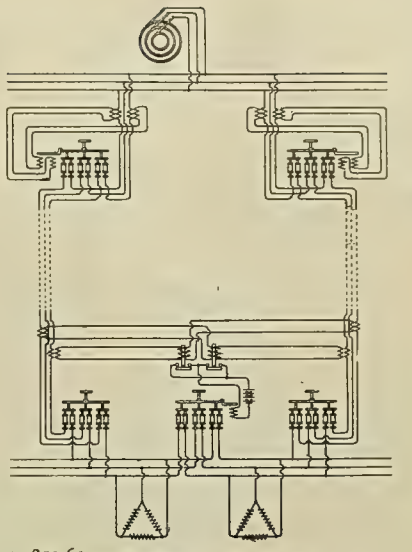
The apparatus comprises an air chamber, a diaphragm therein, means for vibrating the diaphragm consisting of a vibratory hammer lever provided with an armature actuated by electromagnetism, and means for transmitting resultant vibrations of air to a patient.

853,648. Electric Clock. Timothy B. Powers, New York, N. Y., assignor to Kutnow Bros., New York, N. Y. Application filed May 12, 1906.

In combination are a single-core electromagnet mounted to oscillate upon an adverse axis between its poles, a stationary armature located in proximity to the path of a pole of the magnet and circuit connections and contracts whereby the magnet is momentarily energized to add an impulse to the oscillation of a rotary balance wheel as a pole of the magnet approaches the armature.

853,655. Protective Means for Parallel Feeders. Charles W. Stone, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

The means described for parallel feeders include bus-bars at the receiving station, switches for connecting each set of feeders to the bus-bars, a switch for opening the circuit of the bus-bars between the first switches, a trip coil for the last switch, series transformers having their primaries in circuit with the feeders, and a differential relay energized from the secondaries of the transformers and controlling the circuit of the trip coil. (See cut.)



NO. 853,655.—PROTECTIVE MEANS FOR PARALLEL FEEDERS.

853,672. Holder for the Receiver of a Telephone. William A. Beavan, Philadelphia, Pa. Application filed December 28, 1906.

Details are described.

853,678. Vapor Electric Apparatus. William R. Burrows, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 7, 1905.

Combined with an evacuated chamber are a lead wire sealed in the wall therof and an electrode mounted on the lead wire, the electrode completely inclosing the end of the lead wire and provided with grooves to increase its superficial area.

853,682. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 28, 1902.

Combined with a trunk line are a cord circuit to connect with its outgoing end and a called subscriber's line having only two wires extending throughout the multiple switchboard with which its incoming end is connected, a disconnect signal for the incoming end placed in condition to operate by current flowing over a portion of the talkng circuit when the trunk is connected with the called line, and means depending upon the connection of the cord with the trunk to prevent the actuation of the signal during such latter connection.

853,688. Electric Controlling Switch. Wilhelm Gminder, New York, N. Y. Application filed August 26, 1905.

The switch comprises air boxes, each having expansible diaphragms, thermo-electric means in proximity to the boxes for expanding the air therein, a lever mechanism adapted to be actuated by the diaphragms, a switch device actuated by the lever mechanism and adapted to actuate a motor or other device, a source of electricity, and conductors connected therewith with the thermo-electric means. A switch is interposed in the conductors at a point distant from the thermo-electric means for connecting the same with the source of electricity and a signal lamp in proximity to the switch.

853,694. Electrical Sadiron Heater. Charles Van Dyke Hill, St. Louis, Mo. Application filed September 15, 1906.

An electrical heater adapted to have an ordinary sadiron mounted thereon, has clamping means for securing the sadiron to the heater.

853,703. Motor Drive. William F. Lautenschlager, Cincinnati, Ohio. Application filed March 2, 1907.

In a motor drive for an electric motor, combined with a plate, are an operating lever, a tightener pulley therefor, electric contacts the making and breaking being effected by the lever, terminals for a source of electric energy, electric connections between the terminals and the motor terminals and electric contacts arranged in rear of the plate.

853,710. Electrical Advertising Clock. John H. Melchers, Decatur, Ill. Application filed June 28, 1906.

Details are described.

853,711. Motor Control. Wilbur L. Merrill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 15, 1906.

In combination with a load to be driven are two electric motors of different capacities, low-speed gearing between the smaller motor and the load, high-speed gearing between the larger motor and the load, a constant-potential supply circuit, means for deriving from the circuit two independent variable voltages for the respective motors, and a single switch controlling the voltage supply to both motors.

853,736. Circuit-closing Device for Burglar-alarm Systems. William H. Robins, Minneapolis, Minn., assignor to the American Bank Protection Company, Minneapolis, Minn. Application filed December 6, 1905.

In combination with an alarm circuit having a gong are a shield enclosing the gong, a circuit closer arranged in the lower part of the shield and having a suitable receptacle, the circuit closer being connected with the alarm circuit and arranged when actuated to close the same, the inner walls of the shield being arranged to direct sand or foreign material deposited in the shield into the receptacle.

853,743. Insulating Device. Louis Steinberger, New York, N. Y. Application filed March 29, 1906.

The device comprises a body of insulating material having complete [illegible] of [illegible] thereby a strengthening member built up of a number of members arranged one within the other.

853,744. High-tension Insulator. Louis Steinberger, New York, N. Y. Application filed March 28, 1906.

The insulator includes a body portion of insulating material provided with ribs extending radially therefrom, a skirt mounted upon the ribs and integral therewith, and a hood supported over the body portion and provided with surface engaging the supporting ribs.

853,745. Horizontal Support for Conductors. Louis Steinberger, New York, N. Y. Application filed December 10, 1906.

An insulator comprises a longitudinal saddle-like metallic member and a body of insulating material disposed exteriorly of the metallic member, the metallic member having portions for engagement with a fastening.

853,755. Apparatus for Transmitting to a Distance Real Optical Images. Edouard Belin, Paris, France. Application filed July 10, 1905.

A system of transmitting to a distance real optical images comprises a receiving station having a recording apparatus, the apparatus including a band and means for forming perforations of variable diameter in the recording band by means of electric sparks, a secondary circuit having an induction coil excited by the current serving the receiving station for producing the sparks, and a collector or multiple commutator in the station being arranged in the secondary circuit.

853,765. Operating Bulkhead Doors. Arthur A. Buck, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 20, 1904.

In combination are a switch, an operating handle therefor, yielding means for maintaining the switch normally in its off position, a distant control system comprising electromagnetically actuated means for shifting the point to which the switch tends to return when the operating handle is released, and a switch at a distant point for controlling the circuit of the electromagnet.

853,778. Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1906.

A transformer having a winding comprises a number of independent coils connected in series, the central coil or coils being provided with regulating leads whereby a portion of the central coils may be cut out of circuit.

853,779. Three-phase Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 19, 1906.

A three-phase transformer of the "shell" type comprises a magnetic core, three windings arranged in apertures in the core, one winding having its axis perpendicular to the line joining the centers of the other windings, and a casing of circular cross section adapted to contain the core.

853,780. Switch-controlling Mechanism. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1906.

Combined are a dynamo-electric machine, an end play device therefor, conductors for connecting the machine in circuit, and means operated by the windage of the machine for causing energy to be supplied to the device from the conductors.

853,784. Resistance Unit. Harry E. Heath, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 22, 1906.

The resistance unit consists of a sheet of insulating material having a resistance conductor mounted thereon and secured thereto by projecting loops through the sheet and bending the conductor to prevent its return.

853,789. Mercury Meter. Frank Holden, London, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 24, 1906.

A mercury meter comprises a narrow mercury chamber enclosed by a magnetic field, current leads to and from the mercury, a duct for leading the mercury to and from the chamber, a register, and a reversing switch actuated by reversal of mercury flow operating the register.

853,790. Electric Measuring Instrument. Frank Holden, London, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed December 14, 1906.

The instrument embraces means for producing a magnetic field, a narrow chamber containing mercury located in the field, a reservoir, a tube connecting the reservoir and chamber, a gauge tube rising from the chamber, conductors entering the chamber, and a by-pass of small bore around the chamber for permitting circulation of the mercury.

853,791. Door-lock Electric Switch. William E. Hughes, Seattle, Wash. Application filed July 17, 1906.

Spaced contacts are mounted within the frame of the switch. A second switch is pivoted upon the frame and is adapted to engage the contacts.

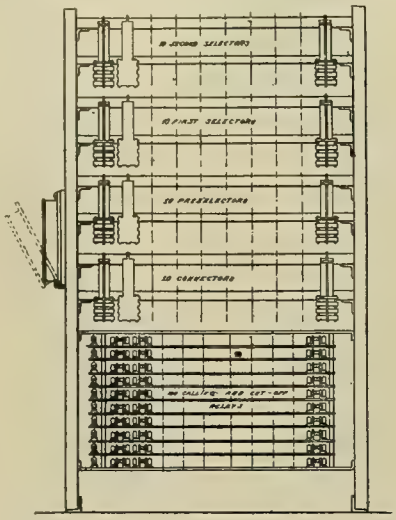
853,806. Electric Pump. Walter Lambert, Sunnyside, Wash. Application filed October 3, 1906.

The pump comprises a casing, a pair of solenoids mounted therein and in alignment with each other, a core of magnetic material concentric to the solenoids, and a slide rod connected with the core and adapted to reciprocate when actuated thereby. Collars encircle the core and are provided with portions engaging the slide rod. There are means for adjusting the last-mentioned portions relatively to the slide rod for the purpose of controlling the relative positions of the collars. Contact mechanism is connected with the solenoids for the purpose of energizing the same, the mechanism being provided with a movable member disposed within the path of the collars.

853,815. Railroad Rail. William G. MacLaughlin, Walkerville, Ontario, Canada. Application filed June 23, 1906.

The rail comprises a base section formed with supporting members which are provided with longitudinal grooves on their inner surfaces adapted to receive electrical conductors. A tread section is formed with a depending longitudinal web adapted to hold the conductors in the grooves mentioned.

853,818. Automatic Telephone System. Friedrich Merk, Berlin, Germany. Application filed January 2, 1907.



NO. 853,818.—AUTOMATIC TELEPHONE SYSTEM.

The system includes in combination with the subscribers' lines divided in groups, a number of preselectors and first selectors for each line group, each preselector comprising line contacts connected to the subscribers' lines of the group, a traveling contact device and means for moving the contact device to cause it to make contact with the line contacts, each first selector comprising line contacts. Trunk lines are connected in multiple to the line contacts of the first selectors. Means are connected with the trunk lines and arranged to make the final connection over the selected trunk line to the desired subscriber. (See cut.)

853,820. System of Motor Control. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 25, 1905.

Combined with a motor are an electromagnetic switch controlling the armature circuit thereof, a pushbutton controlling the switch, a shunt around the button, and a switch controlling the shunt and actuated by the motor, a circuit breaker for the armature circuit, and a limit switch actuated by the motor and controlling the circuit breaker.

853,826. Fire-alarm or Temperature Indicator. Micajah L. Poulter, Stockport, Iowa. Application filed June 4, 1906.

Combined are a hollow body containing an expansible medium, a needle, means arranged between the body and needle for actuating the latter by variations in volume of the medium, and an electric signal device controlled by the needle, the device comprising strips of insulating material spaced apart on the body to form a pocket to receive the free end of the needle, means for securing the strips directly to the body, and a contact piece arranged between the strips.

853,829. Therapeutic and Other Electric Lamps. Charles M. Robinson, New York, N. Y. Application filed February 18, 1907.

An electric lamp is provided with a reflector and a coupling, the latter being adapted to receive the lamp socket. A gasket or washer of non-conducting material is interposed between the coupling and the reflector.

853,838. Current Collector. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1906.

Combined with a suspended conductor and a current collector for electric vehicles, are a retractor for the collector, means controlled by the movement of the collector out of its normal working position for actuating the retractor, and means disposed at desired intervals upon the conductor for moving the collector out of its working position.

853,843. Transformer. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 21, 1906.

The transformer described has a magnetic core having a number of parallel legs, a winding surrounding each leg, cooling pipes extending parallel with the winding axes between the windings and the core, and hollow end-plates for the core forming connections between pipes on different legs.

853,855. Desk Telephone and Switching Mechanism. Albert K. Andriano, San Francisco, Cal., assignor to the Direct-Line General Telephone Company, San Francisco, Cal. Application filed July 22, 1905.

The apparatus embraces a case, a circle of switching contacts therein, a transmitter rotatably mounted in the case, having a hub coincident with the center of the circle of contacts, and provided with a member forming a movable contact piece to the switching contacts.

853,871. Electric Lamp Hanger. Adam S. Elliot, Peterborough, Ontario, Canada, assignor of one-half to Charles Smith Botsford, Peterborough, Canada. Application filed April 14, 1906.

A suspending cord is attached to a spring-actuated drum, and conductors upon an insulating head on one end of the drum connect the wires of the cord with the circuit connections.

853,877. Battery Element. Olin F. Harvey, Wilkesbarre, Pa. Application filed August 11, 1905.

The element consists in part of a series of blocks of active material arranged one above the other and a flexible conducting strip in contact with each block.

853,886. Safety Device for Railways. Otto F. Kloetzer and William A. Borders, Washington, Ind., assignors of one-third to Charles G. Gardiner, Washington, Ind. Application filed November 9, 1906.

The appliance comprises track rails divided into blocks, sectional conductor rails divided into blocks and connected to the track rails of adjacent blocks. Means are carried by the train for delivering an electric current to the conductor rails and receiving a current from the track rails.

853,888. System for Electrical Distribution. Richard C. Leake, Auburn, N. Y., assignor of one-half to Dwight J. Strickland, Auburn, N. Y. Application filed October 6, 1905.

The system includes a number of electric working circuits, electrically controlled means for closing each of the circuits separately, an electric-circuit closer controlling the action of the means, and additional means to retard the action of the first-named means under comparatively short current impulses, and to permit its action under prolonged closing of the circuit.

853,891. Electric Resistance Element. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed January 17, 1907.

The element consists of a metal alloy of vanadium in the proportion of less than 20 per cent of the element and nickel in the proportion of more than 80 per cent of the element.

853,892. Electric Water Heater. Edward C. Miles, Denver, Colo. Application filed February 11, 1907.

The heater comprises a casing, an insulating diaphragm inserted in the casing, and a series of coils mounted on the diaphragm, the coils being connected in series, and a source of electricity with which the coils are connected, the reservoir being provided with inlet and outlet conduits.

853,899. Lamp Trimming. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 6, 1904.

Combined are an electric lamp globe or bulb, a zonular reflector through the opening in which the neck of the bulb is passed, and resilient means for pressing the reflector against the globe.

853,922. Switch. George Gilmore, Alliance, Ohio, assignor to the Electric Filter Company, Alliance, Ohio. Applicaton filed September 18, 1905. Renewed March 15, 1907.

The mechanism embraces a number of series of stationary contact members mounted upon a post, which is affixed to the base of the switch, electrical conductors in communication with the contact members of the several series, and insulation interposed between each contact member.

853,929. Wireless Telegraphy. Walter W. Massie, Providence, R. I. Application filed November 4, 1905.

The system comprises a wave-frequency oscillatory receiving circuit including inductance and capacity adjustable for tuning the circuit, the inductance consisting of a magnetic-detector coil, and the resistance, inductance and capacity of the circuit being constant when the same is tuned.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on May 20, 1907:

428,066. Arc Lamp. C. P. Breese, New York, N. Y.
428,071. Insulator for Electric-railway Wires. H. P. Brown, New York, N. Y.
428,072. Trolley System for Electric Railways. H. P. Brown, New York, N. Y.
428,073. Commutator Brush for Dynamos. L. Van Brown, Asheville, N. C.
428,084. Electric Meter. A. Frager, Paris, France.
428,087. Process of Electro Deposition. D. Garrett, Kansas City, Kan.
428,095. Electric-signal Circuit. O. W. Hart, Fall River, Mass.
428,098. Electric Railway. R. M. Hunter, Philadelphia, Pa.
428,116. Galvanic Battery. A. J. MacDonald, North Tiverton, R. I.
428,136. Trolley-arm Support for Electric Railways. F. B. Rae, Detroit, Mich.
428,169. Electric Motor Regulator. W. H. Knight, New York, N. Y.
428,174. Telephone. J. C. Ludwig, San Francisco, Cal.
428,189. Three-wire Multiple Switchboard System. E. P. Warner, Chicago, Ill.
428,210 and 428,211. Electric Railway. R. M. Hunter, Philadelphia, Pa.
428,221. Synchronous Multiplex Telegraphy. F. J. Patten, New York, N. Y.
428,222. Multiplex Telegraph. F. J. Patten, New York, N. Y.
428,223. Multiplex Telegraphy. F. J. Patten, New York, N. Y.
428,224, 428,225 and 428,226. Synchrouous Multiplex Telegraphy. F. J. Patten, New York, N. Y.
428,280. Electric Meter. J. F. Mehren, Chicago, Ill.
428,289. Armature for Dynamos, Etc. A. Schmid, Allegheny, Pa.
428,290. Electric Meter. E. W. Von Siemens, Berlin, Germany.
428,317. Regulator for Electric-current Generators. G. Pfannkuche, Cleveland, Ohio.
428,378. Electric Furnace for Melting Metals. E. A. Colby, New Haven, Conn.
428,379. Electric Induction Device. E. A. Colby, New Haven, Conn.
428,380. Dynamo-electric Machine or Electric Motor. E. Croasdale, Philadelphia, Pa.
428,562. Electric Communication with Railway Trains. T. J. Houck, Baltimore, Md.
428,574. Electrical Converter. W. Stanley, Jr., Great Barrington, Mass.
428,575. Method of Building Electrical Converters. Wm. Stanley, Jr., Great Barrington, Mass.

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Electric Light and Power in the Nation's Capital.

By Waldon Fawcett.

DELEGATES and visitors in attendance at this year's convention of the National Electric Light Association will have an opportunity to inspect and study electrical plants and equipments that possess many feature of interest. Naturally, the city of Washington, being a community which in neither population nor business interests can be classed with the largest American cities, is not possessed of electrical installations notable by reason of maximum size or record-breaking investment, but as the capital of the nation and a municipality unique in many respects it has been the scene of a development along electrical lines that is significant and full of suggestion for the practical man ever alert for new ideas that may be adopted to the solution of his own individual problems.

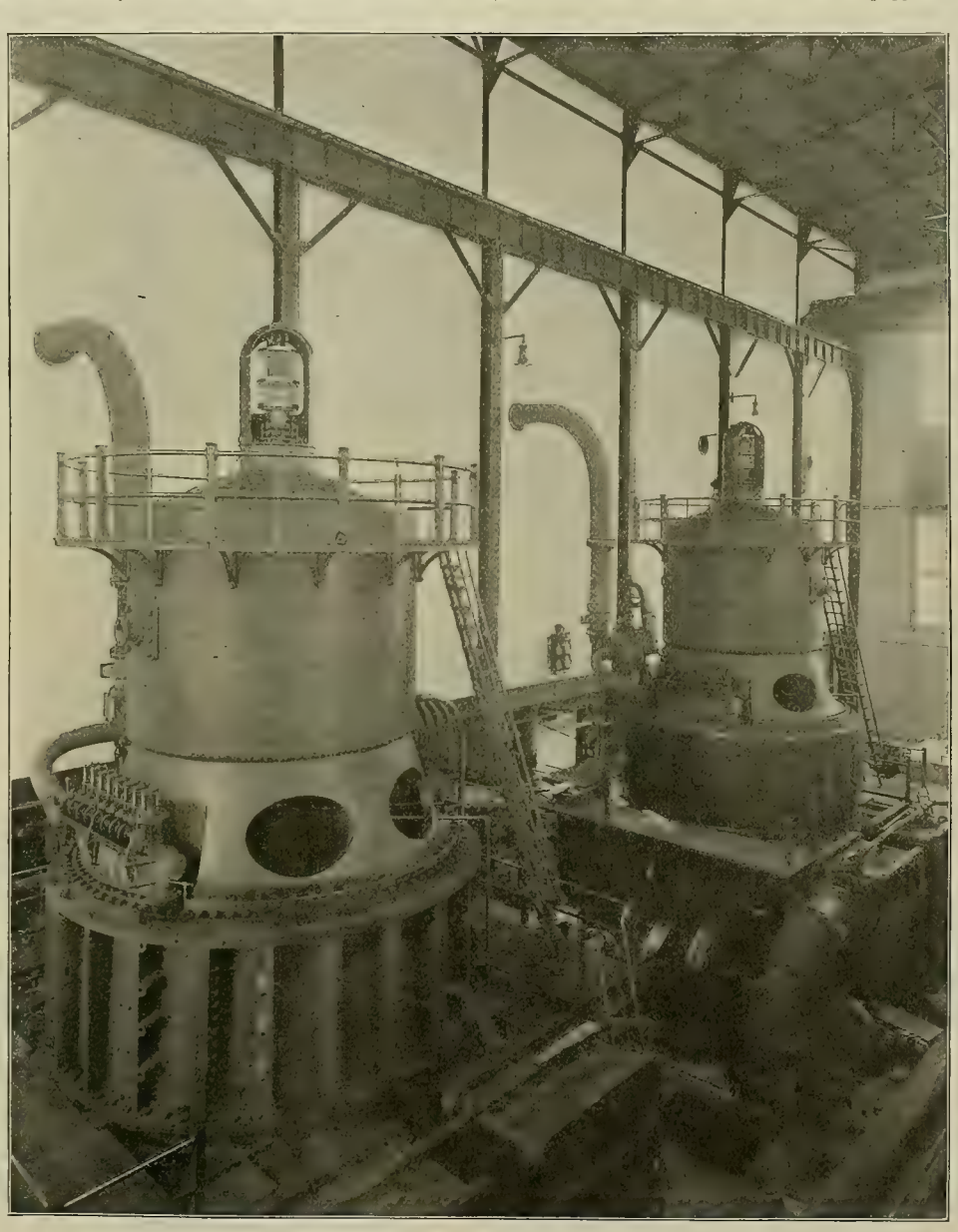
Central Stations.

The chief electrical interest in the city on the Potomac is that embraced in the enterprises of the Washington Railway and Electric Company, a $13,000,000 corporation, operating 11 city and suburban railways and a light and power company, the latter designated as the Potomac Electric Power Company. At the corner of Fourteenth and B streets, N. W., adjacent to the business center of the city and little more than a stone's throw from the New Willard Hotel, the meeting place of the convention, is located the red-brick building which for the last eight years has served as the central station of this company.

This downtown plant, however, is on the eve of being supplanted as the chief source of electrical energy by a new power house now nearing completion on the outskirts of the city, and of which more will be said later in the article. No immediate abandonment of the centrally located station is proposed, although a portion of its equipment is being transferred to the new outlying institution. Rather has the new turbo-generator plant has been provided to meet an increasing demand for power and, incidentally, to provide the company with an adequate source of current in the event that the exigencies of the future compel an abandonment of the old central station at comparatively short notice.

In order that the reader may appreciate the uncertainties as to the future which impelled the company to give this exemplification of far-sightedness it may be pointed out that the old power house is located in a strip of territory lying between Pennsylvania Avenue and the Mall (the park extending from the White House to the United States Capitol). The Mall is already occupied by a number of government buildings, and it is obvious that the whole territory between this park and Pennsylvania Avenue will ultimately be required for governmental structures. Indeed a bill appropriating $10,000,000 for its purchase passed one house of Congress at its last session. In the face of these conditions the light and power company officials are simply killing two birds with one stone in hastening the completion of their new plant.

The central station at Fourteenth and B streets is to continue in operation, as above intimated, minus of course the two 2,000-kilowatt Curtis turbines which have been removed to the new institution which is exclusively a steam-turbine plant. One of these 2,000-kilowatt turbines, it may be noted in passing, is the unit that was exhibited by the General Electric Company at the World's Fair at St. Louis.



TWO 5,000-KILOWATT TURBO-ALTERNATORS IN NEW BENNINGS STATION OF WASHINGTON RAILWAY AND ELECTRIC COMPANY.

Old Power-plant Equipment.

Without these turbines the aggregate capacity of the old power plant is 6,000 kilowatts. The equipment of the power house includes eight McIntosh & Seymour engines. Engine No. 1 is of 1,200 horsepower, with 480 kilowatts generator capacity direct on its shaft and also driving by belt an arc machine and an alternator. Engines No. 2 and No. 3 are each direct-connected to 480-kilowatt generators, direct current, 110 volts. Engine No. 4 is similar to No. 1 and drives a 960-kilowatt generator. Engine No. 5 is coupled to a 600-kilowatt generator and also operates a 250-volt generator feeding into the Edison three-wire system. Engines Nos. 6, 7 and 8 drive railway generators, respectively, of 500, 800 and 500 kilowatts capacity.

The boiler plant at the old power house consists of 15 450-horsepower boilers, while six are of 300 horsepower each, a total of 21 boilers, all of the Babock & Wilcox type, and working at 180 pounds pressure. Thirteen boilers in this installation are fitted with Hawley down-draft furnaces and eight of them are equipped with Roney stokers.

The general offices of the Potomac Electric Power Company are located in a building adjoining the power house at Fourteenth and B streets, and visitors to the plant may thus, with a minimum expenditure of time, also visit the clerical departments in order to gain an insight into accounting methods and other office practice.

Load Factor.

As has been mentioned, there are some unique features in connection with electric-light and power practice in Washington. One of these is the circumstance that Washington possesses a better load factor than most cities, particularly during the interval between 1 a. m. and 7 a. m. That the load is proportionately larger than in most other cities at this time will be appreciated when it is explained that the Washington plant carries 2,000 kilowatts during the period mentioned.

However, the most interesting feature in the Washington electrical field just now is the new power plant which has been constructed at an expense of about $1,500,000 at Bennings, Md., just over the boundary line from the District of Columbia.

The New Power Station at Bennings.

First of all, this new station is of exceptional interest in its housing, being installed in a structure which represents an extensive use of concrete blocks (in contrast to solid reinforced concrete). The machinery of the plant is interesting as being particularly up-to-date, and finally emphasis must be placed on the achievement from an economic viewpoint.

In the matter of economy of space it may be explained that the plant, with an aggregate area of 29,520 square feet, will produce when in full operation a normal output of 19,000 kilowatts—that is, at the rate of only 1.52 square feet per kilowatt.

It may also be hinted that future disclosures will prove that this new plant can boast the lowest cost per kilowatt of any in the United States. However, General Superintendent L. E. Sinclair is not yet ready to give out any definite figures on this point, and consequently prefers to make no statement for the time being, fearing that in the absence of detailed data any unsupported declaration as to low cost might imply that the plant had been slighted in construction cost in order to attain it.

The new power plant at Bennings is confined in

its operations to the generation of alternating current to be transmitted through comparatively small mains and transformed at any or all of 14 substations now building or in commission. As already made clear, the station is designed to supplement present facilities rather than to supplant existing equipment.

The new power house is in reality three buildings in one, the semblance of individuality being preserved in the exterior architecture as well as in the interior arrangement.

Down Town (Fourteenth Street) Power House.

New Power House at Bennings, Maryland.

GENERATING PLANTS OF THE WASHINGTON RAILWAY AND ELECTRIC COMPANY.

The boiler room is 164 by 180 feet in size, the generating room has dimensions of 164 by 45 feet and a height of 70 feet, and the three-story annex for switching compartments, offices, etc., is 164 by 15 feet. Withal the structure, although severely simple in outline, is pleasing in appearance, the windows being set in panels and the walls finished by a neat corbelled cornice.

Piling and Foundations.

The power house is located on the bank of the eastern branch of the Potomac River, and whereas this has proved an advantage in that it has permitted the use of the river as a source of supply for condensing water, it is on the other hand indirectly responsible for a condition of soil at this site that made it necessary for the builders to drive piles in order to insure proper footings for the engine room, walls, columns, etc.

Concrete piles of the Raymond type, varying in length from 30 to 40 feet, were employed. The turbine foundations, owing to the depth, did not require piling. It is of interest to note that the condensing water conduits—the intake and discharge tunnels each having an area of 40 square feet—are incorporated in and run directly through the lower turbine foundations. These foundations were built in accordance with specifications calling for a bearing power of 1.8 tons per square foot of soil and old rails were imbedded in the concrete as an added safeguard against uneven settlement between the different turbines. Something of the solidity of construction in the whole power structure is indicated by the fact that 800 tons of structural steel and more than 100,000 cubic feet of concrete blocks were embodied in the building

The Concrete Construction

The use of concrete blocks in a building of this character would seem to be commendable solely on the score of avoiding that monotony of appearance that so often characterizes solid concrete in wide expanses. However, there are yet more important arguments in its favor. For one thing the block construction obviates the hair cracks which so frequently mar extensive expanses in monolithic buildings, and then, too, it saves the cost of the "form work" necessary for solid concrete walls and which would be very expensive in the case of so large a building. As to the cost of concrete compared with other possible mediums for power-house construction, there is, to say the least, most marked contrast.

Hollow concrete blocks of dimensions of 3 feet by 1 foot by 1 foot, such as have been employed in the walls of the Bennings station, can be produced with the best of material at an outlay of about 33 cents, and allowing a margin of 12 cents for profit and 6 cents for handling the total cost is 51 cents each, as against 75 cents to $1—the outlay that would be required for a similar amount of brick. The superstructure consists of a self-supporting steel skeleton frame which would presumably represent about the same outlay in either event.

The economy of concrete over natural stone is of course even more pronounced than in the case of brick. By way of illustration it may be cited that a concrete keystone 4½ feet long, 14 inches thick, 29 inches wide at the top and 10 inches in width at the bottom can be produced at a cost of $7.50, whereas a natural stone of the same dimensions delivered in Washington would stand the builder from $30 to $60 net.

FIRING AISLE IN BOILER ROOM AT BENNINGS STATION.

The concrete blocks for the door and window lintels and sills of the Bennings power house were all specially designed, and all the lintels are reinforced, some of those having a 12-foot span being reinforced by three-quarter-inch rods.

Concrete Stacks.

The adherence to concrete construction which is conspicuous in other portions of the plant extends to the three large chimneys, which are of the Weber steel-concrete type. Such chimneys are something of an innovation on the Atlantic Coast, although they have made their appearance in increasing numbers in the Middle West and other parts of the country. The trio of chimneys at the Bennings station rise to a height of 200 feet above the basement, 183 feet above the grates and 163 feet above the flue openings, having an internal diameter of 12 feet. They rest upon and are tied to a concrete substructure by the vertical steel reinforced rods of the shaft, and the shaft is also reinforced by horizontal rings at suitable intervals.

The bore of each stack is of uniform diameter throughout, but the lower portion is built with an inner and outer shell, separated by air space. The upper single portion of the chimney is supported by the outer shell, an offset being formed over the top of the lining in such a manner as to prevent soot from dropping into the air space. Save at this offset both shells of the chimney have the same thickness. The outer portion protects the inner portion from wind and weather stresses.

Boilers and Pumps.

No claim of novelty can be made for the general arrangement of that part of the power house in which the boiler room is located, at right angles to the generating room; and an annex extending the entire length of the generating room is provided for the switching apparatus. Nevertheless the arrangement of the boilers on two firing aisles requires little more than half the space that would have been necessary had the plan involved three firing aisles in accordance with common practice.

At present there are in place for the generation of steam 16 boilers, arranged in four rows, forming two firing aisles, while space has been reserved for eight additional boilers. As the power house has three stacks there will be an allowance of one for every eight boilers when the complement is entirely filled.

All the boilers are of the Babcock & Wilcox type, and two boilers form a battery, the working pressure being 175 pounds. The boilers are provided with Roney stokers, and each boiler has a grate surface of 111.8 square feet and a heating surface of 6,040 square feet. The equipment includes superheaters having 1,180 square feet of heating surface and capable of superheating the steam 150° F.

The facing of the boiler fronts is of white enameled brick and flue connections are made at the top of the boilers. Four boilers join in one breeching, thus giving two breechings for each chimney. A hand damper is provided for each boiler, whereas the four main flues are equipped with dampers operated by automatic regulators. Placed between the boilers and chimneys are a couple of Warren Webster open feed-water heaters with a capacity for heating (from 80° to 205° F.) an aggregate of 200,000 pounds of boiler feed water per hour.

To compensate for the loss from leakage or other causes there have been installed in the boiler room two make-up tanks of 25,000 pounds of water capacity each, together with two Epping-Carpenter house pumps.

Boiler feed water is supplied by two Worthington 16 by 10¼ by 16-inch horizontal duplex pumps, which deliver to a six-inch ring header system from which branches lead to the boilers. Each of the two pumps can supply water to any boiler, and in conformity with the economic policy everywhere carried out the branch connections to the boilers

are so located that a water tender can operate the valves of eight boilers from practically one point.

Coal and Ash Handling

A feature of this twentieth century power plant which is sure to interest every visitor who is of a mechanical turn of mind is the coal and ash-handling plant in the basement of the boiler house, which basement by the way has a height of 14 feet. The power plant is located about half a mile from the main line of the railroad, and coal-laden cars are conveyed from the switching point to the site of the power house by means of a Westinghouse electric locomotive, which is also utilized in the removal of the cars loaded with ashes.

INTERIOR OF FOURTEENTH STREET POWER HOUSE, WASHINGTON, D. C.

Arrived at the power house the fuel is either unloaded by means of a locomotive crane and placed in storage, or, as is more often the practice, is dumped directly into receiving hoppers located at the end of the firing aisles of the boiler house. At the basement floor under these hoppers are coal crushers, which, after handling the fuel, deliver it to bucket conveyors, by means of which it is hoisted to the top of suspended coal bunkers.

Here in turn the coal is received on two belt conveyors having a capacity of 40 tons an hour which distribute it over the bunkers. The coal bunkers have a capacity of six tons per running foot, or an aggregate capacity of 1,300 tons, and they consequently enable the storage of fuel in excess of immediate needs. From them the coal is guided by means of chutes to the receiving hoppers of the stokers.

The removal of ashes is facilitated by an industrial railway system. The ash hoppers discharge into small cars which carry the refuse to receiving hoppers. Bucket conveyors are utilized to hoist the ashes to suspended ash hoppers of reinforced concrete construction and 50 cubic yards capacity each, whence the material is removed by railroad cars.

A conspicuous feature of this portion of the installation as well as in other parts of this up-to-date institution is the extensive use of concrete displacing the construction materials formerly in vogue. At the Bennings plant we even find concrete replacing iron in the receptacle provided to catch the fine coal that falls through the front portion of the over-fed stokers.

The type of ash hopper employed, as already explained, is a suspended structure of concrete reinforced with one-half-inch round rods which are hooked into apron plates riveted to the steel framing of the boiler room floor. On these rods are hung the cast-iron spouts for filling the ash cars.

Obviously an ash hopper of this design can be constructed at less cost than those of plate steel, which require a lining of fire brick or concrete to prevent damage to the steel from the dilute acid formed when the ashes are wet down. The concrete in these hoppers is of no greater thickness than that required to line a steel hopper, while the reinforcing rods and apron plates represent less than 10 per cent. of the weight of a plate hopper.

Turbo-Generators.

The most impressive feature of the equipment of the new station is of course contributed by the four steam turbo-generators. Ultimately and in order to attain the contemplated 19,000 kilowatts capacity, three 5,000-kilowatt as well as two 2,000-kilowatt Curtis turbines will be installed, but for the time being only two of the three 5,000-kilowatt machines will be placed. The 5,000-kilowatt turbines, which operate at 750 revolutions per minute, are five-stage machines, designed to carry a load of 2,000 kilowatts with a vacuum in the four last stages. The generators are constructed to withstand an overload of 25 per cent. for 24 hours, an overload of 50 per cent. for two hours and a momentary overload of 100 per cent. The 2,000-kilowatt turbines are four-stage machines.

Piping and Condensers.

Much care has been bestowed in the installation of the communicative system between the boilers and turbines. All steam leads from the boilers have a diameter of seven inches and are connected to the main header system by means of long radius bends. The largest size header has an outside diameter of 15 inches. Steel pipes are used exclusively and all fittings are of semi-steel. The branches which lead from the header to the 5,000-kilowatt turbines are of 12-inch pipe, while the diameter of the pipes leading to the 2,000-kilowatt machines is 10 inches.

Such is the velocity of superheated steam in excess of saturated steam at the same pressure that the velocity in the 12-inch leads to the 5,000-kilowatt turbines is estimated to approximate 7,800 feet per minute.

The pipe system is not provided with separators, but provision is made to drain the entire system by means of four 1¼-inch Squires traps located in the boiler-room basement.

Incidentally it may be mentioned that this plant requires only a 10 per cent. water supply, all turbines and other machinery being operated in connection with condensers. The cooling surface of the condensers of the 5,000-kilowatt turbines aggregates 20,000 square feet.

Switch House.

The same careful arrangement noticeable in other portions of the station may be observed in the switching department which, as already noted, occupies what is in effect an annex. On the first floor of this section are found the manholes for generator leads and outgoing cables, the arrangement being in the form of double tile ducts on the side of the wall, whence the lines lead underground to the various sub-stations. The generator field rheostats are also installed here.

Some 9½ feet above this floor is located a gallery containing the oil switches which control the generators and outgoing feeders together with two bus sectionalizing switches. These switches are of the cellular type, each pole being mounted in a separate concrete compartment and arranged in one row.

Directly in the rear of these cells are the bus-bar compartments. Between the bus-bar compartments and the wall are located the static dischargers and disconnecting switches. Brick compartments are provided for the switches.

In the second gallery of the annex have been placed the switchboards, and incidentally it may be explained that the entire switching section is within full view of the generating room by means of large openings in the dividing wall. The switchboards in the second gallery are of black enameled slate of dull finish supported by a pipe framework and containing all the controlling switches, indicating lamps, instruments, etc.

Main Board in Fourteenth Street Power House.

Controlling Boards at New Bennings Power House.

SWITCHBOARDS IN GENERATING STATIONS FOR WASHINGTON, D. C.

Auxiliary Apparatus.

The auxiliary machinery in a plant of the pretensions of the new Bennings station is, of course,

worthy of more than passing notice. An ingenious arrangement has enabled the partitioning in the boiler room basement of a space that is virtually an extension of the main generating room floor as a site for exciter units, boiler feed pumps, oil pumps and two house pumps as well as oil filtering tanks and testing tanks.

In order to provide ample power for the supplementary machinery a separate six-inch steam header has been installed in the basement for the auxiliaries. It extends the full length of the plant and draws steam at three points from the main header by means of six-inch connections. All the steam piping, both main and auxiliary, is covered with 85 per cent. magnesia.

Grouped around one of the main turbines is auxiliary machinery that includes one 24-inch steam-driven Worthington centrifugal pump, steam-driven Dunn-Gordon rotative single-stage vacuum pumps and Worthington motor-driven hot well pumps located in hot well pits five feet nine inches below the floor of the main operating room. The exhaust pipes of all auxiliary machinery discharge into one common header which leads to the open feed-water headers.

When the equipment of the plant is fully complete it will include four Worthington pumps for supplying oil to the step bearings of the various turbines. The return oil is brought back to a Turner collecting tank and thence pumped to oil-filtering storage tanks of 1,600 gallons capacity each. The two exciters already mentioned as having place among the equipment in the basement are 100-kilowatt 125-volt engine-driven machines of the General Electric type.

Transmission Distribution.

In transmission work the policy of the Washington corporation does not differ materially from ordinary practice. Power is transmitted from the new central station to the city through cables which at present number five and to which additions will be made as occasion may demand. All generators are three-phase 25-cycle 6,600-volt machines, the current going direct to sub-stations, where it is transformed either to 220 volts for lighting (three wire) or to 600 volts for railway power service.

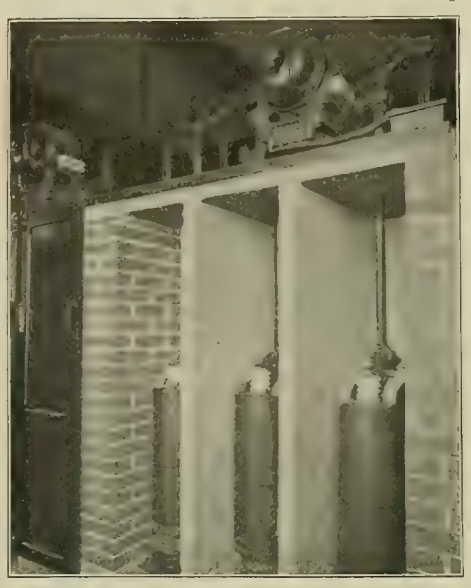
The sub-stations referred to all occupy locations which are believed to have strategic importance from the point of view of present or future business. Of the 14 sub-stations in commission or projected about one-half represent new construction. For one of these ground has not yet been broken. Each sub-station has been designed to meet local conditions peculiar to itself, and there has consequently been no attempt to preserve uniformity architectually or otherwise.

Sub-stations.

A sub-station that may be accepted as fairly representative is that designated as No. 2, which is designed for an ultimate capacity of 6,000 kilowatts. The building is brick with steel frame and concrete floor, and the installation consists of two 1,100-kilowatt three-phase transformers and two 1,000-kilowatt rotaries. The direct-current voltage may be varied, inasmuch as the transformers are provided with dial switches connected to taps brought out from different points on the transformer secondary winding. For controlling the incoming and outgoing current to smaller sub-stations there have been installed a number of remote control oil switches. A 276-cell storage battery may be connected to the three-wire system or to the railway circuits.

A departure from generally prevalent practice is to be seen at sub-station No. 10, where there are installed two 500-kilowatt motor generators and a 75-kilowatt balancing set. This institution, with an ultimate capacity of 5,000 kilowatts will serve the Edison three-wire system. On the second floor there is a storage battery room with space for 250 cells.

Yet another sub-station known as No. 12 is representative in another sphere. The equipment consists of a 500-kilowatt frequency changer and three 500-kilowatt rotary converters. The latter carry a street-railway load while the frequency changer transforms the 6,600-volt 25-cycle current to 2,400-volt 60-cycle current.



OIL SWITCHES AT BENNINGS POWER STATION.

Perhaps the most interesting of all the Washington sub-stations will be that known as No. 14, which will be located at Bennings, Md., only a few rods from the new power house, and, like that building, will be of block concrete construction. This sub-station will have two rotaries, 600 volts, feeding directly into the Columbia line (city and suburban) and will have the step-up equipment for the Washington, Baltimore and Annapolis Railroad, a new interurban railroad traversing the 45 miles between Baltimore and Washington and which is to operate on a 6,000-volt trolley.

The plant will transform from 6,000 to 33,000 volts and distribute from three-phase bus to single-phase. Current of 6,600 volts will be taken from the sub-station for the section of the new road from Washington to Annapolis Junction (halfway point) and feeders will convey the 33,000-volt current to Annapolis Junction, where it will be again stepped down to 6,600 volts to feed the section from Annapolis Junction to Baltimore and also to feed the branch line which will extend from the junction to the city of Annapolis, Md.

Marketing the Current.

Washington as a market for electric light and power presents conditions radically different from those which obtain in any other city in the country, but withal involving problems which every seller of electric current must need in one form or another.

To convey an idea of the unique position occupied by the American seat of government in the matter of selling electricity it is necessary to point out some of its peculiarities. Washington is a community of more than 300,000 people, but approximately one-third of this population is colored, and for the most part cannot be taken into consideration as possible purchasers of either light or power.

What might be termed the middle class of the community, comprising, say 25,000 families, is largely dependent for a livelihood (directly or indirectly) upon Uncle Sam, the heads of households earning on an average from $1,200 to $1,800 a year, which incomes, however, do not bring to the possessors as many comforts as would be available for persons of like salaries in cities where living is less expensive than in Washington. Finally there is a large and rapidly growing colony of wealthy leisure folk who are building costly residences and entertaining on a scale that vies with that at Newport to the satisfaction, of course, of the purveyors of the electric current.

In some of the large Washington mansions at the height of the social season the bills for electricity for lighting, elevator operation and other domestic uses will run $600 to $700 a month. However, this rate of consumption continues for less than half of the months in the year and this brings us to another peculiar phase of situation in the city of magnificent distances.

Washington for a considerable share of its population fulfills the function of a winter and spring resort. Practically all of the wealthy class and many of the well-to-do middle class make it a practice to close their houses and leave the city for intervals of from two to five months every twelvemonth. This wholesale desertion of the capital during the heated term has the effect of causing a wide fluctuation in receipts for such a commodity as electricity, and indeed in computing its volume of business the Potomac Electric Power Company never attempts comparisons other than to contrast the receipts of a given month with the income for the corresponding month during the preceding year.

It may be surmised from the foregoing that Washington, taken all in all, affords a very fair market for electric light, and this has improved markedly of recent years, owing to extensive construction of apartment houses. A decade ago the apartment houses and family hotels could have been numbered on the fingers of one hand, whereas today there are hundreds of these buildings ranging in size all the way from four to 120 suites, and with individual suites of from two to 14 rooms each. Some of these buildings have their own electric plants, but for the most part they patronize the public corporation.

However, the market for power is not satisfactory in anything like the same degree. Washington is not a manufacturing city, and everything save light manufacturing is discouraged by public sentiment, which desires to preserve the capital as a beautiful residential city. Incidentally it may be noted that this desire for a clean city works a hardship upon the electric power companies, since every time the fires at a power plant are stirred and heavy smoke is emitted for more than a momentary interval the superintendent may expect to be hauled

ELECTRIC LOCOMOTIVE FOR HAULING COAL AND ASHES AT BENNINGS POWER HOUSE.

A TYPICAL SUB-STATION INTERIOR IN WASHINGTON, D. C.

into police court and fined $100. This has happened repeatedly. A bill affording relief passed both houses at the last session of Congress, but was vetoed by President Roosevelt.

RATES AND INCOME.

The rates of the Potomac Electric Power Company are rather lower than those that prevail in most cities of the size of Washington. For light the maximum rate is 10 cents with a rate of five cents in excess of 120 hours in a month. For power the rate is 10 cents for the first 30 hours of total installation and five cents in excess of this limit. A wholesale rate is also in force. Charging is done on a straight meter basis. A $1 guarantee is exacted in the case of every installation, but local sentiment has always been strongly against any more extensive system of guarantees.

The Washington company has an income of about $1,000,000 a year from light and power. The United States government is the best customer on the books, paying about $67,000 a year for service. Many of the government buildings have, of course, their own electric plants, but the Potomac company furnishes current for light and for the operation of elevators etc., in not a few of Uncle Sam's establishments, including the Treasury Department, National Museum, Department of Agriculture, etc.

ELECTRIC SIGNS.

A valuable source of revenue is that from electric signs. Washington is perhaps the greatest tourist mecca in the country, and it is said that more signs are erected for general advertisers than in any other city save New York and Atlantic City. Indeed the volume of this business is only limited by the number of commanding locations available. The sign business with local merchants is not proportionately heavy, but the power company has taken pains to develop the field for low-price signs and now has an income in excess of $30,000 a year from signs costing the merchant from $10 to $30 a month.

ADVERTISING.

The Potomac company has been most aggressive in seeking new business and has for years past prosecuted a most vigorous advertising campaign, using every imaginable medium. For a time all features of this campaign were originated at the company's office, but latterly the task has been entrusted to an advertising agency, which has supplemented the newspaper and billboard advertisements, calendars, etc., with a monthly house organ, a pleasing, well illustrated little magazine which is mailed monthly to a selected list of 5,000 names.

This mailing list, by the way, was set up, as is often the case, from the city directory or telephone directory, but was compiled by experienced employes of the company who made a careful canvass of the business and residence streets of the city, and at first hand took down the names of good "prospects." The list is revised by a similar process at least once a year.

Much of the advertising of the company in newspapers, on the billboards, etc., is of the character known as "general publicity," and consequently precludes the possibility of results being directly traced, but at frequent intervals the contract department mails to selected lists attractive advertising novelties, each of which contains a reply postal card requesting a visit from a solicitor empowered to quote rates or give other information. Detailed records of results are kept for each piece of advertising matter of this character, the record showing not only the number and character of replies but the number of contracts ultimately closed through aid of a given medium.

The company's field staff comprises 11 solicitors and one engineer, and the head of the contract department declares that it would be larger if he could secure competent men. Close tab is kept on new building operations of all kinds through the daily bulletins of new construction issued by a well-known agency. Solicitors also call upon all architects and builders in the territory at least once each week, and the company has distributed pocket-books, desk novelties and other souvenirs to the members of this fraternity, who obviously have immense influence in contributing to the electrical business.

ELECTRIC RAILWAYS.

The Washington Railway and Electric Company, whose varied activities have been dealt with above, operates about 270 miles of city and suburban railway lines, of which approximately one-half has the underground contact system. The only other corporation supplying electricity for public utilities is the Capital Traction Company, which confines itself to the operation of about 40 miles of city and suburban lines, of which 30 miles has the underground contact system. This company, like its rival, is modernizing its plant and has just commenced the erection of a $25,000 addition to its existing power house.

TYPICAL SUB-STATION IN WASHINGTON, D. C.

The present equipment of the plant consists of five 525-kilowatt General Electric generators and Allis engines, to which steam is supplied from eight Babcock & Wilcox boilers, each of 333 horsepower and working at a pressure of 150 pounds. Supplementing this there will be installed two Parsons turbines of 1,500-kilowatts capacity each and four Babcock & Wilcox boilers, each of 600-horsepower capacity, working at a pressure of 175 pounds.

STREET CARS IN WASHINGTON, D C. (UNDERGROUND-CONTACT.)

The company will erect a sub-station to transform the current from 11,000 to 600 volts, and one of the 525-kilowatt generators above mentioned and two of the old boilers will be transferred from the main power house to the company's suburban power house at Chevy Chase, Md., where current is generated for a suburban road some 10 miles in length.

GOVERNMENT PRIVATE PLANTS.

Of the various branches of the Federal government which maintain their own lighting and power installation none has a more representative equipment than is to be found in the Postoffice Department, which occupies one of the newest as well as one of the largest of the government buildings. The steam plant is made up of 12 horizontal tubular boilers, each of 125 horsepower, set in two rows and all equipped with Roney stokers. The electrical installation is made up of four 120-kilowatt Thresher direct-coupled dynamos running at 240 revolutions and delivering current at 115 volts. There are four 250-horsepower engines of the Buckeye tandem compound type. There are 42 lighting and four power circuits, and among the novel uses of electrical power is the operation of a number of machines for canceling the stamps on letters and postal cards.

Visitors are in many instances disappointed not to find a more thoroughly up-to-date electric light and power plant at the United States Capitol, but any deficiencies in this respect will be remedied upon the completion of the projected central lighting and power plant for the Capitol and the new Senate and House of Representatives office buildings which adjoin it on either hand. Exceptional interest would also naturally attach to an electric plant at the White House, but the current for lighting and power at the presidential mansion and executive offices is supplied from the plant at the State, War and Navy Department Building.

Electric-railway Development in Texas.

A number of electric-railway projects are on foot in Texas. In addition to several proposed interurban lines, steps have been taken to build electric street-railway systems in a number of the growing towns of the state which are now without these transportation facilities. The increase of population of the towns and of the country localities in certain parts of the state during the last year or two has had the effect of making attractive propositions out of what were before considered to be unprofitable, so far as electric-railway investments were concerned. In North Texas, where the density of population is greater than in any other part of the state, the activity in electric-railway building is greater than was ever before known in the state. A number of interurban lines are projected out of Fort Worth and Dallas.

It is stated that the Central Texas Traction Company has completed the survey and estimates for the construction of its proposed electric line between Corsicana and Palestine, a distance of about 50 miles, and that things will soon be in readiness for starting construction. It is intended ultimately to extend this line from Corsicana to Dallas, a distance of about 60 miles.

Rapid progress is being made in constructing the electric railway that is to run between Dallas and Sherman. It will be about 60 miles long. More than 30 miles of grade have been finished, and tracklaying will start in July.

It is reported that John W. Gates of New York is largely interested in the South Texas Traction Company, which proposes building an interurban electric railway between Beaumont and Port Arthur, a distance of 20 miles. The company will construct a system of street railways in Port Arthur. Lines will also be built to the plants of the Gulf Refining Company, the Texas Company and the rice mills.

J. H. Ransome of Hereford, Texas, is at the head of a syndicate which has applied to the City Council of San Angelo for a franchise for building an electric street-railway system in that town.

The City Council of San Antonio has granted the application of the San Antonio Traction Company to double-track its line that runs to the Hot Wells suburb, a distance of about three miles.

The preliminary arrangements for building an interurban electric railway between Galveston and Houston, a distance of 51 miles, have been completed. The surveys for the proposed road were finished some time ago. Messrs. Stone & Webster of Boston, Mass., are behind the project. The county of Galveston has levied a tax for building a causeway across Galveston Bay, a distance of two miles, and this structure will be used by the proposed electric railway as well as by the several steam railroads to gain entrance into Galveston.

In addition to these several assured lines of electric railway, steps have been taken to build interurbans between Fort Worth and Waxahachie; between Fort Worth and Mineral Wells and between Fort Worth and Cleburne. H.

The recently organized Central Electric Accounting Conference will hold its next meeting in Indianapolis on June 1st. This conference was organized at Dayton, Ohio, in April for the purpose of enabling the accounting officers of electric railways in the Central States to meet from time to time and discuss matters of interest. The conference may adopt a uniform method of accounting. M. W. Glover of Cincinnati is chairman, and C. S. Baker of Lima, Ohio, is secretary.

Institute Adopts New Constitution and Elects Officers.

The annual meeting of the American Institute of Electrical Engineers was held in New York on the evening of May 21st. President Sheldon called the meeting to order, and the secretary, Mr. Ralph W. Pope, read the report of the board of directors for the year ended April 30, 1907, which was duly adopted. The directors reported that there are now 33 local organizations. "As soon as the revenue of the Institute will permit, it is the general belief that arrangements should be made for the systematic visitation of branches by officers of the Institute and prominent engineers. There is a general call for some action of this kind, which it is hoped would be productive in general good fellowship. The encouragement of the attendance of delegates from the branches to the annual convention is also recommended by the committee." The amount subscribed to the building fund is now $163,734, of which $124,829 has been paid in. The largest contributors during the year were the Westinghouse companies, who sent a check for $50,000. Barely $20,000 is now required to complete the amount that the Institute has assumed. The total membership on April 30th was 4,521. During the year the receipts per member were $12.21 and the corresponding disbursements $11.62. The receipts of the year for general purposes were $55,184.

B. V. Swenson, chairman of the committee on tellers on the vote on the adoption of the new constitution, reported that 2,358 members and associates had voted for the new constitution, while 95 votes were recorded against it. President Sheldon therefore declared the new constitution adopted. The instrument will go into effect on June 10th.

The new constitution makes the fundamental law of the Institute consistent with present-day requirements. It is particularly definite in relation to the work of local branches. Paul Spencer of Philadelphia, chairman of the committee on local organizations, gives this information in relation to it:

"It provides for the formation of a branch wherever there is a sufficient number of members and sufficient interest to support the work.

"It does not hamper the development of any branch by restriction as to the particular way its work shall be carried on, excepting, of course, that it shall be in accordance with the aims and ideals of the Institute.

"It provides that the local organizations committee shall be one of the standing committees of the Institute.

"It provides that the chairman of each branch shall be a member of that committee.

"It provides that the chairman of each branch, or his alternate, shall be a delegate to the annual convention, thus providing for a body that can meet at least once a year and consider officially the interests of the local organizations.

"Furthermore, and a matter which is of great importance, it includes an amending clause, which will permit amendments of the constitution to be adopted in the future. It does this by providing that a proposed amendment, after being properly brought before the board of directors, shall be submitted by letter ballot to the entire membership, and be adopted if of sufficient general interest to bring out a vote equal to 30 per cent. of the total membership, and if three-fourths of all those interested enough to vote are in favor of it."

These officers of the Institute were elected:

President—H. G. Stott, New York, for one year.

Vice-presidents—L. A. Ferguson of Chicago, J. G. White of New York and W. C. L. Eglin of Philadelphia, to hold office for two years.

Managers—B. G. Lamme of Pittsburg, H. W. Buck of New York, P. H. Thomas of New York and Morgan Brooks of Urbana, Ill., to hold office for three years.

Treasurer—George A. Hamilton, New York, for one year.

Secretary—Ralph W. Pope, New York, for one year.

The paper of the evening was an important one by Frank J. Sprague, bearing the title "Some Facts and Problems Bearing on Electric Trunk-line Operation." In the course of his long paper Mr. Sprague took a conservative position. He believed that capacity, railroad capacity, rather than a narrow measure of economy as measured by the cost of electrical horsepower, will be the controlling factor in the electrification of trunk lines. True to his record, Mr. Sprague was a doughty champion of the direct current, conceding, however, that the single-phase system has its place. Those taking part in the discussion were Mr. Wilgus, vice-president of the New York Central; L. B. Stillwell, consulting engineer; W. B. Potter, A. H. Armstrong and Dr. Steinmetz of the General Electric Company; Charles F. Scott and N. W. Storer of the Westinghouse Electric and Manufacturing Company; G. R. Henderson, a practical railroad man, and William McClellan of Westinghouse, Church, Kerr & Co., engineers.

National Fire Protection Association.

The eleventh annual convention of the National Fire Protection Association opened its first day's session on May 22d in the auditorium of the Engineering Societies Building, New York city. President C. A. Hexamer in his opening address called attention to the general interest that has been awakened in the work that the association is doing and congratulated the society on the cordial relations that continue to exist between it and the National Board of Underwriters. The convention then proceeded to the consideration of the reports of the various committees.

The report of the special hazard and fire record committee paid especial attention to sprinklers and other mechanical devices for putting out fires, concluding with the statement that "the automatic sprinkler of approved type is absolutely reliable, sure in action and certain to control fires under normal conditions."

The large percentage of failures to detect fires credited to watchmen and thermostats caused a lively discussion, and some rather uncomplimentary opinions were expressed as to the value of watchman service. It was, however, generally conceded that the electrical devices were superior to any mechanical or other device for the purpose of sending fire alarms.

Reports of committees on "Nitro-cellulose Products, Devices and Materials," and a very technical report on the "Fire-protecting Coverings for Window and Door Openings," which dealt mainly with suggested changes in the present requirements, were received and accepted with a few modifications. A paper on the "Season Hotel" was read by H. L. Hiscock of Boston, and the meeting adjourned for the day.

The first business on reassembling the following morning was a report on automobile garages. A lively discussion ensued over the requirements for thickness of walls, due to the committee being unable to make its views coincide with those of the Architects' Association on the regulation of the building code of the National Board of Underwriters. The general objection was that the requirements as set forth were so stringent that they would not be complied with by builders. The report was, however, accepted, and the committee continued.

A discussion of real interest occurred when the committee on car barns submitted its report, including proposed changes in the rules suggested by the Street-railway Association, which brought up the question of the thickness of division walls. It was held that the matter was in conflict with the ideas of the committee on uniform requirements. After a long discussion the matter was referred to the executive committee and car-barn committee with power to act in accord with the committee of uniform requirements.

F. E. Cabot, chairman of the committee on fireproof construction, reported that the committee had been unable to agree on certain points and yielded the floor to Mr. Stone of the American Institute of Architects, who submitted diagrams and data in opposition to the requirement. The question at issue was why the association should require a 16-inch wall for the top floor of a 10-story building, whereas it only required a 12-inch wall for the top floor of a five-story building. Although this was in accord with the new building code of the National Board of Underwriters, no one could give any very satisfactory reason for the action of the National Board's building committee. The whole matter was referred back for further consideration.

The third day of the session found the convention considerably behind in its programme. The reports of the various committees were read and acted upon with little discussion.

The report of the committee on lightning, prescribing the exact methods to be adopted in protecting structures of all classes approached so nearly to that required by the National Electrical Code that it was adopted as read.

Officers for the ensuing year were elected as follows: President, W. W. Dudly of Chicago; vice-president, William A. Anderson of New York; secretary and treasurer, W. H. Merrill, Jr., of Chicago; executive committee—H. C. Henley, Albert Blauvelt, E. B. Creighton, H. H. Glidden, C. M. Goddard, F. E. McKnight, H. K. Miller, H. L. Phillips, C. M. Phinney, Alfred Stone, T. B. Sellers, C. A. Hexamer, J. E. Curtis and M. D. Pierce

The Dubuque Demonstration of Domestic Electricity

Progressive central-station companies have learned by experience that when once brought forcibly to the attention of the public the smaller electric heating, cooking and power devices such as are adapted for household use are accorded an enthusiastic reception and are usually found to be within the means of everyone who can afford electric illumination. This being the case, it remains for the central-station manager to educate his people to the advantages of these devices, thereby creating a market for his current and at the same time helping his patrons to the enjoyment of the more modern household conveniences.

Note Luminous Heater in Parlor.

INTERIOR VIEWS IN ELECTRIC COTTAGE AT DUBUQUE.

The great success of the recent domestic-science lectures and demonstrations in Dubuque, Iowa, proves the wisdom of the educational advertising plan carried out by Mr. L. D. Mathes, general manager of the Union Electric Company of that city, co-operating with the Dubuque Woman's Club, a strong organization of 400 representative women of the city. Under the auspices of this club there was given a series of lectures, accompanied by demonstrations of all the electric cooking and heating devices which have been proved practical. The lectures extended over a period of 15 days, beginning on April 1st, and were given by a number of ladies educated and talented in their profession, among them being two who are at the head of the household and domestic science departments of two leading universities.

The demonstrations were given in a large store on a busy street. A five-room cottage was erected and fitted up with the latest conveniences and lighted by electricity, special attention being given electric heating and cooking devices. The accompanying views will give an idea of the thoroughness of the exhibition.

The Dubuque movement was entirely educational and proved a great success. Large throngs attended, made up largely of ladies, attracted not alone by the picturesqueness of the exhibit but through a desire to learn of the modern household conveniences. Every provision was made to show the people how pretty lighting schemes and effective general illumination can be produced by the use of electric lights. But the electric cooking and heating demonstrations proved the real revelation. All the devices were shown, from the electric chafing dish to a complete electric range and cooking table shown in one of the pictures. The uses of all these devices were demonstrated and the visitors were served with a large variety of good things to eat cooked by electricity.

It was demonstrated that a complete family washing can be put through in three hours with the electric washing machine, wringer and drying cabinet, finishing with the electric flatiron.

There was nothing for sale at the show, the purpose being to demonstrate what can be done in the household with electricity. The ladies of the household economics division of the Woman's Club had charge of the lectures and demonstrations and the electric company furnished the current and utensils and bore the expense of the exhibit, which was considerable. The combination was a good one and the effort was worth while. Mr. Mathes thinks the Union Electric Company has spent more on electric heating than any other company in the state. He believes in pushing the smaller devices, which are not prohibitive in first and operating cost, gradually working up to the larger units. All in all, the demonstration was undoubtedly the most complete and notable affair of its kind which has been attempted anywhere. A very large proportion of the entire adult population of Dubuque attended the exhibition, and while it is too early to give an accounting of results, the central-station company will no doubt be well repaid for its time and money.

ELECTRIC COTTAGE AT DUBUQUE DEMONSTRATION OF DOMESTIC SCIENCE.

ELECTRIC RANGE AND COOKING TABLE AT DUBUQUE DEMONSTRATION.

AN ELECTRIC COOKING DEMONSTRATION IN DUBUQUE.

SOME EXHIBITS AT DUBUQUE DEMONSTRATION.

Central Electric Railway Association.

With an unusually good attendance, a number of good papers and an interesting demonstration of signal apparatus, the regular bi-monthly meeting of the Central Electric Railway Association was held in the Claypool Hotel, Indianapolis, on May 23d. The meeting was called to order by President H. A. Nicholl. President Nicholl announced that the executive committee had decided to hold the next meeting at Columbus, Ohio, on September 26th.

On motion of E. C. Spring, of the Dayton and Lima, the president was directed to appoint a delegation, to include himself as chairman, to attend the national street and interurban railway convention, to be held in Atlantic City in October.

After the reading of the minutes of the previous meeting, President Nicholl announced that "Modern Train Dispatching" was the principal subject for discussion during the morning session. The discussion was opened by the reading of a paper by J. K. Gray of Lima, Ohio, trainmaster of the Western Ohio Traction Company. Mr. Gray's paper consisted of a simple story descriptive of the methods employed on his line in getting trains over the road. He said that it is a question with the interurban men whether the telephone is superior to the telegraph or whether a system of signals is better than both. Mr. Gray said they used all of these mediums, but depended almost entirely upon the telephone. The only trouble experienced at any time was by reason of placing the wire too close to the high-tension trolley wire. "We have telephone booths every five miles, and in case of trouble with the dispatcher's line that section is cut out and the long-distance telephone is used." Mr. Gray's paper was freely discussed and brought out a number of inquiries relative to the operation of extra trains, work trains and freight cars. Mr. Gray said all of these were run as extra trains and under the rules held on the sidings subject to orders from the train dispatcher. It is a standard rule, he said, that every train going into a switch must be reported by its crew, and must remain there until it gets an order to leave it.

The second paper on the same subject was read by M. C. Stern of the General Systems Company of Dayton, Ohio. Mr. Stern's paper showed that he was familiar with the subject, since he gave an exhaustive review of the method adopted on his line. Mr. Stern said they issued orders in triplicate and when an order is given it is written out in duplicate by either the motorman or the conductor, and each has a copy, thus throwing the responsibility equally upon both.

Mr. Stern's paper was well received and provoked quite a discussion as to whether it is best to give the order to the motorman or to the conductor. Mr. Stern was asked how he directed a train after an order had been marked void. He replied, by issuing another. In case of crippled telephone line making it impossible to issue another order, a train with a void order must move by signal, if at all, and this can be done by the code of rules.

Mr. Spring thought it advisable to effect an agreement on disputed points. Some roads made the conductor responsible, some the motorman, and some divide the responsibility. He thought there should be some uniformity among the roads.

Mr. Merrill suggested the adoption of a standard system of train dispatching. A committee, with F. D. Carpenter, Lima, Ohio, as chairman, was appointed to formulate a uniform or standard system of train dispatching, including a code of rules, at the next meeting.

C. P. Button, general manager of the Telegraph Signal Company, Rochester, N. Y., described his company's telegraph and telephone signal device, with a practical demonstration.

During the afternoon session Mr. S. R. Dunbar, purchasing agent of the Indiana Union Traction Company, Anderson, Ind., read a paper on "The Issuing of Supplies; How to Prevent Leaks." The only way to prevent leaks and waste after supplies are issued is continual vigilance on the part of the heads of departments and a policy of holding each employe strictly and individually responsible for all company property which may come into his hands. The concern that does not know what its products cost, how issued and preserved, will not live to bother its competitor long. Railroads generally supply most of the inhabitants in their territory with a complete set of tools before con-

struction is over. A good plan is to issue no new tools until the old ones are returned, or additional tools are shown to be necessary.

A partial report of the standardization committee was read by W. H. Evans of Indianapolis. It related to brake shoes, axles, journals and journal boxes, tread and flange wheels and rails for street and interurban railways. A seven-inch 91-pound T rail is recommended for city tracks and an A. S. C. E. standard section 70-pound rail for interurbans. The report was discussed to some extent, and, being regarded as very important, it was ordered printed and distributed to the members of the association for the purpose of further discussion at the next meeting.

W. J. Woods and C. V. Adams, members of the Indiana Railroad Commission, were present, by invitation, and each addressed the meeting. Judge Woods said accidents on railroads, both interurban and steam lines, were entirely too numerous, and it was the purpose of the commission to lessen the danger of travel. The interurbans should have a

NEW WILLARD HOTEL, WASHINGTON, D. C., WHERE CONVENTION WILL BE HELD.

printed set of rules governing the operation of trains and the conduct of employes. The men should be compelled to know the rules and observe them strictly. Judge Woods said under the law the interurban company would fall wholly under the jurisdiction of the commission; that is, with reference to freight matters as well as passenger traffic when its freight business contributes 33⅓ per cent. of its gross income. The speaker said that the members of the commission desired to make the acquaintance of the interurban men and learn of their methods of operation. He predicted a bright future for interurban roads and said the commission would help them all it could.

The meeting adjourned to witness a demonstration of Mr. Button's train dispatching and signaling device set up in another room. S. S.

Magnetite Arcs for Topeka.

The Topeka Edison Company has made a proposition to the city to furnish 500 magnetite lamps to run all night every night in the year at a cost to the city of $55 a lamp. This proposition is considered such a good one by the members of the City Council that it may decide to accept it and not ask the people to vote on a bond proposition of $65,000 with which to reconstruct the present city lighting plant.

The cost to the city per year if the proposition is accepted will be $27,500. The cost to the city, if the present municipal plant is reconstructed on the plans made by R. W. Freeman, and, if it should be operated properly, would be about $25,000 a year, not counting accidents and repairs, which would run more than $1,200 per year.

The Edison company said that if the city accepted the $55 proposition it would buy the poles the city owns for which it would pay $5,000, and would pay 17 cents a pound for the copper wire now in use. This would bring in about $5,000 more, as the city has about 28,000 pounds of wire. The company also wants the privilege of cutting off the decayed ends of the poles and using them [illegible], although the cutting would make them lower [illegible] the city allows.

If series-alternating arcs are preferred to the magnetite lamps the company will furnish them at [illegible] lamp. If current only for street lighting is desired the company offers it at rates varying [illegible] cents a kilowatt-hour.

[illegible] proposals of the company will come up [illegible] on June 3d.

Arrangements for the Washington Electric Light Convention.

The thirtieth convention of the National Electric Light Association will be held in the New Willard Hotel (ballroom, tenth floor), Washington, D. C., on Tuesday, June 4th to Friday, June 7th. It promises to be the greatest convention ever held by the association. Certainly the plan of arrangements is the most elaborate ever attempted in the history of the association, as may be judged by the following programme of meetings:

Tuesday Morning, 10 o'clock.

Convention called to order by the President.
Introduction of Gen. George H. Harries, vice-president Washington Railway and Electric Company, by the president.
Address of Welcome—Hon. H. B. F. Macfarland, president Board of Commissioners, District of Columbia. Mr. Macfarland will be introduced to the convention by Gen. G. H. Harries.
President's Address.
Announcements by the Secretary.
Report of Committee on Progress—T. Commerford Martin, New York.
Accidents—Paul Lupke, Trenton, N. J.
The Effect of Frosting Incandescent Lamps—Dr. Edward P. Hyde, Washington, D. C.
Need for an Accurate Maximum Demand Meter for Measuring the True Energy of Polyphase Service—A discussion led by Louis A. Ferguson, Chicago.
Question Box—Paul Lupke, Trenton, N. J. The Question Box will be presented by Mr. Lupke. Opportunity for any desired discussion will be given later in the convention.
Report of the executive committee by the Secretary.

Tuesday Evening, 8 o'clock.

Report of Committee on Electric Light Accounting—H. M. Edwards, New York. Mr. Edwards will preside during the presentation and discussion of this report.
Legal Justification for Differential Rates—George Whitefield Betts, Jr., New York.
Recent Developments in Mercury Rectifiers—Frank Conrad, Pittsburg.
Report of Committee on Standard Rules for Electrical Construction and Operation—Ernest H. Davis, Williamsport, Pa.
Report of Committee on the Fire Hazard of Electricity—C. E. Skinner, Pittsburg.
Report on Insurance and Kindred Matters—W. H. Blood, Jr., Boston, insurance expert of the Association.

Executive Session.

Report of Committee on Membership Dues—W. H. Gardiner, New York.
Report of Committee to Revise Constitution and By-laws—Samuel Scovil, Cleveland.

Wednesday Morning.

New Developments in Arc Lamps and High Efficiency Electrodes—G. M. Little, Pittsburg.
Indefinite Candlepower Ratings in Municipal Contracts—E. Leavenworth Elliott, New York.
Indefinite Obligations in Municipal Contracts—Henry Floy, New York.
Report of Committee to Consider Specifications for Street Lighting—Dudley Farrand, Newark, N. J. Dr. A. E. Kennelly will preside during the presentation and discussion of this report. It is expected that several types of illumination will be on exhibition, including the magnetite, titanium, flaming and mercury vapor arcs; Moore tube lighting; tantalum, Gem, tungsten and Nernst lamps. Dr. C. P. Steinmetz, L. A. Ferguson, Peter Cooper Hewitt, F. W. Willcox, V. R. Lansingh, W. D'A. Ryan, Dr. C. H. Sharp, Prof. L. B. Marks, Paul Spencer, Dr. E. P. Hyde, Wilson Howell and others have been invited to take part in the discussion.
Report of Committee on the Present Methods of Protection from Lightning and other Static Disturbances—Alex Dow, Detroit.
Recent Developments in Protective Apparatus—D. B. Rushmore, Schenectady, N. Y.
Power Factor Correction—F. D. Newbury, Pittsburg.
The Electric Automobile as an Adjunct to Central-station Load—H. H. Rice, Indianapolis, Ind.
Some Power Experiences—S. M. Sheridan, Detroit, Mich.
Italian Methods of Charging for Electric Current—Guido Semenza, Milan, Italy. This paper will be read by J. W. Lieb, Jr., New York.
Report of Membership Committee—J. Robert Crouse, Cleveland.
Report of Committee on Relations with Local Associations—S. R. Bradley, Jr., Nyack, N. Y.
Report of Committee on the Grounding of Alternating-current Secondary Circuits—W. H. Blood, Jr., Boston.

Executive Session.

Why We Failed in a Municipal Ownership Campaign—Glenn Marston, New York.
Municipal Ownership—Arthur H. Grant, New York.

Thursday Evening.

Executive Session.

Report of Committee on Relations between Manufacturers and Central Stations—Henry L. Doherty, New York.
Report of Committee on Rates and Costs—R. S. Hale, Boston, Mass.
Report of Public Policy Committee—Everett W. Burdett, Boston, Mass. Mr. Burdett, chairman, will preside, and it is expected that Charles L. Edgar, Samuel Insull, Alex Dow, Henry L. Doherty, Joseph B. McCall, J. W. Lieb, Jr., and Samuel Scovil will participate in the discussion.

Friday Morning.

Commercial or New-business Day.

Scope and Character of Papers and Discussion—W. W. Freeman, Brooklyn, N. Y.

The Commercial Field—

Co-operative Commercialism in the Electric Field—J. Robert Crouse, Cleveland, Ohio.
Report of National Electric Light Association Co-operating Committee—W. W. Freeman, Brooklyn, N. Y. This report will be read by some member of the committee designated by the chairman.
Possibilities of Commercial Development—Henry L. Doherty, New York.
New Business; How to Get It, How to Keep It—F. M. Tait, Dayton, Ohio.
New Business Results Demonstrated in Cities of All Sizes—J. E. Montague, Niagara Falls.

Discussion.

Questions of Policy—

Sales Policy in Combination Gas and Electric Companies—F. A. Willard, Rochester, N. Y.
The Electrical Jobbers and Dealers' Co-operation in Business Getting—R. V. Scudder, St. Louis, Mo.
Co-operation of the Electrical Trade Papers in Business Getting—F. W. Loomis, Savannah, Ga.

Discussion.

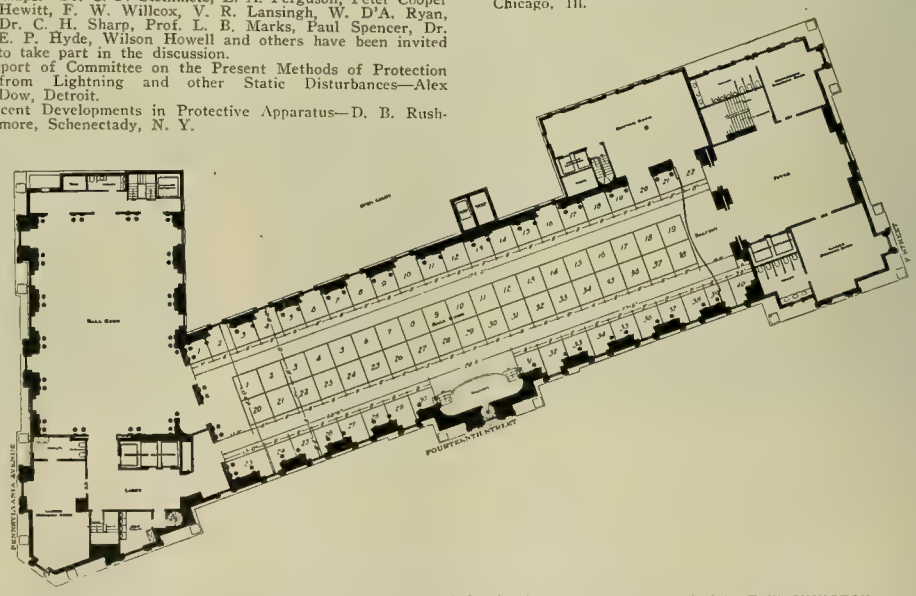
Wiring—

How to Get the Old Buildings Wired—F. H. Golding, Dayton, Ohio.
How to get the New Buildings Wired—J. Sheldon Cartwright, Knoxville, Tenn.
Co-operation of the Electric Contractor in the Wiring of Buildings—Jas. R. Strong, New York, President National Electrical Contractors' Association.

Discussion.

The Solicitor—

Sizing up the Territory; Preparing the Lists of Prospective Customers—George Williams, Cincinnati, Ohio.
Qualifications of Solicitors for Different Classes of Business—F. W. Frueauff, Denver, Colo.
How to Measure Results and Pay Solicitors—Leon H. Schreck, Birmingham, Ala.
Increasing the Efficiency of the Sales Force—J. D. Kenyon, Chicago, Ill.



MEETING ROOM AND EXHIBITION HALL OF NATIONAL ELECTRIC LIGHT ASSOCIATION AT WASHINGTON.

Electric Heating without Special Concessions from the Central Station—C. D. Wood, Jr., New York.
The Future of the Gas Engine—Lewis Nixon, New York.
Application of Gas Power to Central-station Work—J. R. Bibbins, Pittsburg.
Producer Gas Engines for Central-station Work (illustrated by the stereopticon)—Robert T. Lozier, New York.
The Frequencies of Flicker at which Variations in Illumination Vanish—Dr. A. E. Kennelly, S. E. Whiting, Harvard University.
Efficiency of Various Methods of Illumination (illustrated by the stereopticon)—E. A. Norman, New York.
Report of Committee on Electric Heating and Cooking—James I. Ayer, Boston, Mass.

Wednesday Evening.

Lightning and Lightning Protection—Dr. C. P. Steinmetz, Schenectady.

Thursday Morning.

Report of Freight Classification Committee—Ernest H. Davis, Williamsport.
Recent Turbine Developments—W. L. R. Emmet, Schenectady.
Balancers vs. Three-wire Dynamos—B. Frankenfield, Cincinnati.
Value and Use of Solicitors' Handbook—R. S. Hale, Boston, Mass.

Discussion.

Friday Afternoon.

Advertising—

A Balanced Advertising Program—Ralph Richardson, Jackson, Tenn.
Advertising Results Demonstrated in Cities of All Sizes—E. S. Marlow, Washington.
How to Make the Most of Newspaper Advertising—A. D. Mackie, Peoria, Ill.
Measuring the Results of Advertising—M. S. Seelman, Jr., Brooklyn, N. Y.
Value of the Service of the Advertising Agency or Specialist—Lawrence Manning, Owosso, Mich.
Display Room and Demonstration as Business Getters—E. R. Davenport, Providence, R. I.
New Business by Indirect Methods—L. D. Mathes, Dubuque, Iowa.

Discussion.

Light—

Illuminating Engineering as an Aid to Securing and Retaining Business—C. F. Oehlmann, Cincinnati, Ohio.

Methods of Securing Residential Business—R. W. Hemphill, Ann Arbor, Mich.
Co-operative Lighting of Streets by Merchants—H. J. Gille, St. Paul, Minn.
Methods of Securing Sign, Window and Outline Lighting—Homer Honeywell, Lincoln, Neb.

Discussion.

Power—

Methods of Securing Power Business—George N. Tidd, Scranton, Pa.
Catering to Power for Automobile Charging—R. W. Rollins, Hartford, Conn.
Establishing Day Circuits in Towns of 10,000 Population and Under—F. H. Plaice, New Bremen, Ohio.

Discussion.

Heating—

Methods of Exploiting Electric Heating Devices—T. K. Jackson, Mobile, Ala.

Discussion.

Review of Advertising (illustrated with stereopticon slides)—C. W. Lee, Newark, N. J.
Memorials—T. C. Martin, New York.
Report of the nominating committee.
Election of officers for the ensuing year.
Adjournment.

Of course the principal feature of the entertainment programme is the special reception at the White House by the President of the United States. This is arranged for Tuesday afternoon, June 4th, and it will be necessary to leave the hotel promptly at 2:15 p. m. Only members and guests wearing association badges will be admitted to the executive mansion.

On Monday evening the opening of the exhibition will be followed by a reception and dancing on the tenth floor of the New Willard Hotel. Music will be furnished by the band of the United States Marine Corps. An automobile ride for the ladies about Washington will be given on Tuesday morning, and in the evening of the same day there will be a theater party for the ladies at the Columbia Theater.

Wednesday will see another automobile ride for the ladies in the forenoon, while in the afternoon there will be an exhibition cavalry and field artillery drill at Fort Myer. After Dr. Steinmetz's lecture in the evening there will be a ball at the New Willard.

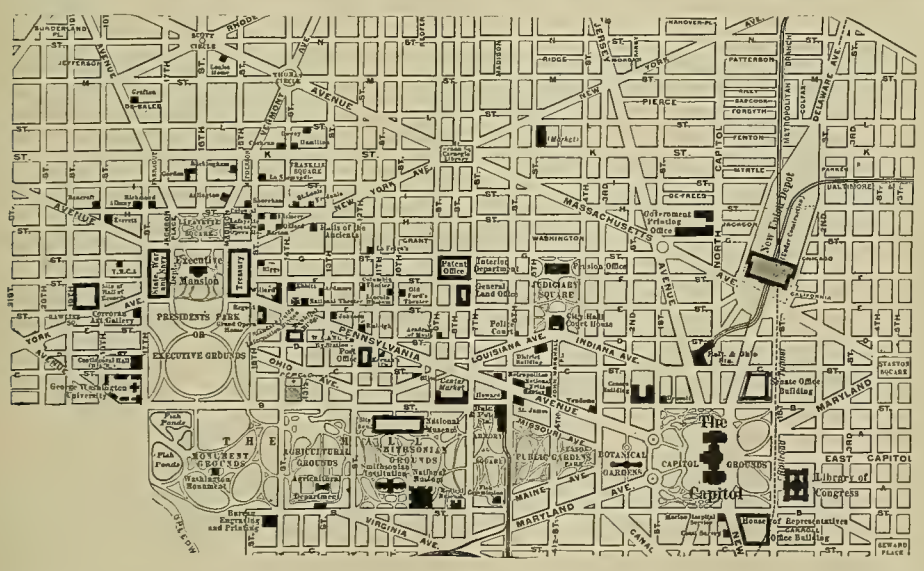
The entertainment programme for Thursday begins with an automobile ride in the morning. A visit to the Corcoran Art Gallery is also planned. In the afternoon there will be a boat trip to Mount Vernon, while in the evening Luna Park will be inspected, with a ride to Cabin John Bridge.

Plans for Friday include automobile rides and visits to the Corcoran Art Gallery. Many will plan to visit the Jamestown Exposition on Saturday, leaving Washington Friday night. It is expected also that arrangements will be made to visit the National Bureau of Standards in Washington during the convention.

Following the plan of last year there will be an exhibition of electrical apparatus by associate members. For this purpose the large ballroom of the New Willard, having a floor area of nearly 10,000 square feet, has been secured. This room is on the same floor with the hall in which the delegates will convene. The exhibition hall has been laid out into 78 sections, as shown on the accompanying plan. Public attendance and interest promise to be so great, in the judgment of the management of the New Willard, that it has been proposed to issue through various agencies special admission tickets for attending the exhibition. L. E. Sinclair, Fourteenth and East Capitol streets, Washington, is chairman of the exhibition committee. Walter Neumuller, 55 Duane Street, New York city, is vice-chairman. Many of the members will show working exhibits. The exhibition committee has arranged for electrical decorations for the hall at a cost of $1,500. Following is a list of the names of exhibitors:

Standard Vitrified Conduit Company, New York; Franklin Electric Manufacturing Company, Hartford, Conn.; Pittingill-Andrews Company, Boston; Philadelphia Electric and Manufacturing Company, Philadelphia; Southern Exchange Company, New York; John L. Gleason, Boston; C. W. Lee Company, Newark, N. J.; Federal Electric Company, Chicago; Crocker-Wheeler Company, Ampere, N. J.; Fibre Conduit Company, Orangeburg, N. Y.; American Electric Heater Company, New York; Dearborn Drug and Chemical Company, New York; M. O. Publishing Bureau, New York; Electric Storage Battery Company, New York; H. W. Johns-Manville Company, New York; Pittsburg Transformer Company, Pittsburg; Electrical Review, New York; Oneida Community, Ltd., Oneida, N. Y.; American Instrument Company, Philadelphia; N. Y. Beck Lamp Company, New York; Fort Wayne Electric Works, Fort Wayne, Ind.; Weston Electrical Instrument Company, Newark, N. J.; Curtis Advertising Company, Detroit; National Electric Lamp Association, Cleveland; Western Electric Company, Chicago; Simplex Electric Heating Company, Cambridge, Mass.; General Electric Company, Schenectady, N. Y.; Pope Motor Car Company, Indianapolis; Westinghouse Companies, Pittsburg; Crouse-Hinds Company, New York; Jandus Electric Company, Cleveland; Electrical World, New York; Allis-Chalmers Company, Milwaukee; Wagner Electric Manufacturing Company, Philadelphia; Harold P. Brown, New York; Standard Paint Company, New York; Metropolitan Engineering Company, New York; Dossert & Co., New York; W. J. Barr Electric Company, Cleveland; Francis Raymond (Sheldon School), Chicago; National Electric Supply Company, Washington; Telelectric Music Company, New York.

ARTHUR WILLIAMS, PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.



MAP OF WASHINGTON, SHOWING POINTS OF INTEREST.

Transportation arrangements include special trains from New York and Chicago and reduced rates from other points. The New York train will run from that city via Central Railroad of New Jersey and Baltimore and Ohio Railroad, leaving foot of West Twenty-third Street at 8:50 a. m. (Liberty Street, 9 a. m.), on June 3d, passing through Philadelphia and Baltimore and arriving at Washington at 2 p. m. George F. Porter, master of transportation, 29 West Thirty-ninth Street, New York, can give further information.

The Chicago "special" will run over the Pennsylvania lines. It will leave the Union Station on Sunday, June 2d, at 3 p. m., and will arrive in Washington about noon on the next day. The train will run via the Fort Wayne route, passing through Fort Wayne, Lima and Pittsburg. The Pennsylvania train is known as the official train. Arrangements for it were made by Frank L. Perry, 507 Marquette Building, Chicago, assistant master of transportation. Requests for sleeping-car space on this train must be addressed to the Pennsylvania city ticket office in Chicago, 248 South Clark Street, or C. L. Kimball, assistant general passenger agent.

A rate of a fare and one-third, on the certificate plan, has been secured from all points in territory of New England Passenger Association, Trunk Line Association (except points in West Virginia), Southeastern Passenger Association, Southwestern Excursion Bureau and the Eastern Canadian Passenger Association for those attending the Washington convention.

Washington is naturally well supplied with hotels. Headquarters will be at the New Willard, but the hotel committee has made a schedule of hotels with rates ranging from $1 to $7 a day on the European plan, depending on the hotel, the size and location of the room and whether with or without bath. E. S. Marlow, 213 Fourteenth Street, Washington, is chairman of the hotel committee, and E. E. Bondy of 55 Duane Street, New York city, is vice-chairman.

An innovation at this convention is the advance registration. Members expecting to attend are asked to register in advance by mail, using cards provided for the purpose. A badge giving the member's name is then provided. Miss Edith M. Myers, 55 Duane Street, New York city, is in charge of this interesting and important feature.

The preparations for this convention, which looms so large in advance, represent the untiring effort of a number of persons. Chief among these, of course, is Arthur Williams of the New York Edison Company, the president of the association, who possesses administrative ability of a high order and who has planned broadly and labored unceasingly for the success of the convention. Co-operating with him have been the officers of the association, including the members of the executive committee. Vice-presidents Farrand of Newark, N. J., and Dow of Detroit, Secretary Eglin of Philadelphia and Miss Harriet Billings of New York, the assistant secretary.

Much of the work has fallen on the committees. The general convention committee is made up of Dudley Farrand, chairman; W. C. L. Eglin of Philadelphia, General George H. Harries of Washington, John Martin of San Francisco, H. L. Doherty of New York, L. A. Ferguson of Chicago, Alex Dow of Detroit, Samuel Scovil of Cleveland, C. L. Edgar of Boston and F. W. Frueauff of Denver.

The programme committee consists of Arthur Williams of New York, H. W. Fuller of Washington, and J. Robert Crouse of Cleveland. An especial word of praise is due Mr. Crouse for his remarkable work in arranging the New-business Day programme and in increasing membership.

Space will permit the naming of only the chairmen and vice-chairmen of convention committees that have not been already mentioned: Reception, General Harries; entertainment, H. W. Fuller; advertising, Cyril Nast of New York, chairman, and George P. Mangen of Washington, vice-chairman; engineering plans, Philip Torchio of New York; automobiling, J. M. Stoddard of Washington.

Electric Smelting of Iron.

Dr. Haanel, Dominion superintendent of mines, in a report to the minister of mines respecting the thermo-electrical experiments carried on by him at Sault Ste. Marie for smelting of iron ores by electricity, states that a 10,000-horsepower plant capable of producing 120 tons of pig iron per day of 24 hours would cost $700,000, and that, allowing for interest and depreciation of plant, the cost of smelting would be $2.43 a ton. Adding the cost of ore, charcoal, labor, electric energy and other running expenses he estimates that a ton of pig iron could be made for $10.69.

The electric smelting works now being erected at Welland, Ont., are expected to produce from 35 to 40 tons of pig iron a day.

The report lays much stress upon the possibilities of developing Canada's many iron deposits by means of waterpowers which are to be found throughout the Dominion, pointing out that many waterpowers exist in both the provinces of Ontario and Quebec which are surrounded by iron ore fields but in localities ill-adapted for the application of electric energy for any other purpose and which could be developed to furnish an electric horsepower for from $4.50 to $6. With such a price for the energy required, the small consumption of electrode, the cheapness of the ore employed and the peculiar excellence of the iron produced, electric smelting of iron ores in Canada in properly constructed furnaces, using charcoal or peat coke made from Canadian peat bogs which exist everywhere and of enormous extent, may be pronounced commercially feasible.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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DATES AHEAD.

International Independent Telephone Association (annual convention), Auditorium Hotel, Chicago, June 4th, 5th and 6th.

National Electric Light Association (annual convention), New Willard Hotel, Washington, D. C., June 5th to 7th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society (first annual convention), Boston, week of July 28 August 3, 1907.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

IN THE HISTORY of the American Institute of Electrical Engineers the annual meeting held last week will be notable for the adoption of the new constitution. This is an important step for the Institute and one which has commended itself to the wisdom of an overwhelming majority of the members. The old constitution was outgrown, although it had been amended several times, and with fundamental law adapted to its present-day needs the society can do its work better. One excellent feature is the recognition of the importance of the local branches, with an extension of the home-rule principle. The Institute, with over 4,500 members, is now a very large society—too large in a country like the United States to have as its base of support merely the narrow confines of Manhattan Island. It should touch the soil at other points, and this it does by means of the local branches, to which, rightly, attention and deference are paid. The new president, Mr. Henry G. Stott, is superintendent of motive power of the Interborough Rapid Transit Company of New York city, and is an engineer of capacity and experience who has paid especial attention to electric-railway problems. He takes the helm when the Institute is better housed, larger and more influential and prosperous than ever before. With Mr. Ralph W. Pope remaining as the executive officer of the society the prospects are bright for another successful year.

WITH ITS 79 papers, addresses or committee reports the programme prepared for next week's convention of the National Electric Light Association at Washington is a formidable one. It will be interesting to make a little calculation to see how much time can be devoted to each paper and its discussion. Excluding Dr. Steinmetz's evening lecture, there are seven sessions scheduled. Each of these will not, probably, average more than 2½ hours after deducting time taken out for routine business, announcements and the like. This means 1,050 minutes for the presentation or reading or abstracting and discussion of 78 papers, or an average of 13½ minutes for each. Obviously, it will be impossible to give a summary of an important paper or report and discuss it in such a short time, even if the three-minute or five-minute rule is strictly enforced, which is a difficult thing to do, especially among unpracticed debaters. Of course some papers and reports will pass without discussion and some will be read merely by title; but as the list of subjects is brimming over with good material, nothing trivial having been placed on the programme, it will be a hard task to go through the list and give due attention to all the varied entries. The very efficient programme committee has done its work so well that the convention is threatened with an embarrassment of riches, and it is to be feared that the full and free interchange of ideas which is the most valuable feature of a technical convention may have to be curtailed or omitted in many instances.

But nevertheless a wealth of material will be presented, even if time for discussion is lacking, and this will be available after the convention, in part through the columns of the technical press and later in full in the printed Proceedings. The Western Electrician for its part hopes to make some reference to every feature on the programme and to give abstracts of many of the papers and discussions in succeeding issues. We are sure we voice the sentiments of all our readers in thanking the National Electric Light Association and its energetic administration for the opportunity of doing so. The contributions presented at the convention will thus have a far wider audience than could be secured at any convention. This not only enhances the prestige of the association but is to the distinct advantage of all engaged in the art.

The length and character of the programme reveal the extent and variety now exhibited by the business of supplying electric light, heat and power. These are the days of big things in the electrical industry, including big conventions and long programmes. Perhaps the day is coming when, as in the case of the street-railway association, there will be a parent society and subsidiary organizations—say one to consider questions of policy and legislation, one to take up engineering topics and a third to discuss the selling end—in the electric-light field. Be that as it may, the immediate prospect is that the Washington convention of the National Electric Light Association will be the greatest in the history of that organization, and we congratulate the president, Mr. Arthur Williams, and his able coadjutors on that prospect.

MR. FRANK J. SPRAGUE is rightly regarded as the father of the electric railway in the United States; no other man is so clearly entitled to that honor. Whatever he sets forth deliberately on the subject of electric-railway development is sure, therefore, to be an important contribution to the literature of the subject. It follows that much attention will be attracted by his Institute paper of last week, "Facts and Problems of Electric Trunk-line Operation," abstracted elsewhere in this issue. Mr. Sprague is a thorough believer in the electric railway, of course, but he is not visionary; he tempers his enthusiasm with prudence. He says that the financial factor is largely the determining factor in the proposed change from steam locomotives to electricity on trunk-line railroads. There is, however, an important qualification:

"But it is especially to be noted that while fuel economy, not only in the matter of power generation but also as affected by its own transportation (often a most serious matter), must be kept in view, the keynote of the prophecies of the future is more specifically sounded in the word *capacity.* It is this fact which must be always borne in mind. Increase of capacity, not only such as is possible and individual to electric application, but also such as is common to the larger development of railroads, however operated, means, of course, economy in its highest sense, that is, saving in passenger and ton-mile operation, assuming that traffic increases at least in proportion to capital account, because of increased loads, reduced train crews, higher operating schedules, better distributed service, less dead time on sidings, less interruptions to schedule and greater freedom from accidents. I believe that this question of capacity will be a far greater controlling factor in the electrification of trunk lines than that of economy as narrowly measured by the cost of electrical horsepower."

Mr. Sprague epitomizes certain conclusions to which he has arrived as the result of his long study of the whole subject, and these are given in the abstract of his paper presented on another page. He says that electricity is no panacea for railroad ills. "There are roads which can now properly consider the adoption of electricity. There are others which by no stretch of imagination can seriously consider it for many years to come." The author gives an elaborate comparison of various types and applications of apparatus—motors, electric braking, working conductors, relative potentials, motor and locomotive construction, train control, transformers, general cost and the like. He deprecates a hidebound advocacy of either direct current or alternating current for all railway purposes, although he does not surrender his well-known liking for the direct-current system under many conditions. To quote again:

"It seems to me that the present principal hope of usefulness of the single-phase system is on roads of considerable extent which operate an irregular and sparse traffic, and where only a moderately expensive, or what may be called a second-class overhead construction, which will keep down the ratio of line investment to that of the balance of equipment, is tolerable. As one departs from this condition, adopts more permanent construction and faces the problems of denser traffics and higher capacities, any advantages of the single-phase system will disappear and a superiority of the direct-current equipment, with such improvements as are in sight, become manifest. But whatever may be the future of single-phase operation under the conditions stated, any present claim for it as the preferable equipment for congested service demanding high schedules and great capacity is not worth a moment's thought, for in this field, at least, it cannot touch the direct-current system."

The whole paper is extremely instructive, and we regret that the exigencies of space will not allow us to give more of it. An abstract of the illuminating discussion that followed it is also given elsewhere.

CHICAGO HIGH-TENSION TRANSMISSION MEETING.

High-tension transmission was the subject for discussion at the special meeting of the American Institute of Electrical Engineers in the Auditorium Hotel, Chicago, on May 24th. It was the largest meeting ever held by the Chicago branch, about 200 being present when the meeting opened at 9 o'clock in the morning. Besides the value of the discussion those present enjoyed the hospitality of the local committee extended in the form of a tasteful dinner in the palm room of the auditorium, and later there was a lake trip and inspection tour to the large new hydro-electric plant of the Grand Rapids and Muskegon Power Company on the Muskegon River in Michigan.

The whole event from the opening of the meeting on Friday morning to the return of the steamer Puritan on Sunday morning was highly profitable and greatly enjoyed by all. To Messrs. P. B. Woodworth and George A. Damon of the local committee, Mr. P. M. Lincoln of Pittsburg and Mr. F. E. Greenman of the power company is due much credit for the success of the meeting and excursion.

Prof. P. B. Woodworth of Lewis Institute, Chicago, secretary of the local branch, called the meeting to order on Friday morning, and after a few remarks in which he called attention to the series of meetings arranged by the transmission committee of the Institute, introduced P. M. Lincoln of Pittsburg. Mr. Lincoln took charge of the discussion in place of Ralph D. Mershon of New York, chairman of the high-tension committee, who was unable to attend on account of an attack of tonsilitis.

Discussion of high-tension problems was based on five papers, as follows: "Relative Merits of Three-phase and One-phase Transformers," by H. W. Tobey of the General Electric Company; "Relative Advantages of One-phase and Three-phase Transformers," by John S. Peck of the British Westinghouse Company; "Potential Stresses as Affected by Overhead Grounded Conductors," by R. P. Jackson of the Westinghouse Company; "Forced Oil and Forced Water Circulation for Cooling Oil-insulated Transformers," by G. C. Chesney of the Stanley Electric and Manufacturing Company; "Open vs. Enclosed High-voltage Station Wiring," by F. O. Blackwell of New York. The papers and discussions were not presented as covering the whole field of the subjects discussed, but brought out the salient features on which differences of opinion might exist. Messrs. Tobey, Peck, Chesney and Blackwell were not present and their papers were read respectively by W. S. Moody, J. W. Farley, C. W. Stone and Mr. Moody. The first two papers being on the same general subject were discussed together.

Following is an abstract of some of the papers and a synopsis of the discussion based upon them:

Relative Merits of Three-phase and One-phase Transformers.

BY H. W. TOBEY.

During the last few years there has been a gradually increasing tendency in this country toward the use of three-phase transformers on three-phase circuits instead of groups of three, or in some cases two, one-phase units. In this country particularly there is a strong feeling among many engineers in favor of single units. This feeling is probably due in part to the feeling that if one transformer in a group gives trouble it can be readily removed and replaced by a spare, or if no spare is at hand the load can be carried by the remaining two, if delta connected; whereas if one phase of a three-phase transformer gives out the entire transformer is rendered useless. Where the plant is small this feeling is more or less justified on account of the fact that an extra three-phase transformer because of the additional expense would be out of the question, whereas the cost of an extra one-phase transformer would not be serious.

Where the plant is fairly large the saving in cost introduced by installing three-phase units makes possible the providing an extra transformer for reserve. Moreover, if no reserve is available it is possible in the case of shell-type transformers at least to take an injured phase out of commission and operate the remaining two phases in open delta until the necessary repairs can be made. This is done by means of an arrangement recently announced, in which both primary and secondary windings of the injured phase are cut out and short-circuited on themselves. As mentioned, this method applies only to shell-type transformers connected delta, primary and secondary.

As to initial cost, the three-phase transformer has a distinct advantage. In addition to the initial cost there is also a saving in material and labor incurred in connecting up the transformer for service. For installation the total amount of cable required is less, the connections are simpler and consequent danger of error less with the three-phase transformer than with several one-phase transformers. The expense of isolating compartments is also much reduced.

While general appearance is not necessarily a controlling feature, the three-phase transformer with its simple connections would look neater and more symmetrical than would three one-phase units. A saving of at least 30 per cent. can be attained in floor space with the three-phase, and usually its height is somewhat less than that of the one-phase unit.

As regards regulation, neither system can claim an advantage. In the question of handling the choice would be in favor of one-phase units on account of their decreased weight and dimensions.

In small transformers suitable for pole suspension the advantages of the three-phase transformer are emphasized in appearance and reduction in weight.

In general the two systems may be summed up as follows: Where the plant is of small or medium size, the facilities for handling limited and the floor space not an important feature, groups of one-phase transformers would, without doubt, be adopted. For large plants, however, having ample facilities for handling, and particularly where floor space is a question of importance, the three-phase type would be most suitable.

Relative Advantages of One-phase and Three-phase Transformers.

BY JOHN S. PECK.

In considering the relative advantages of three-phase and one-phase transformers it will be assumed at the outset that the three-phase transformer is to be compared with a group of three one-phase transformers whose aggregate output is the same as that of one three-phase transformer; for it will be admitted at once that a comparison between one one-phase transformer and one three-phase transformer of the same output would be all in favor of the one-phase transformer.

On this assumption the advantages of the three-phase transformer over the one-phase group are as follows: (1) Lower cost; (2) higher efficiency; (3) less floor space and less weight; (4) simplification in outside wiring; (5) reduced transportation charges and reduced cost of installation.

The disadvantages are: (1) Greater cost of spare units; (2) greater derangement of service in the event of breakdown; (3) greater cost of repair; (4) reduced capacity obtainable in self-cooling units; (5) greater difficulties in bringing out taps for a large number of voltages.

A three-phase transformer should always be cheaper to manufacture than three one-phase transformers of the same total output; for by combining one-phase units into a three-phase unit there results a considerable saving in active material due to the magnetic phase relations. Also there is only one containing case, one set of end-frames, one cooling system, etc., to be provided for the three-phase unit. There is always less labor cost in manufacturing one large unit than there is in manufacturing several smaller units for the same total output.

Since there is less active material in the three-phase transformer than in the one-phase group the loss at the same densities will be less, and therefore the efficiencies higher, consequently the total radiating surface required may be less.

The lighter weight and less bulk of the three-phase transformer will, in general, result in reduced transportation charges, especially where shipment is made by water. In many foreign countries duties are charged according to the weight of material, but whether duties are charged according to weight or price, the advantages are with the three-phase transformer. In general, it will be cheaper to install one large unit than three small ones.

It is obvious that any three-phase unit having three times the capacity of a one-phase unit will cost considerably more. This may be of some importance where there is but one three-phase unit, but it will be found that in many cases the cost of two three-phase transformers with a total capacity of 200 per cent. will be but little more than that of four one-phase transformers having a total output of 133 per cent.

When three one-phase transformers are connected in delta on both high and low-tension windings, one of the three may fail and be cut out and the remaining ones will continue to carry about two-thirds the total load without overheating. With the star connection on either winding, this cannot be done. A three-phase core-type transformer cannot be operated with a short-circuit on any phase. The three-phase shell-type transformer may be operated, however, with a short-circuit on one-phase, provided both windings are in delta; but while this may be used as a temporary expedient for carrying partial loads, the whole transformer must be removed eventually for repairs.

With three one-phase units it is probable that in the event of breakdown in one, it will be cut out before the others are damaged. With a three-phase unit, where the phases are so near together, there is the possibility that a breakdown in one phase may damage one or both of the others.

In some cases it is highly desirable to use only self-cooling transformers. Fifteen hundred kilowatts is approximately the maximum size of three-phase transformer that with present methods of construction can be made self-cooling. A group of three one-phase self-cooling transformers can be built with an output of two or three times this amount. Thus, if an output greater than 1,500 kilowatts is required, it will be necessary to use two three-phase transformers, a more expensive arrangement than three single-phase transformers.

To sum up, it may be said that the three-phase transformer has certain real and positive advantages over the one-phase type, while its disadvantages are chiefly those which result in the event of breakdown—an abnormal condition which occurs at rarer and rarer intervals as the art of transformer design and manufacture improves. It is the writer's belief that, as on the Continent, the three-phase transformer has already superseded the one-phase in most cases, so in America and Great Britain the use of the three-phase transformer will show a very rapid increase within the next few years.

It is also the writer's opinion that a three-phase core-type transformer having as good or better performance than the shell type can be built for less money. This, together with the fact that the core type can be repaired so readily, makes it more desirable than the shell type.

ENGINEERS ATTENDING HIGH-TENSION TRANSMISSION MEETING IN CHICAGO.

Discussion.

A. H. Pikler of the Crocker-Wheeler Company said that on the Continent, soon after its introduction, the three-phase transformer rapidly gained ground and preference over the one-phase transformer, while its development in this country was very slow, and, until quite recently, the installation of three-phase transformers was very rare. This, he thought, was generally ascribed entirely to technical causes; but he believed the chief cause was the patent situation. He then compared the claims of the Tesla and Dobrowolsky transformer patents and said that while in Europe all the inventions connected with "shifting poles" or rotary magnetic field were ascribed to Galileo Ferraris, and those of Tesla were declared anticipated by his publications, here they were held valid. Since the latter inventions were in the hands of one or two companies the three-phase transformer was a monopolized article, and everybody attempting to manufacture it was promptly prosecuted. Moreover, after the expiration of the Tesla patent on May 1, 1905, the Dobrowolsky patent was still considered basic. It expired only recently, on March 4, 1907. It is a simple matter, the speaker said, to prove that one three-phase transformer is lighter, more efficient and of lower cost than the aggregate of three one-phase transformers of the same capacity. The total net profit earned by the manufacturer on three single-phase transformers is more than that earned on one three-phase transformer. The auxiliary apparatus, switchboard, instruments, wiring, etc., are more complicated, are a greater bulk and insure a greater output for the manufacturer than those in connection with one three-phase transformer. Since, finally, there was absolutely no competition in the three-phase transformer line, on account of the patent situation, this line he thought was neglected and did not develop. Mr. Pikler did not think that it will take more than two or three years for the three-phase trans-

formers to take the lead. As regards technical and engineering features, he agreed with Mr. Tobey and predicted that small sizes of three-phase transformers, as low as three kilowatts, will soon be common. Mr. Pikler was gratified to see in Mr. Peck's paper the recommending of the core-type transformer with butt joints.

P. Junkersfeld of the Chicago Edison Company in a written contribution said that a decision as to the use of three one-phase or one three-phase transformers should necessarily take into consideration all local conditions. In a small system, or in any system in which the total number of units are few, the "greater cost of spare units" and "greater derangement of service" often throws the balance in favor of three one-phase transformers. However, the troubles with or breakdowns of three-phase transformers have perhaps been less than is generally supposed. The Chicago Edison Company had in service on May 1, 1907, about 42,000 kilowatts of three-phase transformers, which type it has installed exclusively in connection with rotary converters during the last six years. The one-phase transformers installed previously for rotary converters aggregate about 8,000 kilowatts. The company also has in service as step-up and step-down transformers for generators or lines, a total capacity of about 6,000 kilowatts. In reviewing the 10 years' experience in which the one-phase transformer capacity has grown to 14,400 kilowatts and the six years' experience in which the three-phase transformer capacity has increased to 32 units varying in size from 550 to 2,200 kilowatts, and aggregating 42,000 kilowatts, the company has found that the total number of "troubles" where transformers have been taken out of service have been less with the three-phase than with the one-phase transformers. In fact, there were only two cases worthy of notice with three-phase transformers, and even in these the damage was not serious. The one-phase transformers varied in size from 100 to 500 kilowatts, some oil-cooled and some air-blast. The three-phase transformers were not adopted until the system was so well developed that a great multiplicity of taps were no longer necessary. In small and often uncertain undertakings and in pioneering or extraordinary extension work there are cases where three-phase transformers should not be used. The advantages of three-phase transformers are, however, so great and the results obtained, both where used in this country and in Europe, are so good that the use of three-phase transformers merits the most careful consideration in every case.

R. F. Schuchardt said that the experience of the Chicago Edison Company has been of such a nature as to fully justify the decision made six years ago to adopt only three-phase transformers. Where the installation is connected to an overhead line or where the units are small in number the situation is perhaps different. He referred to the Edison installation, where the system is very large and underground lines throughout. An individual unit being only a very small per cent. of the total, the expense is very small and the saving will more than offset this. Breakdowns of the three-phase are so very seldom that one can very well afford to take the risk, especially in view of the advantages. The company does not avail itself of the delta connection with primary and secondary; in fact, it has them star-connected.

C. W. Stone of the General Electric Company spoke of the small unit for pole work, which he thought is one of the places where three-phase transformers are particularly well adapted. Poles are always crowded for space and the smallest unit that can be got for the maximum output is needed. That means the three-phase transformer. For underground circuits in manholes the three-phase transformer is particularly good, because the connections are so much simpler, and the trouble in the manholes comes principally from a poorly made connection. In a three-phase transformer you have fewer of them and therefore less chance of poor work. In large-sized units in large stations, Mr. Stone said, the question is not so much the question of cost of spare unit as it is the question of the design of the station. Frequently transformers are left until the last thing. The transformers and the switchboards are always left until after the station is designed, and then one has to tuck them away in some corner. Therefore the question is reliability. The extra cost of spare apparatus, etc., does not come into the question at all. It is a question how much can be got into the smallest possible space. There again the three-phase unit is preferable. As far as reliability is concerned and the cost of repairs, the total percentage of breakdowns and the total necessity for repairing is so small that the speaker did not think that it ought to come into the question at all. The three-phase transformers do not burn out any more than the single-phase. In fact, the burnouts are so few that we can disregard them entirely. There was a question in Mr. Peck's paper about operating the three-phase transformer with a Y-connected secondary, stating that with the delta connection one could operate with one phase cut out and operate the other two on open delta. This, Mr. Stone said, is also being done in many places with the Y connection, using the ground return where the system is grounded. This has happened in a number of cases, where three-phase units are installed and one of the lines has broken down, and with a grounded neutral all the rotary apparatus and similar apparatus has gone on operating without the sub-station man knowing that the main line was out until it was reported from the outside.

Walter S. Moody thought it quite natural that American practice, with its strong appreciation of the desirability of simplification and standardization of design and construction, should for a long time have neglected the saving in cost, simplicity, etc., resulting from the use of three-phase transformers and use single-phase exclusively. As the volume of transformers manufactured increased, however, the force of these considerations largely disappeared, due to the fact that larger transformer makers had such a large output that the cost of manufacturing a given capacity of both single and three-phase transformers would not be appreciably greater than making the same capacity of single-phase transformers only.

While undoubtedly American desire for simplicity and interchangeability retarded more than it should the use of the three-phase transformer, Mr. Moody has strongly advocated their use for six or seven years, and has designed and built some 450,000 kilowatts, ranging in size from five to 7,500-kilowatt units. Concerning the relative advantages of the core or shell-type construction as applied to three-phase transformers and with reference to the ease with which repairs may be made on the core type, Mr. Moody thinks the European practice of a removable yoke is sufficiently objectionable to offset its advantages. Bolts in a transformer core are always a source of danger, in that the insulation around them may become charred or otherwise damaged, thereby greatly increasing the eddy-current losses. The butt joint between the yoke and the rest of the core can only be satisfactorily made if the surfaces that are to come in contact are milled or otherwise finished to a true surface. If the surfaces are not finished, or even if they are, the eddy current between the sheets in the two parts of the core may readily be sufficient to cause the welding together of the laminations that Mr. Peck mentions. The labor involved in removing the yoke, if it be interleaved with the rest of the structure, is not as great as might be supposed. The speaker mentioned an instance of such a yoke on a 500-kilowatt transformer being removed and returned to position in 50 minutes. The likelihood of a burnout in one phase being communicated to adjoining phases is quite common in case of a bad short-circuit in the core-type construction, but the speaker never knew it to happen in the shell type, as the large body of iron between the phases protects the copper in different phases, except that portion that projects beyond the cores, and at these points it is easy to put in a fireproof barrier. Consequently, the somewhat greater ease with which the core type may be repaired is largely offset by the fact that the damage is likely to be less restricted in its extent than in the shell type.

W. B. Jackson of Madison, Wis., referred to a statement in Mr. Peck's paper to the effect that for important work single three-phase transformers are used in Europe. He questioned whether in America for what would be considered important power work one should be willing, even with the present design of transformers, to use a transformer without some reserve. The time is approaching when the question of reserve is not so important as it was a few years ago, and when we can use possibly a single transformer without reserve in cases where service is not so very important. But to take a condition of furnishing light for a small town, a reserve must be provided. For almost all classes of service one must always have an arrangement by which a portion of the apparatus can be knocked out of service and still the service will go on. It may go on in a crippled condition, but the service will not be shut down.

Five years ago, in talking to one of the prominent engineers of Austria, discussing the matter of the use of three-phase transformers for transmission and the matter of using the single-phase transformers, the Austrian was unable to see any possible reason for the use of single-phase transformers, and Mr. Jackson was unable to convince him that there was a single reason for the use of the single-phase as against the three-phase transformers until he took up the matter of the lightning troubles common in America. Then he was entirely willing to admit that it was highly desirable to have the single-phase transformers, or at least to have some arrangement by which a part of the apparatus could be put out of service by accident and another piece of apparatus put in its place without in any way disturbing the service.

Speaking of leads, Mr. Lincoln said that in very high-voltage transformers, say, 60,000 volts and above, it is one of the most difficult elements of the design to bring out the leads properly, and where it is a question of bringing out three leads for 60,000 volts instead of one, as is the case with a grounded Y transformer, or two, as is the case with a single-phase transformer, to work in delta, he believed the difference is quite considerable, and that the difficulty of bringing out those three leads in the case of the three-phase transformer as against the one or two leads in the case of the single-phase transformer is a question to be taken carefully into consideration. That objection applies only to the very high voltages. Even with two leads brought out, practically all the available space is taken up by the two leads which it is necessary to bring out of the case.

In case of lightning or a similar trouble where a single transformer is cut out, Mr. Lincoln said that if we have three transformers connected in delta it is possible to go ahead and do business on two of them remaining in. However, when that occurs, either there must be an interruption to the service in order to cut out the damaged transformer or have automatic apparatus such as reverse-current relays or something of that kind, to cut out the damaged piece of apparatus automatically. Reverse-current relays, theoretically, can be so constructed as to cut out the damaged piece of apparatus and let the other two go on and do business. However, the speaker's experience with reversed-current relays and such apparatus led him to be rather doubtful whether in actual practice such a scheme will work. When one gets a short-circuit on these high-tension lines, with the tremendous amount of power behind a synchronous apparatus on the ends of the line, there are surges going on in that system of which little is known, and Mr. Lincoln considered it rather doubtful whether or not a system of automatic disconnecting apparatus can be arranged so as to take care of cutting out one of a bank of single-phase transformers connected in delta when one of them gets into trouble.

There is a very decided difficulty in bringing out the leads of a high-tension transformer, said Mr. Stone, and there again the three-phase transformer comes in, because, he said, we only bring out three leads as against six in three single-phase transformers, and wherever we pass through a case there is a weak point. It means we have to pass through an insulator. That is a weak point. We have six weak points on three single-phase. We only have three weak points on the three-phase. Mr. Stone's remarks applied to delta connection.

Edward A. Wagner of the Fort Wayne Electric Works called attention to the practice of a good many stations in this country of having three-phase generators and distributing mixed loads, that is, motors and light. Where they distribute light the distribution is scattered, so that it would not pay to put in a three-phase transformer to furnish the light. In such cases the single-phase transformer is far more desirable, because the excessive copper required for running the secondary line would more than offset the advantages of the three-phase transformer. Mr. Wagner believes that the three-phase transformer is more efficient than three single-phase transformers combined, but there are other cases where the operation may possibly determine the necessity of installing single-phase transformers.

To the point of Mr. Moody that the disadvantage of the core-type transformers with butt joints is that the insulation around the bolts might get damaged, Mr. Pikler replied that if the transformer is manufactured right this will not bother, and there are many manufacturers who do not have any difficulties on that score. The decreasing of the eddy currents is not done by interposing a sheet of paper between the yoke and between the lags, but by interposing paper between the sheets of the yoke itself or between the laminations of the lag. As to the increase of the magnetizing current, Mr. Pikler thought, in a shell-type transformer, other things being equal, it is a good deal higher than in a core-type transformer where the surfaces are carefully milled, because the magnetic reluctance in a shell-type transformer—on account of the flux, the lines of force traveling from one plane to the other, and so on, or from one plate to the adjoining plate in the same plane—is much greater than in a core-type transformer with butt joints. In general, he said, the core-type transformer with the butt joints is a great advantage to the customer, because it enables him to repair a transformer in a very short time. It is necessary to put very heavy insulation between the coils, between the high-tension and low-tension coils, and the disadvantage of that is that if you have a good insulation you have retained within the coil the heat which cannot radiate, and in a core-type transformer, between the high and low-tension coils, there is an open duct all around the coils and always circulation. This is not the case in the shell-type transformer. In the shell-type transformer coil, Mr. Pikler said, on the top and bottom of the coil there are quite sharp corners, and at the same point there is the support of the coils, and from this it can be seen that at the very point where the construction is mechanically the weakest, it is also electrically, and it is also weak from the point of heating.

E. N. Lake of Chicago thought that, irrespective of minute details of manufacture, all could agree upon the use of three-phase transformers in large distributing systems consisting of a large number of sub-stations interconnected by means of underground circuits. But when it comes to the use of these transformers for a line like a railroad, in which there is a long string of sub-stations any one of which is quite essential to the operation of the line, the danger of interruption to the service would probably be greater in the case of a three-phase transformer than of three single-phase transformers. In a line some 35 or 36 miles in length having three sub-stations, each equipped with three single-phase transformers, each operating a single

rotary, one spare transformer was provided. During lightning or other disturbances to the system, where these transformers went out, it was possible to operate with 60 per cent. of the transformer equipment.

In a written contribution to the discussion, K. C. Randall of the Westinghouse company said that for quite small units, up to approximately 100 kilowatts, or even larger, where interruption may be tolerated, the three-phase unit will doubtless show well. Where the units are larger and isolated, and especially where continuity of operation is of prime importance, three single-phase units will probably show better in three-phase work. As sizes of 1,000 kilowatts and larger are approached, the three-phase units again come to the front, especially as to installation costs.

As to handling, when the station is new, during the course of construction provisions may be made for lifting nearly any size unit which it may seem desirable to install; therefore, the choice of the single-phase unit is not necessarily an essential consideration. If a large growth of power business is contemplated, and if at first it is desirable to install but one or two of the future six or eight units, it may be advisable to use the three-phase units irrespective of their size. If the station be an old one, it will probably be desirable to adhere to the already selected type of unit, unless the original choice has been subject to improvements, which would warrant the selection of different units. This would mean two different types within the same station, or upon the same system, and probably sacrifice the feature of interchangeability.

The failure of a three-phase transformer or of one of a group of single-phase transformers is about of equal significance in its bearing upon shutdown. In either case if operation is delta-delta, switches may be so arranged that the transformer on the faulty phase may be cut out, the remaining two transformers operating in V to carry a portion of the load. This applies equally well to the single-phase or three-phase units. Shell-type transformers are here contemplated. A failure in any phase of a core type will put the transformer out of service unless the faulty phase can be opened and isolated. If operation were star on either end, then operation could not be continued until the unit was repaired or replaced. The cost of the three single-phase units with a spare may be called 400 per cent.; and the cost of two equivalent three-phase units 500 per cent. The cost of two groups of single-phase units, that is, six transformers, will be 600 per cent. As a matter of fact, it is doubtful if the two three-phase units will actually cost any more than the four single-phase units when they are finally installed, wired up, water piping completed and ready for operation, the single-phase unit being arranged so that any three may operate in a bank, and the three-phase units being arranged to operate singly or in parallel, as may be desirable. It should not be lost sight of that the three-phase units have a capacity of 200 per cent., while the four single-phase units have a capacity of but 100 per cent., it being impracticable to operate more than three at a time.

It would then appear that for good-sized units, say, 1,500 to 2,000 kilowatts, in stations where considerable power is to be used and a continual growth of business is expected, it will frequently be advisable to employ three-phase units rather than single-phase, as in this way complete new units may be installed one at a time to much better advantage than if single-phase units were used in groups of three. The three-phase unit being the heaviest, it will generally be more difficult to handle, particularly in the case of old stations where crane facilities are very limited; yet it still may seem advisable to install the three-phase unit, making a special effort for this purpose. Side tracks are now quite generally found near most stations, so that the purely transportation consideration is pretty well taken care of.

There is a tendency toward shipping transformers taken down like large generators. If this is done, the disadvantage of the additional weight of three-phase over single-phase units is small, and it will only require the attention of an experienced man for a number of days to put together the three-phase units on the premises rather than at the manufacturer's works.

J. W. Farley of the Westinghouse company gave his ideas on the subject at some length. He showed that both types of transformers have their particular field and gave a very clear outline of the conditions under which one or the other transformer would show to advantage. Mr. Farley said the subject could not be properly discussed on the basis, "Which is best, a single-phase transformer or a three-phase transformer?" The question should be, "Where is the dividing line between the territory in which the advantages of the single-phase transformer are the greatest and the territory in which the advantages of the three-phase transformer are greatest?"

With regard to the use of three-phase transformers for pole work suggested by Mr. Stone, H. B. Gear of the Chicago Edison Company said that the use of small units in three-phase transformers does not seem to be especially disadvantageous in view of the possibility of using the open-delta system for units up to 25 or 30 horsepower, where the saving gained by two transformers of single-phase instead of three is just about equal or perhaps a little more than the saving made by installing three cores in one case. Furthermore, as far at least as one company is concerned, the prices which it has been able to get for the three-phase units so far show no saving whatever over the three single-phase. Possibly that could be adjusted if those who were interested wished to do so.

As to the larger units above 25 horsepower, where it is customary to use three one-phase transformers where they are mounted on a pole, Mr. Gear said, the disposition of the weight is rather more easily effected where there are three single units than with one unit. A 60 or 75 or 90-kilowatt unit, which would be required for a good many three-phase installations in Chicago, is a very awkward thing as a single unit to set on a pole, unless a platform of some sort is set to one side or a separate pole set and a platform put between them, whereas three 20 or 30-horsepower units can be installed on ordinary hangers by using cross-arms, double arms of a little extra strength, without any platform construction and with no greater expense of erection than would be entailed by the erection of a single unit.

As to the use of underground three-phase units, Mr. Gear thought that the advantages cited by Mr. Stone are undoubted, in that the number of joints in the manhole is reduced, but there is the disadvantage, which is quite material, that a three-phase unit of 60 or 75 kilowatts is so large that special manhole covers must be provided and special construction arranged to get the piece of apparatus in and out of the manhole, whereas with the single unit the transformers, either one which may be damaged, can be moved over and taken up through an ordinary sized manhole cover. The most serious objection, the speaker said, to the use of three-phase units in a large distributing system is the fact that an additional equipment of another type of apparatus must be carried in stock. To any company which is installing and removing every day considerable numbers of transformers for both lighting and power purposes, the question of keeping a full line of all sizes in stock is a matter of considerable importance, and therefore most companies, he thought, have found that the fact that they could use the same kind of transformers for both lighting and power and could carry a line of each size in stock, two or three of each size—enough so that they would have a sufficient quantity for any three-phase installation at any one time or for any lighting installation—has been, perhaps, the principal determining factor.

The regulation of a single-phase transformer, Mr. Pikler said, is better than that of a three-phase transformer. The regulation depends mostly upon the reactance of the transformer. In a core-type transformer the reactance depends upon the length of the lag over which the coils are distributed, and then the relative distance between the coils and the thickness of the coils. In a shell type of transformer it depends again on the dimensions of the coils and the number of subdivisions between the primary and the secondary coils. If we make a three-phase transformer into three single-phase transformers, then we have to use in a core-type transformer, a shell core, and on that score the reactance of the transformer is greater. In a shell-type transformer the dimensions of the coils are bigger, the coils are thicker, and if we would make the dimensions smaller that would mean to increase the magnetic circuit very much, which would be greater disadvantage. So from this, the speaker said, we can see the reactance in both cases is greater and the regulation of three-phase transformers compared with single-phase is worse.

On this point Mr. Wagner said that the combining of three single-phase transformers into one common unit or on to one common magnetic circuit does not affect the reactance of those coils, because the reactance path, due to the leakage in the iron, is negligible and therefore the reactance in the coils, the internal reactance, is due to the area of the path between primary and secondary and also the length and combining of that on a common magnetic structure so as to get a multi-phase magnetic path does not affect the reactance of each separate length, and it should not, therefore, affect the regulation, since the regulation is due entirely to the combination of the resistance and the reactance of the coils, both primary and secondary.

Mr. Pikler said that he referred to one single-phase transformer alone, and one three-phase transformer alone, a single-phase transformer of one-third of the capacity of the three-phase and the three-phase transformer the aggregate capacity of three single-phase.

A communication from A. S. McAllister of New York was read, in which he called attention to the following statement in Mr. Peck's paper: "On account of the phase relations of the currents the capacity of each (V-connected or T-connected) transformer must be 15 per cent. greater than half the capacity of the three-phase transformer, with a corresponding increase in cost and losses. There is another serious objection to this (either the T or V) arrangement, for on account of the out-of-phase relation of voltage and current the voltage across the three phases will not remain balanced as the load comes on." The author's remarks, said Mr. McAllister, are true when applied to the V connection, but they must be somewhat modified when dealing with the T connection. When two transformers are T connected on both their primary and secondary sides, one of the transformers must be designed for 15.5 per cent. more volt-amperes than one-half the rating of the equivalent three-phase transformer, but the other transformer is subjected to exactly one-half of the volt-amperes of the three-phase transformer. If the voltage between the phase leads is E and the current per lead I, the three-phase transformer must be designed for 1.732 I E; one of the T-connected transformers would be designed for I E and the other for 0.866 E I.

Two transformers with T-connected primaries and secondaries will transform three-phase power from one voltage to another without voltage distortion equally as well as two similar transformers used to change two-phase power from one voltage to another; even for unbalanced loads the transformation will be satisfactory, provided only that the transformer with the larger volt-ampere rating be constructed with its primary and secondary coils well interspaced.

W. F. Lamme of San Francisco in a written communication said that the strongest argument against using three-phase transformers instead of single-phase is the one of accident to the transformer, but when the installation of transformers becomes very large so that the number of spares becomes large this argument of accident decreases. Transformers as built today by responsible manufacturers are quite reliable and the chances of breakdowns are, or can be, made remote. In the case of three-phase transformers this reliability can be increased by the use of more careful design and construction and higher insulation tests, and the customer can still purchase his three-phase transformer for less than three single-phase transformers will cost him, and the risk of shutdown in the two cases due to accident to the transformer may be considered equal.

Enclosed Station Wiring.

BY F. O. BLACKWELL.

In the power house of a few years ago, when the amount of power was relatively small, a short-circuit was not a serious matter; but today, with 50,000 or 100,000 horsepower concentrated in one plant, a much higher standard of station wiring is called for.

With a large amount of power the destructive ability of an arc is enormously increased, and the use of high potentials has made it possible for arcs, once started, to jump almost any distance if not confined.

The direct loss of income is large, but this is nothing to the indirect loss due to the depreciation in the selling value of the power output, caused by loss of public confidence in the reliability of the service.

The metal vapor from an arc, even after the current has been interrupted, will often short-circuit conductors at a distance from the point where the arc started. Wires of high-potential circuits which are as far apart as it is possible to have them inside of a building, may be affected by arcs between low-potential conductors beneath them. Lightning striking in the neighborhood of a transmission line has been known to cause a short-circuit after the discharge was over, due to the path of hot gas floating across the wires.

In order to prevent the occurrence of short-circuits, and to localize the damage should an arc start from any cause, the following elementary principles should be observed:

1. The system of connection should be as simple as will give the necessary control over the station.
2. The conductors should follow the shortest and most direct line from generator to transmission line.
3. Each conductor should be surrounded and separated from every other by a continuous fireproof barrier.
4. The circuits should be as far apart as possible.

Enclosed wiring has already become the accepted practice in important low-tension plants of from 2,000 to 15,000 volts, but is not used as generally for higher potential, where the writer believes it is much more important.

Low-potential insulated cables, drawn through ducts or enclosed by split-tile or pipe coverings, are safe, provided care is used to cover the cable joints at the manholes, as a cable joint is a frequent source of trouble.

A single-cable tunnel, or duct system, with common manholes, through which all the cables in a plant run the length of a building, is often employed, in which, if anything goes wrong with one cable, the entire power house is disabled. Accidents of this kind might be avoided by keeping the cables from each unit in a conduit at a distance from other circuits, and laying out the wiring so that each generator can be operated as if it were in a separate power station.

Where bare conductors are used on account of many connections, or where the potential is too high for insulated cables, the wires should be enclosed by substantial walls or barriers of brick, concrete, tile or stone, with only such openings as

are necessary to get at insulators or connections. Covers should be provided for all openings.

DISCUSSION.

C. W. Stone remarked that engineers, to make a system flexible, put in all sorts of tie connections; then in order to save space and cost they put in knife switches. By putting in the knife switches they accomplish just what they are trying to avoid. The knife switch may be opened by mistake. If it is opened under load by mistake there is a big arc which may be whipped across and involve all the adjacent apparatus. Therefore, if possible, try to keep each individual circuit entirely distinct, with no tie, and if ties are used use enclosed switches—that is, all switches in the form of knife switches must be put in between barriers in order to confine the arc. From Mr. Blackwell's paper it is quite evident one cannot confine the arc if an arc at low voltage will jump 40 feet. By placing barriers between circuits the jumping distances are shortened, and therefore the barriers must be placed farther apart. This makes it almost prohibitive to install bus-bars in a bus-bar compartment, because the bus-bar compartment becomes as large as the station in order to get the safe jumping distance. It would seem good practice to eliminate all secondary devices whatever from the high-potential side, put all instruments on the low-potential side, running directly from the transformer, say, or the switch to the line with nothing whatever connected to it.

F. C. Mahrberg thought that with enclosed wiring for 60,000 volts and higher compartments become too large to be practicable. If wires are put far enough apart so that the arc cannot hold, that is all that can be done. For voltages of about 30,000 no doubt bus-bar compartments and barriers between bus-bar compartments and switches have become the standard practice. However, it seems that wires and insulators are enclosed more than would seem necessary. Barriers between all wires and between the bus-bars would seem to be plenty, with the advantage of having the wires and insulators as conspicuous as possible and as "getatable." If the vertical risers from the bus-bar compartments to the switches are enclosed any leakage is not detected as readily as if the wiring is open, while insulators cannot be cleaned as readily as they can be otherwise. Instruments and transformers on the high-tension side should be omitted where possible. However, if a high-tension bus and the individual lines have to be protected, current transformers on the high-tension side are necessary.

Mr. Lincoln thought all would agree on the first two points made by Mr. Blackwell, but not so on the statement that "each conductor should be surrounded and separated from every other by a continuous fireproof barrier." Mr. Lincoln said that the principal advantage of enclosing bus-bars, wire, etc., is to prevent a destructive arc from forming in those bus-bars, etc. The higher the voltage of a station is the less destructive become the arcs. With 2,000 volts the destruction is about maximum. Therefore in building any 2,000-volt bus-bars for even a moderate amount of power they should be enclosed by all means; but for the same amount of power at 60,000 volts or at 40,000 volts the same thing does not hold. The destructiveness of an arc is in proportion to the volume of current, and the higher the voltage the less the amount of current available for producing destruction. That is one very good reason for omitting these fireproof barriers at some point as the voltage goes up. Another obvious and very good reason for omitting them is the difficulty of obtaining insulation as the voltage goes up.

E. N. Lake illustrated on the blackboard the construction of a small rotary sub-station operating at a potential of 25,500 volts which accomplishes the points of the paper.

Mr. Mahrberg said that for sub-stations it seems that the arguments that are advanced for separating the wires do not hold good as in the case of main stations. If the 20,000 or 30,000-volt transmission line is first introduced into the circuit where the conductors cannot be separated there seems little gain in separating the conductors after they enter the building. If the building is fireproof the arc that might be set up can do but little damage. It would introduce a rather expensive construction to separate all the wires on every 200 or 300-kilowatt rotary sub-station.

H. C. Hoagland of the Illinois Traction Company stated that where wires are placed reasonably substantially the company has had very little trouble with the wiring inside the station under regular circumstances. Its troubles were always due to disturbances other than the wiring.

Mr. Jenkins said that with a 60,000 or 30,000-volt system of a capacity of perhaps 60,000 kilowatts and a reasonable number of distributing circuits every precaution has to be taken against accidental contact, and if a large station were put up without barriers in a working construction force of 50 to 100 men there would be quite a number of troubles. On the higher potentials it is not possible to get oil switches which are equipped with disconnecting appliances. Therefore one is forced to install knife switches outside the oil switch, which on the high potential again calls for a barrier. In some cases his company provides the barriers and then insulates the conductors inside the barriers. Mr. Jenkins thinks that barriers should be used in all cases, and that the effect of the short-circuit is greatly decreased, even though the arc holds between the conductor and the barrier.

F. Woodmansee thought that in a sub-station at the end of the line it was only necessary to insulate the wires from each other, as there is little liability of anything getting across the wires to cause a shutdown. Consequently the additional expense is not warranted in separating between polarized lightning arresters or anything which may cause an arc in its operation. But in the power house proper where the question of keeping the potential on the bus-bars is very important and where there are a number of men working in the station the bus-bars should be separated from each other by some fireproof barrier. In a good many cases the stations are made much more complicated than they should be. The question of running leads from bus-bars is a very important point to consider. It is oftentimes easier to insulate the bus-bars and run them lengthwise of the station and thus cut down a good many feet of cable which would otherwise be required. These can be run and protected in such a way that it is almost practically impossible to give trouble.

Mr. Lincoln gave it as his opinion that the general modern tendency is rather toward doing away with all buildings than putting buildings around every individual wire and piece of apparatus in a station. The time is coming when the bus-bars, transformers, switches, etc., will be put out in the weather and a building put around only such apparatus as must absolutely be housed, such as instruments. Space up in the air is very easy to obtain. All that is necessary is to put the station out of reach. An ordinary transmission line is not considered dangerous; it is out of reach. Exactly the same thing can be done with the sub-station. If it is logical to put fireproof barriers around the individual wires in a sub-station, it is just as logical to run those fireproof barriers clear back to the generating station. That reduces the fireproof barrier proposition to an absurdity.

W. B. Jackson remarked that where it is possible for the wires to be touched by the employes in the regular performance of their duties they must be protected by the fireproof compartments or by separating walls of some kind, but as soon as the wires get out of that zone let them be free.

D. C. Jackson told of stations in certain of the western towns. They have a step-down sub-station where the building consists practically of a light wooden framework covered with corrugated iron, and the line that passes over it drops down through the roof through a suitable terminal.

The wiring is run to transformers through ordinary fiber conduit, using the usual linen-covered wire. That makes a sub-station that comes as near simplicity as is possible. It is almost the equal of having the whole thing out of doors. Perhaps it is even cheaper than to erect the structure on an elevated platform, and it also protects the transformer terminals and such switching terminals as are needed from the weather.

There were a number of written contributions to the discussion on the subject of station wiring, but these were not read on account of lack of time. The contributions were from A. L. Mudge, Calvert Townley, A. H. Babcock, N. C. Canfield, C. P. Cole, D. L. Huntington, W. F. Lamme, W. C. McClellan, Stephen Q. Hayes, L. A. Herdt, C. W. Hutton and B. P. Rowe. These discussions will appear in the Transactions.

The paper of R. P. Jackson on "Potential Stresses as Affected by Overhead Grounded Conductors" was very interesting and brought out some good points in the discussion. Prof. Morgan Brooks of the University of Illinois and J. W. Andree, a senior at Illinois, contributed some valuable data of experiments they had made in investigating the subject. The paper on "Forced Oil and Forced Water Circulation for Cooling Oil-insulated Transformers," by C. C. Chesney, also brought out enthusiastic discussion. An abstract of these two papers with the discussion will appear in a later issue.

LUNCHEON AND EXCURSION.

At noon on Friday those present at the meeting were the guests of the local branch of the Institute at luncheon in the palm room of the Auditorium Hotel. About 150 sat down to the elaborate repast and a very enjoyable hour was spent. A hearty vote of thanks was extended for the hospitality of the Chicago branch.

The lake excursion and inspection trip planned for Friday night, Saturday and Saturday night proved entirely worth while. There were 60 in the party when it reached the Croton Dam of the Grand Rapids and Muskegon Power Company on the Muskegon River in Michigan.

The Grand Rapids and Muskegon Power Company is just completing a hydro-electric power plant of 16,000 horsepower on the Muskegon River 40 miles north of Grand Rapids. This power plant and dam has many interesting features, which were inspected by the Chicago party. Six miles farther up the river at what is known as Roger's Dam the company has a similar plant of about half the capacity which is in operation. This plant transmits its current at 66,000 volts to Muskegon, Grand Rapids and all towns in the territory, where it is used for street railways, light and power.

The party left Chicago on the steamer Puritan at 8 p. m., arriving at Holland, Mich., in the morning. At 6 o'clock a special car provided by the Grand Rapids, Holland and Chicago interurban electric road was boarded for the 27-mile run to Grand Rapids. This road is supplied by a 19,000-volt transmission line from the Roger's Dam plant. An interesting point in its construction is that the overhead grounded conductor which was the subject of enthusiastic discussion at the high-tension meeting is used on the pole line. The overhead conductor is of barbed wire. En route the sub-station at Zeeland was inspected.

At Grand Rapids the party took breakfast and at 8 o'clock boarded a special car on a Pere Marquette train for Croton Dam. At the little town of Casnovia, the birthplace of Bion J. Arnold, past-president of the Institute, the train was stopped while the visitors stepped out and gave three cheers for that distinguished engineer.

After inspecting the plant at Croton Dam the party was given an excellent dinner at the dam by officials of the power company. Returning to Grand Rapids the visitors enjoyed the courtesy of the Grand Rapids Street Railway Company, which furnished a special car for a ride about the city. The sub-station of the power company was also inspected. Charles A. Floyd of the Grand Rapids, Holland and Chicago Railway Company supplied a special car for the return to Holland.

The excursion was in charge of George A. Damon of The Arnold Company, who made it a complete success. At Holland the visitors were met by F. E. Greenman, assistant general manager of the power company, who planned and carried out the various features in a way which drew the hearty thanks of the party. Other officials of the power company who joined the party at the dam were President Thomas Hume and John G. Emery, Jr., H. U. Hovey and George L. Erwin.

Purdue Branch of the Institute.

The last and perhaps the most enjoyable meeting of the Purdue Branch of the American Institute of Electrical Engineers for this year was held on the evening of May 14th in the lecture room of the Electrical Building. Quite extensive preparations were made for this meeting, and the promoters were in no way disappointed. The attendance was good and a general feeling of satisfaction existed.

Mr. G. H. Kelsay, '00, superintendent of motive power for the Indiana Union Traction Company, was the speaker of the evening, and he proved himself to be well prepared on his subject, "Organization and Methods in the Operation of the Mechanical and Electrical Departments of Interurban Railways." He divided his address into four principal parts. He first considered organization in general. Here the speaker dwelt at length upon the extent of the organization for plants of various sizes, giving actual cases as examples. His second division was methods of operation and the handling of men and equipment; third, maintenance of the power-plant equipment, etc., and, fourth, high-tension line construction and repairs.

In each of these phases of the discussion Mr. Kelsay showed a deep and thorough knowledge. He exhibited several forms and charts upon which the different employes were to report the results of their labor or the performance of their machinery. An accurate record is kept of everything of importance, so that at any future time comparisons may be made and policies outlined.

After the address many questions were asked. This part of the programme proved to be exceedingly instructive to all.

Retiring Vice-chairman G. B. Walker then took the floor, and, after thanking the Branch for its support during the year, turned the office over to Mr. R. H. Webb, vice-chairman-elect, who made a few remarks relative to his plans and policies for next year. He proved himself able to "take hold," and the Branch is to be congratulated upon its choice.

After a short business session, the sliding doors leading into the main laboratory were thrown open, revealing the paraphernalia necessary for a "feed," which was enjoyed by all.

The annual report of the executive committee showed a prosperous year for the Branch, with an average attendance at the meetings of 98. The retiring officers are: Vice-chairman, Glenn B. Walker; assistant secretary, Francis H. Bagley; treasurer, Charles H. Hansell; chairman telephone section, Oscar C. Warner; secretary of the telephone section, Frank J. Strassner. Prof. C. P. Matthews and Prof. J. Walter Esterline, chairman and secretary, hold over.

It is proposed to "harness" the waters on the eastern side of the Continental Divide in Colorado. A company capitalized at $7,000,000 has been formed for this purpose and the Central Colorado Power Company is said to be behind the project. The new company, it is understood, will operate as far south as Pueblo and will be a factor in furnishing electricity for the operation of public utilities in Denver and other cities.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

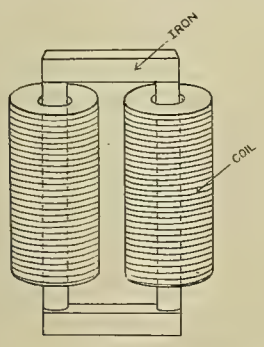
XVIII.—Central-station Auxiliary Apparatus.

Transformers.

The general principle of induction coils was explained in Chapter IV.; and transformers consist of induction coils of special design.

In the transmission of energy to great distances high-potential alternating current is now invariably used, on account of the small size of copper wires over which a large amount of energy can be transmitted for a long distance. Transformers play a very important part in all high-potential distribution, as by means of them the voltage of the current may be raised or lowered to any figure desirable.

The transformer, consisting of stationary coils of wire mounted upon an iron core, acts automatically without attention, and its efficiency is very high, being for good transformers in the neighborhood of 98 per cent. at full load. In other words, a current of many thousand volts is reduced by passing through the transformer to one or two hundred volts, or any other desirable working pressure, with a loss of but two or three per cent. at full load.



CORE TYPE OF TRANSFORMER.

Transformers for changing the voltage in the way described, are the kind most commonly used, although a very similar device, known as a current transformer, is used for transforming a constant-potential current to a constant current of variable potential. The potential transformer has its primary winding connected in multiple across the supply mains, while the constant-current transformer is connected in series with the source of supply.

Potential transformers are used for both raising and lowering the voltage supplied from the generating station, and transformers which raise the voltage are known as step-up transformers, while those which lower the voltage are known as step-down transformers.

In practice it is not feasible, on account of the difficulty of securing adequate insulation, to generate a current of more than 11,000 or 12,000 volts of potential. When the distance of transmission is not very great this 11,000-volt current may be led out directly from the generator over the transmission lines, to the point of consummation, where it is connected to step-down transformers. These transformers reduce the 11,000 volts current to whatever voltage is required for the lamps or motors which it is to operate.

In case of very long distances, however, 11,000 volts is too low a pressure to be transmitted over small wires, and in such cases the central-station current is usually generated at rather lower potentials, and led into step-up transformers, by means of which it is raised to any desired pressure for sending over the transmission lines. Pressures of 16,500 volts, 33,000, 50,000 and 60,000 volts are all in commercial use, the latter being about as high as can be safely used with the character of line construction and insulating materials available at the present time.

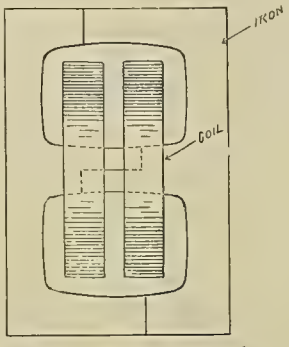
There are two general designs which cover all transformers, although each of these types has a wide variety of details introduced by various manufacturers. The two general types, however, are known as the core type and the shell type. This distinction refers entirely to the form of the magnetic circuit or frame upon which the windings are built. The difference between the core type and shell type transformers will be readily perceived by referring to the accompanying diagrams.

Either type of transformer consists of an iron core and two principal windings, known as the primary and secondary windings. The primary winding is that one which is connected to the source of current supplied, and a secondary winding is one from which the current is utilized by lamps or motors. These two windings are made up in entirely independent coils, which are very thoroughly insulated, and there is no mechanical connection between the two.

The primary coil is permanently connected to the source of alternating-current supply, and this primary current sets up alternating magnetic fields in the core. These alternating fields in the core in turn induce current in the secondary windings.

The high-tension coil of a transformer is wound with a large number of turns of fine wire, and the low-tension side has a much smaller number of turns of coarse wire. The relation between the voltages of the primary and secondary side are exactly proportional to the number of turns in the primary and secondary coils.

For example, in a transformer to raise the current from 300 to 30,000 volts, there would be 100 times as many turns in the primary coil as there are in the secondary. The relations of the current in the two windings can therefore readily be deduced. If we have one-half ampere transmitted at 30,000 volts, the energy is equivalent to 15,000 watts. In an ideal transformer, with an efficiency of 100 per cent., the secondary winding would deliver 50 amperes at 300 watts.



SHELL TYPE OF TRANSFORMER.

Transformer Losses.

There are two factors which affect the efficiency of transformers. These are the iron losses and the copper losses. The copper losses are due entirely to the resistance of the wire, and are greatest at full load when the resistance is still further increased by the heating of the iron core. The iron losses are due to hysteresis and eddy currents.

Hysteresis may be defined as magnetic resistance, or the resistance of the iron to changing the direction of its magnetism as rapidly as the exciting current alternates. The effect of the eddy currents is practically neutralized by splitting the iron of the core into thin laminations parallel to the direction of the magnetic flux and insulating these laminations from each other by paper, varnish, etc.

The hysteresis losses cannot be so readily overcome, and ordinarily this loss increases with age, on account of the high temperature to which the coil is subjected. This action is referred to as the aging of the iron. In ordinary grades of iron this aging increases the core losses of transformers by as much as 25 or 30 per cent. or more; but by means of special treatment adopted by different manufacturers, the aging effect has been greatly reduced, and it is now possible to produce a grade of iron which is practically non-aging.

Cooling and Insulating of Transformers.

Various means are taken for dissipating the heat generated in transformers. Large-size transformers are generally cooled by means of a circulation of air or of water through the core and windings of the transformer. Transformers cooled by air are known as air-blast transformers, and water-cooled transformers have their core and winding immersed in oil, through which cold water is piped for carrying off the heat. Air-blast transformers are usually located over an air chamber in which the air pressure is maintained by means of centrifugal blowers slightly above atmospheric pressure. The outlet from the air chamber leads through the transformers, so that the core and windings are constantly subjected to a draft of cool air which reduces the temperature of the transformer sufficiently so the insulation is not injured.

Oil-insulated transformers are made both self-cooling and water-cooled. The circulation of the oil through all the parts of the transformer tends to maintain the interior at a uniform temperature, and this temperature in the water-cooled transformer is reduced by the flow of water through a system of piping immersed in oil, which serves to reduce its temperature.

In the self-cooling transformers the only provision for cooling is by means of the circulation of the oil insulation, and in order that the heat may be dissipated with sufficient rapidity, the casing of the transformers, which is the only place from which the heat can escape, has to be made large enough to offer sufficient radiating surface for this purpose. In order to present sufficient radiating surface without making the case extremely large, it is customary to build the latter of corrugated iron.

In addition to effecting a lower operating temperature, the use of oil for the immersion of the core and coils of transformers is of great benefit, as it adds to the strength of the insulation. Oil only of a very high fire test should be employed, and the loss from evaporation is practically negligible.

A very important feature of oil insulation is its tendency to repair itself when ruptured. If, for example, a static discharge, such as lightning, enters the transformer and punctures the insulation, the oil tends to close up the openings made by the discharge, and thus prevents the line current from following the path of the static discharge, and burning up the transformer.

Transformers are built in a wide variety of sizes, varying from the largest size of several thousand kilowatts, down to a small fraction of one kilowatt, and they are frequently provided with several taps, taken from different parts of the windings, thus giving several different voltages on both primary and secondary sides, so that the ratio of transformation may be varied within moderate limits.

In some cases the coils are divided into two or more sections, which can be connected either in series or in parallel, so that a very wide ratio of transformation is obtainable. For example, by dividing the primary windings into two sections, and the secondary windings into four sections, a primary voltage of either 1,000 or 2,000 may be used, and secondary voltages of 55, 110 and 220 may be obtained, and by means of the auxiliary taps a variation of 10 per cent. of the secondary voltage is further obtainable.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Decision in Stanley Patent Case Upheld.

The United States Circuit Court of Appeals for the Second Circuit (Judge Townsend writing the opinion) has affirmed the decision of the lower court in the suit based on the alleged infringements of certain claims of the so-called Stanley patent No. 469,809, in which the Westinghouse Electric and Manufacturing Company was the complainant and the Montgomery Electric Light and Power Company of Canajoharie, N. Y., the defendant.

The patent, which relates to a system of electrical distribution and regulation adapted to incandescent-light plants, was assigned to the Westinghouse company, having been issued to William Stanley, Jr., on March 1, 1892. Infringement of the first and third claims of the patent by the Montgomery company was held by the Court of Appeals.

Judge Townsend, in his opinion, gave this interesting summary of the invention:

"The problem which confronted the inventor, Stanley, was presented by defects in existing systems which resulted in variation in the luminosity of individual lamps with variation of pressure due to variations in the number of lights in use. Stanley discovered that the cause of this variation was a lack of harmonious action between the dynamo and the converter. He had to deal with the antagonism between leakage at the dynamo and self-regulation of secondary pressure in the transformer. Increasing the length of the primary wire decreased leakage, but diminished self-regulation. Decrease in the length of the primary wire improved regulation, but increased leakage. Stanley further discovered that these antagonistic relations could be co-ordinated to each other by the use of a certain length of wire on the primary of the converter, and he told the public in his patent that the wire should be 'of such length that reacting self-inductively upon its own magnetic circuit, the average counter potential so produced approximately equals the potential applied to the primary circuit.'"

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The Story of a Small Central-station Plant.

By G. W. T.

A couple of years ago the writer decided to enter the electric-lighting business and get something safe and sure after the strife and uncertainty of other fields of endeavor. And thinking that the new states being opened up were being overdone, he went to a moderate-sized town in an older-settled country that had been passed over for the new states. The town was of course anxious to get a plant and offered much encouragement in the shape of "hot air," which didn't cost anything. However, in a few days a few men were found willing to take a financial interest in the venture, so a company was formed and a franchise obtained.

A canvass of the business district showed that 800 16-candlepower lamps could be placed at a flat rate of 50 cents each per month. But the ordinary condition of small plants being cheap construction and an overloaded plant, with consequent poor service and breakdowns, it was decided to spend plenty of money, build a first-class plant of its kind and give the best of service, with the idea that the customers would we well satisfied, the business would grow and the operating and repair bills would be light; so we started in.

The town had an actual population of 2,200, and a 75-kilowatt and a 30-kilowatt generator were installed. There were two boilers of 100 horsepower each, one being in reserve all the time. One 100-horsepower non-condensing engine was belted to the larger machine, the idea being to run condensing later. The small machine was driven by belt from the line shaft of a large mill near by. The idea was to run the main plant from 6 to 10 p. m. during the important load and let the small machine carry it the rest of the night, and also during daytime in summer for fan service. We were on three railroads; slack coal evaporating six to seven pounds of water per pound cost $2 a ton on track. The mill had surplus power, so we figured that at two cents per kilowatt-hour at the switchboard they would be making a good profit in furnishing power for our small machines. They were under no guarantee: we simply had the privilege of buying power when they were running. In return they could take power from our line for lighting the mill whenever desired at the two-cent price, which saved them the cost of a dynamo for lighting their mill and also gave them light when they were shut down. This arrangement worked well for several months until another man bought control of the mill and thought we would stand squeezing up to a six-cent or eight-cent rate, saying that we were selling that same current for 15 cents down town. There were other difficulties, so they were getting mill lights for about half price, the consequence being that we took our machine out and quit doing business with them, ran our plant until midnight and cut out the extra service.

We built 60 blocks of pole lines, covering the town thoroughly, too well, in fact, as several blocks of that line are not paying yet. If the line was not already built it would be easier to get new business there, but now the residents along it can take service or leave it, and let us hold the sack, which they take great pleasure in doing. But we built it well, put in plenty of copper, heavy poles, guyed it right, bought 120 meters, and by the time the plant was done we had spent about $18,000, considerably more than we intended.

In the start we had been foolishly liberal in our treatment of the people, and went on the assumption that they would appreciate a square deal and trusted them to do the right thing. So we did not require any contracts for a term of service, simply wired the building at cost and connected them up. We made a residence rate of 15 cents per kilowatt-hour, minimum bill of $1.25 per month, and gave lamp renewals at half price. We gave stores the same rate, except that we charged only 8 cents for all current used after two kilowatt-hours per month per 16-candlepower lamp connected. Our idea was that later the plant would be able to give free renewals and a 10 per cent discount for prompt payment of current bills.

We installed a great many Nernst lamps in stores, the lamp being our property, our plan being to light the stores well and give them the most and the best light for the least money. But the writer had no experience with country towns and had no idea how big a dollar looked to these people when they had it and were asked to spend it for electric service. So instead of asking them how much they wanted to spend a year for store lighting, we tried to light the stores well. The plant was started in the fall and the bills the first month were high, but as it got later in the year they kept getting higher and higher, until at last when the December bills were sent out the merchants got together and talked it over a little.

They figured we were just starting, had a good plant and a big investment and that we needed business badly. So they came to us and said: "Here, we can't stand this. We don't know anything about your meters or your kilowatt-hours, and we can light our stores a whole lot better with gasoline for so much [naming an absurdly low figure], and you can either take our business for so much a month or take the lights out."

Well, they had us, and they knew it. In a more progressive town it would have been different; but they were that kind of people. If we had known more about the business in the first place and had had no timid local stockholders it would have been different. But we had to have the business, so we "arbitrated" and made the best bargains we could. And as we had installed Nernsts mostly, we had not the original standard of 50 cents per 16-candlepower lamp to go by, so we were able to get only from 60 cents to 90 cents per glower per month flat rate, and furnish and maintain the lamp besides.

The consequence was that as fast as we could do so we replaced the Nernsts with incandescents at the storekeepers' expense and charged them 25 cents each for renewals thereafter. The Nernst was the best lamp for the money on a meter basis, but under those conditions we could make more profit with incandescents by reducing our investment and maintenance expense.

We left the meters in on the flat-rate customers and found we were getting from five to nine cents per kilowatt-hour for our current. But we had to stand it then. We had a large plant for that town, lightly loaded, and a little extra current only cost us a little extra coal, about one cent per kilowatt-hour, and our plan was to get all the income they would give up, even if they did use a little extra current. We had to make the plant pay somehow, so we took the business at the best price we could get and kept still about it.

Then we got down to business and canvassed every shanty within reasonable distance of our lines. We figured that within a year or two we would have a good permanent residence load built up on a meter basis. Then we could go to our worst flat-rate customers and make them pay a fair price for their service or get off the line. Then, as fast as we could afford it, we hoped to go to the next worst, and so on, until we had the meter system restored in full.

For street lighting we started with four 6.6 ampere arc lights at $25 per month, dusk until midnight, with the expectation that in a short time the council would take more service. We did not insist that we get a good city contract as a condition of building the plant, as we should have done. The consequence was that we never got any more city street lighting. We found out later that the council was busy running the city waterworks pumping plant and that things looked queer. We learned that of a $10,000 bond issue spent three or four years previous only about $4,000 of real value was put into tangible improvements in the waterworks. This information came later.

Our first residence customers were the leading people in the town, with the large houses, who "didn't mind the cost," but took electric lights because the other people took them. And, of course, save as they could, they ran up bills that looked big to them compared with the kerosene they had been using before. So they talked about it and became martyrs to the cause of public improvement, and told how high their light bills were, but would pay it to help the thing along. They would often mention amounts higher than the bills really were and then "kick" to us in private. So when we came to canvass the town the people with the small houses who had to consider expense were all "scared stiff."

So we made a flat rate of 75 cents per month for the first 16-candlepower lamp and 25 cents for each additional, and then worked them for all they would take. The consequence was that they would put three or four lights in the main living rooms, and then before long wire the rest of the house and install a meter. It was simply a matter of their getting used to it and finding out that electric lights would not bankrupt them. And we canvassed the merchants, too, knocked out a gasoline plant or two, took them in exchange for wiring, and then sold them to someone as far away from the town as we could. The gasoline man sent an agent there, and we quoted a give-away price for current on the first couple of competition jobs, and the agent left the town in disgust.

Some of the merchants would not wire the stores, so we had to do the wiring free, sometimes getting paid for the labor, to get them to use our lights. The principal hotel wanted about 80 lights, open wiring, for which we agreed to charge $100. But the hotel people couldn't stand that, so they agreed to take the light for a year and pay us $2.50 per month rent on the wiring for that time, in addition to the current, and at the end of that time they could have the privilege of applying that $30 as part payment on the $100 and pay the balance, or we could take the wiring out. That was good business, as it brought us about $250 extra revenue per year that we could not get otherwise, and the $30 would nearly cover our expense for material and labor in putting in and removing, with large chances that it would never be taken out at all.

And there was more or less trouble in the company. The local stockholders, who held the controlling interest and knew very little about the business, became sick of it, and were anxious to get out. But there was nothing to do but keep at it, and before long the plant was paying operating expenses, and then began to accumulate a little surplus; and now, with the large machine a little over half loaded, it is earning 10 per cent. on the investment over operating expenses. And with the new business coming in all the time it will not be long until the plant will be earning that much in addition to interest and depreciation, and will be independent of the whims of a few stingy patrons.

Everything considered, the plant has fared very well; but there was a risk taken that should have been avoided at the start. The customers should have been tied up at first on three or five-year meter contracts, and a good city contract should have been secured as a condition of the plant being built. As it is, there will be trouble for a few years in changing the customers from a flat rate to a meter basis. But figuring from four to five years in the future it paid to build the plant as it was; but it would have paid better from the start if only about $10,000 had been spent at first and extensions had been made as the business justified them. There would have been more immediate profits for the original investors, less money risked, and less troubles for the manager.

The plant now, after 18 months' operation, with 2,000 lamps connected, has a gross income of $4,500 per year, operating expenses and taxes of $3,000, leaving $1,500 to apply on the principal for interest and depreciation. With new business in sight the income for 1907 will be $5,000, and for 1908 will be perhaps around $6,000, by which time the plant will be on a satisfactory basis.

But if we were to do it over again we would keep down the original investment, would run things more on a business basis regarding contracts for service and rates, and if anyone wanted service for less than a fair price we could then afford to be independent and let them do without.

BOOK TABLE.

DESIGNS FOR SMALL DYNAMOS AND MOTORS. By Cecil P. Poole. New York: McGraw Publishing Company. 1906. Pp. (6 by 9¼ inches) 187, with 231 illustrations and diagrams. Price, $2.

A presentation in a clear and accurate style of practical methods of designing about 25 useful kinds of small and medium-sized dynamos and motors is given in this book. Working drawings for parts, and diagrams showing connections and the manner of assembling are given, with all other information necessary for actually constructing each machine. The designs include those for one-sixth to three-horsepower motors, fan motors, launch motors, lighting dynamos for private plants, a 400-ampere electroplating dynamo, single-phase rectifier, single-phase induction motors, alternating and direct-current machines.

The work is instructive as a textbook and useful as a manual or reference book.

Facts and Problems of Electric Trunk-line Operation.[1]

By Frank J. Sprague.

I believe that the question of capacity will be a far greater controlling factor in the electrification of trunk lines than that of economy as narrowly measured by the cost of electrical horsepower. I do not know of a single instance in which electricity has been adopted in which this feature has not been paramount, nor do I know of a road operated today which would sacrifice capacity to economy. Taken as a whole the electrical equipment and operation of trunk lines is essentially more of a financial than a technical problem. The commercial success of electric operation is a question of relative and absolute density of train movement.

I do not intend to burden this paper with statistics or abstruse mathematics—one can prove almost anything by them—but just here I will epitomize certain conclusions which I think will bear the test of time:

(1) Of the two broad lines on which electrification can be considered, if increased economy, that is, reduction of operative expenses by replacing the steam locomotive with an electric one, with concentration of prime power and perhaps the use of waterpower, be deemed the dominant reason for change of motive power, then every wheel in an electrified division should be turned electrically; the savings effected should pay not only a fair rate of depreciation of the total equipment but a satisfactory rate of interest on the new capital expended—in fact, a better rate than if spent in some other way.

(2) Increase of capacity, both in locomotive haulage, schedule speeds, motor-car trains and terminal facilities of a character impossible to steam service—all resulting in augmented traffic and increased use and capacity of the dead part of the systems, the tracks and roadbed—will ordinarily be the more potent influence in leading to the adoption of electric operation, and will often warrant heavy capital expenditures.

(3) Every large road is a problem which must be considered financially and technically on its own merits, and in most features other than those which without effort can be harmonized its decision will be of little practical concern to other roads.

(4) The adoption of electricity will ordinarily begin with those divisions where traffic is comparatively dense, and once adopted the territory over which it can be extended will naturally increase.

(5) Terminal properties in great cities, underground and tunnel sections, and heavy mountain sections where duplication of tracks because of extra heavy construction cost is prohibitive, offer an immediate field for the serious consideration of electrification.

(6) There cannot now be safely established any final standard or any single system selected as the best for all roads. What is the best for one might easily be less advantageous for another, and there is no valid reason why any road should adopt something fitting to a less degree its particular requirements because of the action of some foreign road.

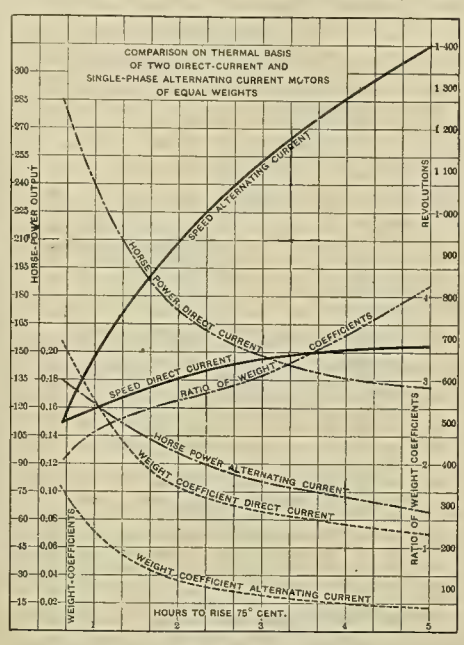
(7) Extraordinary advances have been and are being made and new discoveries are always possible. The limits of none of the systems now in use are clearly defined, and it would seem both natural and wise that the various manufacturing, technical and inventive activities should pursue every lead to its logical conclusion, for the best will be none too good.

In discussing the selection of any system, the first thing to investigate is the motor. The working conductor, with everything connected to it in transmission or generation, although essential, is tributary to the motor and its requirements. It is not sufficient that the source of power can be made of any desired size, although it is an essential feature; in any case such concentrated generating equipment must supply a number of motors. What is essential is that the new motor shall have not only certain mechanical advantages to the extent of eliminating the evils of reciprocating parts and reducing the cost of up-keep, but above all it must have capacity, measured not alone by drawbar pull or speed but by both, and it must be of sustained character; and this capacity, to accomplish more than the steam locomotive, must be greater than that of the latter. Such capacity should naturally be attained—first, by increase of the capacity of the individual motor or locomotive, and then, when this increase has reached its limit, by combining motors or locomotives under a common control by the multiple-unit system.

Among the many types of motors proposed for railway service, four are now being exploited: Polyphase alternating-current motor without commutator, single-phase alternating-current motor without commutator, single-phase alternating-current motor with commutator, and direct-current motor with commutator. Of these, two, the direct-current and the three-phase motors, each has a continuous rate of energy input, while the single-phase motor has an intermittent and variable rate. Moreover, there are combined in the single-phase motor two distinct functions, those of a motor and a transformer, and the latter cannot be entirely eliminated. The result is a reduction in both continuous and overload capacities.

The accompanying curves show graphically the comparative speeds, capacities and weight coefficients of two direct-current and single-phase alternating-current motors of equal weights, all referred to the time required to rise 75 degrees in temperature when operating at full normal potential under varying loads and with natural ventilation.

The principal object sought, and certainly a most desirable one in the use of higher potentials, whether direct current or alternating current, is not now so much reduced cost of working conductors on a trunk-line system—for practice has shown that this cost is not materially affected—but lessened feeder investment, increase of sub-station distances, reduction of total sub-station capacity, and, in the single-phase system, the abolition of moving machinery in the sub-stations. The degree of success of the alternating-current development will depend primarily on the development of capacity and all-round operative features in single-phase locomotive and car equipments. The 25-cycle motor (hitherto the only frequency actually installed for single-phase equipment), whether judged by individual comparison or specific equipments, or the general testimony of electrical engineers of manufacturing companies, has proved inadequate when compared with its rival. To correct this defect it has been proposed to adopt 15 cycles as a standard of operation. Considered solely from the standpoint of the series commutator type of railway motor, a reduction from 25 to some lower compromise number of cycles—15 if you please—has certain distinct advantages; for it should make possible the use of higher field induction, larger air-gap, higher armature potential, slower armature speed and less sparking—all making for increase of motor capacity for any given weight and affording greater mechanical freedom in construction and operation. It likewise increases the capacity of trolley and track circuits and raises the power-factor both of the line and the motor; but against this is an unavoidable increase in the weight of transformers, which about offsets the saving in motor weight. It appears, then, that the total weight of single-phase apparatus on a car for a given capacity is approximately the same within a very wide range of variation of the number of cycles. There are in addition special objections in the matter of turbine and generator construction as well as in other directions.



COMPARISON OF RAILWAY MOTORS.

The remarkable extension of the multiple-unit system and its recent application to locomotive practice, as for example on the New York Central Railroad, has led to the suggestion that freight trains shall be equipped with secondary controlling lines, and that a plurality of locomotives, not only at the head of the train but distributed throughout it, shall be handled by a single operator on the leading engine, whose controller shall be provided with the automatic safeguards common to the service which has already been developed. I do not hesitate to pronounce this an impracticable scheme for general application. Quite aside from the cost of equipping the hundreds of thousands of rapidly deteriorating freight cars, the majority of the train lines of which would not be used, it would be against public policy and contrary to the most ordinary safety of train operation to leave such an extended and high-powered train in charge of a single man.

It seems to me that the present principal hope of usefulness of the single-phase system is on roads of considerable extent which operate an irregular and sparse traffic and where only a moderately expensive or what may be called a second-class overhead construction, which will keep down the ratio of line investment to that of the balance of equipment, is tolerable. As one departs from this condition, adopts more permanent construction and faces the problems of denser traffics and higher capacities, any advantages of the single-phase system will disappear and a superiority of the direct-current equipment, with such improvements as are in sight, become manifest. But whatever may be the future of single-phase operation under the conditions stated, any present claim for it as the preferable equipment for congested service demanding high schedules and great capacity is not worth a moment's thought, for in this field at least it cannot touch the direct-current system.

The most satisfactory system will be that one which will permit of continuous all-round operation under such conditions as will utilize to the utmost all the beneficial features of electric application. If any one system can be demonstrated to meet these conditions better than all others, then that system will become pre-eminent, no matter what standards may have been adopted or recommended, and no matter what our preconceived prejudices may be.

Discussion (in part).

W. J. Wilgus, vice-president New York Central Railroad: I believe that the cause of electrical engineering will be much more rapidly advanced if an effort can be made to bring the steam-railroad official more closely in touch with the practical side of the application of electricity to the art of transportation. With respect to the conditions that will justify the use of electricity as a motive power in trunk-line operation, I believe that evolution will govern rather than revolution. In other words, there will be no sudden general substitution of electricity for steam as a motive power. Coincident with the change of motive power in crowded passenger terminals is coming the use of electrically propelled trains on existing steam railroad tracks between large centers of population where frequent units are necessary to accommodate the public. With a start in the substitution of electricity for steam in the operation of congested terminals, connecting lines between large centers of population and long pusher grades with heavy freight traffic, we may look with confidence to a gradual expansion of the use of the new motive power in other directions.

With regard to the question of the respective merits of the three electrical systems, viz., the direct current, single-phase alternating current and three-phase alternating current, it is to be deplored that the advocates of each of these systems have seen so much to condemn in the others, as by so doing the steam-railroad men have been frightened into a fear of taking any decided steps when there is such disagreement among those upon whom they must depend for guidance. Direct current was adopted for the New York Central installation at New York, among other reasons because the clearances in the Park Avenue Tunnel and the ordinances of the city of New York absolutely precluded the use of overhead construction. The physical and legal conditions prevented the adoption of any other system than the direct current. We are often told that the overhead single-phase system should be used because of the advantage of requiring no sub-stations and sub-station attendance, but nothing at the same time is said about the higher cost of alternating-current locomotives for performing the same service nor the higher cost of overhead construction as compared with third rail. I am merely mentioning this to show the necessity for fairly setting forth all sides of a problem before drawing a conclusion that may be entirely wrong.

I cannot too strongly endorse Mr. Sprague's remarks bearing on the wisdom of adopting the multiple-unit system for handling suburban service. The New York Central has already reaped its reward in adopting this method in the elimination of practically all of the delays of train service at the Grand Central Station, and the use of the multiple-unit system has at this time resulted in an increase in the capacity of the station of at least 33 per cent. Moreover, the rapid acceleration of this character of equipment as compared with locomotive practice has resulted in the ability of the operating department to maintain schedules with a reduced rate of speed between stations. The New York Central has realized the wisdom of its course in adopting bonds concealed beneath the fishplates, as there has been no loss from their theft, whereas I believe that on other roads where this precaution has not been taken electrical operation has been seriously interfered with from the theft of exposed bonds.

L. B. Stillwell, consulting engineer, New York: For trunk-line operation I have held and still hold the opinion that the 15-cycle alternating-current single-phase system possesses inherent characteristics which, in this class of work, constitute controlling advantages as compared with any direct-current system that has been suggested, or is liable to be developed into an operative system. With this opinion the paper of this evening takes issue. The paper before us while presenting certain data and opinions purporting to sustain the contention that the 1,200-volt alternating-current system is superior to the 15-cycle alternating-current system presents no sufficient and fairly comparable data upon

1. A condensation of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, May 21 1907.

which any such conclusions can be based. The paper emphasizes the statement that "capacity is the keynote of equipment." With this conclusion few will differ. In our consideration of capacity of equipment, however, we should not limit our attention to the motor but should take into consideration also the comparative methods of transmitting power to the moving trains. In general the choice of a system will depend upon the ratio of capacity as measured in tractive effort to aggregate cost of equipment. I have read the paper of the evening somewhat hastily and possibly may have overlooked an adequate statement of the advantages of the alternating-current system which result from the elimination of the converter sub-stations. There are to-day in operation in this city something over 80 1,500-kilowatt converter units for the purchase and installation of which I have accepted responsibility. While this machinery is doing excellent service I know enough of its cost and limitations to realize that for trunk-line railroad operation in the broad sense, a system which employs the converter as an essential link between the coal pile and the train must give way to a system which eliminates this link, provided the single-phase alternating-current motor is designed and manufactured with anything approximating the care which to-day is bestowed upon the direct-current motor.

I may say that only last week with reference to a specific installation which I am studying I obtained from the engineers of one of our leading manufacturing companies comparative figures relating to 15-cycle single-phase alternating-current motors of 200 horsepower at one-hour rating and 600-volt direct-current motors of the same output. These motors are practically identical in speed when delivering 200 horsepower. The data in which I am particularly interested are the maximum vertical dimensions and the weights of these motors. The maximum vertical dimensions of the alternating-current motor is 36½ inches, that of the direct-current motor 15⅝ inches less. The weight of the alternating-current motor is 6,280 pounds; that of the direct-current motor 6,000 pounds; both of these weights are exclusive of gear, gear case and pinion. The alternating-current motor requires a wheel base one foot longer than is necessary with the direct-current motor. The ratings in the case of both motors are based upon the same rise of temperature without forced ventilation. It should be noted that while the only comparative data given with respect to motor performance relate to the 550-volt direct-current motor, the paper implies that in competition with the alternating-current system a direct-current potential of 1,200 volts will be used. I venture to express the opinion that comparing the 15-cycle single-phase alternating-current motor with the 1,200-volt direct-current motor the latter in general will have very little if any advantage in respect to dimensions or weight. Moreover it is not to be lightly assumed that rotary converters delivering 1,200 volts would be found as cheap and reliable as the 600-volt machines now in use.

Mr. Putnam and I have made estimates of the cost of the two systems as applied to average trunk-line railways operating both freight and passenger service. The costs of alternating-current equipment which we have assumed are based upon recent figures from the manufacturing companies. We have assumed that 1,200-volt direct-current motors, converters and train control will cost approximately the same as 600-volt apparatus, an assumption which is distinctly against the alternating-current system. We find that the first cost of electric equipment of the direct-current system exceeds that of the alternating-current system by about 50 per cent. Of course, this difference can be reduced if we assume that freight trains are not to be operated electrically, but in considering the general problem of trunk-line operation it would be folly to fail to provide for operation of freight as well as passenger service.

W. B. Potter, engineering department, General Electric Company, Schenectady: There is one suggestion in the remarks of the gentlemen who have preceded me, with regard to which I should like to state, at least so far as I and a number who are associated with me are concerned, our position with reference to what has been called the rival systems. It is not our intention to be the advocates of any particular system for the sake of the system itself. In nearly every case there are controlling conditions which in themselves are a sufficient argument to determine which particular method of operation is the best suited to those conditions. With respect to one of the installations that has been spoken of this evening, in connection with a trunk-line railroad, there existed conditions which made it obligatory to operate for a considerable portion of the distance with direct current. It does not appear to me, with the state of the art as it then existed, or is at the present time, that the particular installation which has been referred to was a place to try out and develop the single-phase alternating current. I think Mr. Wilgus expressed it well when he said that the place for experiments of that kind was on the interurban or suburban roads, where the conditions would naturally be better suited, and where failure, or only partial success, or any difficulties that might be met with, would be less serious in their results with reference to the traveling public.

I am pleased to say tonight that I believe without doubt (for I have sufficient evidence to warrant me in making the statement) that a single-phase motor can be produced in which the commutation is good, if not better, than the direct-current motors that we are all familiar with, those without commutating poles in which the armature speed will not be more than 15 per cent. higher, with a larger air-gap than has been used here before, and with conditions for general operation that will make that motor much more nearly comparable to the direct-current motor than anything we have seen thus far, and this without the introduction of any extraneous resistance and with an increase in efficiency of several percent. The weights of this motor will still be in the neighborhood of 25 per cent. more than the direct-current motor of the same horsepower rated on the hourly basis. This does not mean by any means that the alternating-current motor takes precedence, but it means that the alternating-current motor has been improved, and improvements will continue to be made, so that any conclusions which may be drawn with respect to the proper field of direct or alternating-current motors must not only include the conditions to be met, but also the improvements that will take place in the art, and with respect not only to alternating current, but direct current as well. With respect to the several rival systems, so-called, I would like to call attention to my connection with these several systems to this extent, that at the present time we are building 600 and 1,200-volt direct-current, 6,000-volt three-phase, and a number of 25-cycle single-phase installations.

Charles F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, Pittsburg: It has seemed to me that a number of points which Mr. Sprague has taken up have been comparisons on a particular basis, and that he has not considered fully the different methods or conditions under which the two motors may operate. For example, he has shown the curves of the two motors, he has shown that the alternating-current motor has at light load a much higher speed than the direct-current motor under the conditions which he has taken. There is an apparent conclusion, therefore, that the alternating-current motor is lacking in the excellent characteristics possessed by the direct-current motor. It seems to me that he has failed there to call attention to another point; that is, the ready adjustability of voltage in the alternating-current system by means of voltage taps from the transformer. By this means the motor, instead of carrying through its full curve with a constantly applied voltage, which is the usual condition with the direct-current motor, may have different voltages applied. It may, therefore, develop its different torques at different speeds, depending on the controller position. Under the control, therefore, of the motorman, the alternating-current motor may have different characteristics of acceleration; it may accelerate to a high point; it may have the same mean acceleration from start to maximum speed, with a less maximum rate of acceleration.

It seems to me in the treatment of the subject the author has, possibly unconsciously, assumed the direct-current motor and its characteristics as the ideal and that wherever the other motor had different characteristics, these characteristics were naturally and per se objectionable. At any rate, it has seemed to me that he has not recognized or emphasized certain advantages on the side of the alternating motor, where these advantages occur. The application of higher voltages gives not only higher speed, but higher output to the motor. Something in the same nature is attained by field control in the direct-current motor, but the field control is a method of adjusting speed without changing the capacity of the motor. The voltage applied to a motor and the current through the motor may remain the same, and hence its capacity. But with the alternating motor an increasing voltage applied to the motor allows an increased output from the motor, with the same current going through its armature. The matter of rheostatic losses in the direct-current equipment, a matter which in some kinds of service is of considerable importance, has not been touched upon.

N. W. Storer, Westinghouse Electric and Manufacturing Company, Pittsburg: In my opinion, the only fair way to compare the performance of single-phase motors with that of direct-current motors is to assume a car with a certain seating capacity, and then consider what equipments, alternating and direct current, are suitable for this service. It is not fair to assume, as is done in the book by Messrs. Parsha and Hobart, a car of a certain total weight, carrying in one case fewer passengers than the other. The object of a railway company is to accommodate a given traffic. It follows, therefore, that an equipment should be provided which will perform the service. Motors should be selected on the basis of their speed time curves and in accordance with their particular characteristics, rather than upon the simple horsepower basis. Further, in this paper, it is unfair to take an isolated case of a single-phase motor which may be heavier than the ordinary and compare it with a direct-current motor, which is certainly much lighter than ordinary motors of that capacity. If the author of the paper, in seeking to compare the two types of motors, had taken the 25-cycle 75-horsepower single-phase motor referred to later on in the paper, his conclusions might have been quite different. The weight which he assigns is 4,199 pounds. The weight of corresponding direct-current motors is 3,500 to 4,200 pounds. Moreover, if the single-phase motor to which he refers were operated on 15 cycles instead of 25, its output would be 90 to 95 horsepower, which would lead to conclusions quite at variance with others in the paper. The weight of a quadruple equipment of 90-horsepower direct-current motors furnished by the Westinghouse Electric and Manufacturing Company, would be approximately 20,000 pounds. The corresponding weight of a quadruple equipment of 90-horsepower 15-cycle motors with oil-insulated transformers equipped for 11,000 volts, would be approximately 27,500 pounds, an increase of about 37.5 per cent. This extra weight, added to a 40-ton car, would amount to about 10 per cent., and, owing to the greater efficiency in the control of the single-phase motors, the power consumption of the car including transformers would, in most classes of service, be approximately the same as that of the direct-current motor at the trolley and would be much less at the power house.

G. R. Henderson: I heartily agree with the assertion that trunk-line operation is vastly different from suburban service. As the two extremes, consider the New York subway, with constant trains at short intervals, and a division on a western road handling stock almost exclusively. There are one or two days a week when the stock must be brought to market, and perhaps from 12 to 20 trains will be run in one direction—possibly upgrade, at 15 or 30 minutes' intervals, as the market must be reached in time to avoid claims. Then for four or five days there may be nothing but one or two passenger trains and a local freight. Can anyone imagine a railroad company even to think of electrifying its road in such a case? The power house and conductors would have to be proportional to the maximum traffic, but the average load factor would not be 10 per cent. Operating methods can no doubt be changed in many cases to advantage in electric traction, but such traffic as I have referred to cannot be altered to suit transportation requirements.

The great possibility of the electric locomotive in freight service (and this is usually the dividend-earning part of traffic) seems to lie in the increased power available by small reductions in drawbar pull corresponding to increase in speeds, but the relative values for each and every line can only be determined by making a careful study of all the factors involved for that particular and individual piece of track, and comparisons with other roads may be not only useless but positively dangerous, unless all the conditions are understood.

William McClellan, engineer with Westinghouse, Church, Kerr & Co., New York: I have stood on an 11,000-volt train and operated it, and found it extremely flexible in every way; in fact, there was nothing to tell me that it was any different from an ordinary trolley car or multiple-unit train. In fact, the acceleration was smoother, which you know is one of the advantages claimed for it. I took the covers off the commutators, and the commutation was absolutely perfect; by that I mean there were no sparks whatever, in spite of the fact that the car at the time was pulling a heavy overload and was acting as a locomotive, so that no complaints could be raised on that score. When we come to take a trunk-line installation and study it completely, I think we should reach the conclusion that the electric locomotive, or any locomotive, does not hold out the attraction that it seems to at present; in other words, we are going to distribute our motive power throughout the train in many cases; the multiple-unit train is going to be the future train for a great number of cases, and therefore in any case capacity will not figure to so great an extent. It does not cut much figure, anyway, apparently, in view of the improved motor.

Some of those who have been accused of being direct-current men are actually devising and installing 650-volt propositions, right along, which removes the value of such a statement entirely, so we are inclined to look on this 11,000-volt or high-tension proposition longingly, so to speak, simply because I think most of us believe that alternating trunk-line operation can never come through a 650-volt proposition; that is not saying anything either about general work or overhead work; it simply cannot come on account of the expense, and therefore we are driven to the conclusion that we must get some sort of a good 11,000-volt proposition in good working order.

A. H. Armstrong, General Electric Company, Schenectady: I witnessed yesterday morning a test of an alternating-current motor, rated nominally at 125 horsepower, which operated at 50 per cent. overload with perfectly black commutation, hardly a sign of a spark, and the machine carried only half its usual complement of brushes. It is a case of new development, and my ideas are somewhat changed in consequence. It is true that the direct-current motor is also open to certain developments. Two years ago we would hardly make the statement that 1,200 volts was a feasible, common-sense method of construction. The commutating-pole motor has been developed and largely applied to the railway design, and the 1,200-volt motor is a perfect success, and we can go higher if necessity calls for it. The alternating-current mo-

tor is also developing, and it is very hard to say just where it will stop. I would like to say to the direct-current enthusiasts that the alternating current is approaching very closely indeed to the best performance of the direct-current motor as now in commercial operation. The tests I referred to were at 25 cycles. This does not weaken my opinion that there is no use in going down to 15 cycles, with all the incidental complication involved in so doing. I heard the statement expressed, I think, by the head of the Chicago Edison organization, to the effect that in and around the large cities the total electrical power developed was represented in the railway field by about 25 per cent., that is, if all the electric railroads in and around the cities were operated, only 25 per cent. of the total power generated would be required for that purpose, the other 75 per cent. to be used for lighting, small power work, and an incidental supply. All of the large cities have adopted and installed 25 cycles as a nucleus, and it would be folly to think of anything else coming in.

Prof. C. P. Steinmetz, Schenectady: I desire to indorse fully Mr. Sprague's statement that we are not ready yet to standardize one type of railway motor—one type of electrified steam railway. We will not be ready for some time, perhaps, never, but I agree with Mr. Wilgus that each railway problem has to be considered on its own merits and the proper method of solving the problem chosen as far as possible on the lines of standards, on those lines which have been found satisfactory in every way, and not deviate from these where it is not absolutely necessary. We have at present a good alternating-current motor and we have a better direct-current motor, whatever argument may be brought against it, because if you take an alternating-current motor and run it on direct current, at the same speed, then you save the energy lost as hysteresis in the field, you save the energy lost in the transformer losses on the commutator, that is, you get a somewhat higher operation, but somewhat lesser heating, and since the output or capacity of the railway motor is determined by the heating, this alternating motor on direct current will run at lower temperature, but with the same temperature you can get a higher output from it, or you can redesign it, as is usually done, as a direct-current motor, adopting a cheaper construction, and so get the advantage of the direct current in the reduced cost, whichever way you desire to use it.

There is quite a class of service where alternating motors are necessary. If you consider a long railway with very infrequent or irregular service, a considerable amount of freight traffic which is very fluctuating in nature, in short, conditions where a rotary-converter sub-station would show a very poor load factor, in such cases direct current appears out of the question, and is the field for the alternating-current motor or steam locomotive. Again, in other cases, where you have a four-track or a six-track railway with such heavy traffic that the distance between trains is limited only by the safe headway, or a little shorter sometimes, in such a case the load factor in the converter sub-station will be so steady, the rapidity of acceleration required so considerable, and the maximum capacity of the motor so great, that the advantage is decidedly in favor of the direct current, and there should be in such a case no excuse for using alternating-current motors. I do not share the objection to the rotary converter, and do not believe there is so great a gain in eliminating this link. It is an advantage in a system to eliminate some of the links in the chain, but what you want to eliminate is the weakest link, and that is not the rotary converter, but the motor. In regard to the 1,200-volt direct-current motor, my conclusion is that the commutation of this motor is so infinitely superior to the commutation of any alternating-current motor I have ever seen, except in the last week, that there is no comparison.

The Public Utilities Bill.

Governor Hughes of New York has procured the passage of the Public Utilities bill. The bill creates two commissions, the members of which shall be appointed by the governor, with powers to supervise and regulate the operation of public corporations both in the city and the state of New York—separate bodies for each.

The commissioners' powers are manifold. They can order any change in equipment or regulations of employes considered necessary for the safety of passengers. They can examine all books, records and papers of any person, firm or corporation engaged in public service. They can control train schedules, fix rates of passenger and freight tariffs, or for gas or electric light. Any action brought in the courts by the commission against a corporation must have precedence over all civil cases except those concerning elections.

Without the approval of the commission no railroad or street-railway corporation or common carrier shall begin construction or exercise any franchise or right under any provision of the rrailroad law, nor of any other law not heretofore lawfully exercised. No franchise shall be assigned, transferred or leased, nor any contract or agreement made with reference thereto without the approval of the commission. The permission and approval of the commission, however, will not be construed to revive or validate any lapsed or invalid franchise, or to enlarge or add to the powers and privileges contained in the grant of any franchise or to waive any forfeiture. Mayor McClellan of New York city has vetoed the bill, but it will probably become a law without his approval.

An International Comparison of Units of Luminous Intensity.[1]

By Edward P. Hyde.

In inaugurating the work in photometry at the Bureau of Standards several years ago it was decided to adopt at once a working standard which could be maintained uniform, and in terms of which lamps submitted for verification could be standardized, and to defer the adoption of a primary standard until a thorough investigation of various primary photometric standards could be made. A comparison of the standards used by a large number of incandescent-lamp manufacturers in the United States showed differences of 10 per cent. or more and emphasized the need of authoritative photometric standards, copies of which could be supplied to lamp manufacturers and others making photometric measurements.

Obviously it was desirable to have the secondary standard which was to be maintained at the bureau in as close agreement as possible with the standards employed in industrial practice in the United States. In the gas industry the British parliamentary candle is the recognized primary standard and has been used quite generally as the workin standard, although in recent years it has been supplanted to some extent by the Harcourt (10-candle-power) pentane lamp. In the photometry of electric lamps, following the recommendation of the American Institute of Electrical Engineers, the Hefner lamp has been recognized as the primary standard, but the luminous intensity of a source has been expressed in British parliamentary candles, using the ratio 1 hefner = 0.88 British candle.

The British candle is thus universally the unit of luminous intensity in the United States, and it was therefore adopted as the unit in terms of which the standard of the bureau should be expressed. But the British candle as a standard is unreliable and may have values differing by five per cent. or more, so that the value of a candle unit obtained from a standard sperm candle would not be satisfactory. It was therefore decided to obtain the candle unit in the way recommended by the American Institute of Electrical Engineers, with one essential difference. Since Hefner lamps which do not differ in intensity from the standards of the Reichsanstalt by more than two per cent. are certified by that institution as correct, and since, owing to the difference in color between the Hefner lamp and ordinary illuminants, comparisons between the Hefner and other sources depend somewhat on the observer, two observers using different certified Hefner lamps may obtain results differing by several per cent. Therefore, instead of measuring at the bureau a number of incandescent lamps in terms of several Hefner lamps in our possession, the Hefner unit was obtained directly from the Reichsanstalt by means of incandescent lamps verified at that laboratory in terms of their Hefner lamps. In this way it was hoped to obtain a standard expressed in terms of the Hefner unit of the Reichsanstalt.

The unit of the bureau was obtained from these lamps by the use of the ratio, 1 Hefner = 0.88 candle. This unit was found to be in approximate agreement with the mean value of the candle in use by many lamp factories and testing laboratories, and was therefore in no sense an innovation. Since the establishment of the unit, all the principal lamp factories and testing laboratories have obtained copies of it directly or indirectly, so that this unit has now become in practice as well as in theory the standard of the United States in the photometry of electric lamps.

Since obtaining the original lamps, several comparisons of the standard of the bureau with that of the Reichsanstalt have been made by means of seasoned incandescent lamps sent to Germany, each comparison indicating that the ratio of our unit to that of the Reichsanstalt had remained unchanged to within the errors of observation. Moreover, measurements made both at the Reichsanstalt and at the Bureau of Standards on incandescent lamps belonging to the Electrical Testing Laboratories of New York[2] showed the bureau unit to equal very closely $\frac{100}{88}$ of the Reichsanstalt unit.

In order to obtain an accurate comparison of the unit of the United States with those of England and France, and to obtain a further comparison with the unit of Germany, the writer carried a number of seasoned lamps abroad in the spring of 1906 and had them compared with the recognized standards of these countries. Eighteen lamps were taken, nine of which were 50-volt, 64-watt, horseshoe-filament lamps which had been standardized for intensity in a specific direction defined by lines etched on the bulb. The other nine lamps were 110-volt, 64-watt, oval anchored-filament lamps which had been standardized for mean horizontal intensity (the mean intensity perpendicular to the axis of the lamp) by the method of rotating the lamps at 180 revolutions per minute. Three lamps of each type were left at the National Physical Laboratory at London as a check on the others, which were taken to Paris and Berlin.

The lamps were hermetically sealed in copper boxes and were carried entirely by hand in order to avoid excessive jarring. They were taken in the order named to the National Physical Laboratory, the Laboratoire Central d'Électricité at Paris, the Physikalisch-Technische Reichsanstalt at Berlin, and then again to the National Physical Laboratory. They were intercompared and measured in terms of the standards of the bureau immediately before leaving and as soon after returning as practicable.

At each laboratory, except the Reichsanstalt, the method employed for determining the mean horizontal intensity of the six 110-volt lamps was the same as that used at the bureau. At the Reichsanstalt the method of rotating a pair of mirrors about the lamp was employed. Moreover, the distance at which both the stationary and rotating lamps were measured was approximately 125 centimeters at each laboratory, except the Reichsanstalt, where the 50-volt stationary lamps were compared at a distance of 300 centimeters, and the other six lamps at a distance of 450 centimeters. The difference in distance was occasioned by the use of the two mirrors in measuring the mean horizontal intensity of the 110-volt lamps.

An investigation was subsequently undertaken at the bureau to determine what differences in the values of mean horizontal intensity might result from the two different methods of making the measurements. For oval anchored-filament lamps the values of mean horizontal intensity determined in the two ways would probably not differ appreciably, although it is impossible to conclude definitely from the results obtained by one observer what the results would be for a second observer. The flicker, which is plainly perceptible even with lamps of the oval anchored-filament type rotating at 180 revolutions per minute, is more annoying and more productive of error with some observers than with others. Two observers at the bureau, however, obtained correct values of mean horizontal intensity for these lamps to within negligible differences.

The possible errors due to the difference in distance at which the measurements were made were also investigated, by comparing the intensities of the lamps at a long distance with their intensities at a much shorter distance, using the rotating sectored disk. In the case of the stationary lamps a bad centering of the filament produces different apparent intensities at different distances. With the rotating lamp images are cast by the bulb in different directions and at various distances from the lamp, and the light radiating from these images has of course a different effective center from that radiating directly from the filament. In the orientation of stationary lamps care is always exercised to avoid a direction in which an image is thrown, but in rotating a lamp the light in every direction in the horizontal plane falls on the screen, so that it must be shown by experiment what differences in the apparent intensities obtained at different distances may result from these images. Although the error due to such an effect would no doubt be quite appreciable if measurements were made with the lamp in such a stationary position that an image would fall directly on the screen, in rotating the lamp the effect of such images is distributed over the entire horizontal zone, so that the resultant error would probably be small. A comparison of the lamps at 300 centimeters and at 125 centimeters revealed no appreciable differences, so that the measurements made at the Reichsanstalt are comparable with those made in England and France and at this bureau.

The results of the determinations made in England were obtained by comparison with incandescent lamps, which in turn had been compared with the standard Harcourt pentane lamp of the National Physical Laboratory. This lamp is supposed to have an intensity of 10 British parliamentary candles, and therefore the intensities of the incandescent lamps verified for the bureau are expressed in British candles. In France the comparisons were made against incandescent lamps which had been measured at the Laboratoire Central in terms of the Carcel lamp. By assigning to the Carcel lamp an intensity of 9.6 bougies décimales, a value obtained by Violle from a direct comparison with the platinum standard, the results are expressed in bougies décimales.

In Germany, the comparisons were made against incandescent lamps which had in turn been compared against the Hefner amyl acetate lamp. The results are expressed in Hefner candles. Since at the Reichsanstalt the electromotive force of a Clark cell at 15° C. is taken as 1.4328 volts, instead of 1.4340 volts (the value used in England, France and the United States), the voltages and currents of the incandescent lamps were modified accordingly, but in the following tables, for purposes of comparison, all voltages and currents are expressed in terms of the same units.

In Table I. are given the complete results ob-

1. This is the major portion of an article in the Bulletin of the Bureau of Standards (Washington, D. C.) for April, 1907.

2. Sharpe: Trans. International Electrical Congress, St. Louis, I., p. 492; 1904.

TABLE I.

Values of Candlepower and Current Obtained at the Different Laboratories.

Lamps	Voltage	Bureau of Standards.		National Physical Laboratory.		Laboratoire Central.		Reichsanstalt.		National Physical Laboratory.		Bureau of Standards.	
		Candle-power.	Current	Candle-power.	Current	Candle-power in Bougies Decimales	Current	Candle-power in Hefners.	Current	Candle-power.	Current	Candle-power.	Current
B. S. No. 44	49.0	17.41	1.3326	17.6[illegible]	1.3330	17.7[illegible]	1.3325	19.9	1.333	17.7[illegible]	1.3330	17.3[illegible]	1.3325
B. S. No. 45	49.0	17.7[illegible]	1.3304	17.6[illegible]	1.3306	17.5[illegible]	1.320	19.6	1.331	17.4[illegible]	1.3306	17.24	1.3302
B. S. No. 46	49.5	17.3[illegible]	1.3225	17.6[illegible]	1.3229	17.5[illegible]	1.323	19.5	1.323	17.6[illegible]	1.3230	17.2[illegible]	1.3225
B. S. No. 49	49.5	17.8[illegible]	1.3301	17.7[illegible]	1.3302	17.7[illegible]	1.3295	19.9	1.330	17.74	1.3305	17.5[illegible]	1.3301
B. S. No. 50	49.5	17.3[illegible]	1.3283	17.5[illegible]	1.3284	17.5[illegible]	1.328	19.6	1.328	17.5[illegible]	1.3288	17.3[illegible]	1.3282
B. S. No. 64	49.5	17.7[illegible]	1.3328	17.9[illegible]	1.3325	18.0[illegible]	1.333	20.1	1.333	18.0[illegible]	1.3331	17.6[illegible]	1.3328
Means		17.45	1.3294	17.7[illegible]	1.3296	17.6[illegible]	1.3293	19.7[illegible]	1.3297	17.6[illegible]	1.3298	17.4[illegible]	1.3294
B. S. No. 4	109.0	16.2[illegible]	0.5973	16.5[illegible]	0.5975	16.5[illegible]	0.5965	18.5	0.597	16.5[illegible]	0.5975	16.1[illegible]	0.5974
B. S. No. 7	108.0	15.9[illegible]	0.5947	16.1[illegible]	0.5944	16.0[illegible]	0.5937	18.0	0.594	16.2[illegible]	0.5946	15.8[illegible]	0.5944
B. S. No. 8	109.0	16.0[illegible]	0.5851	16.3[illegible]	0.5852	16.4[illegible]	0.5850	18.3	0.584	16.3[illegible]	0.5852	16.0[illegible]	0.5850
B. S. No. 13	109.0	15.7[illegible]	0.5936	16.0[illegible]	0.5938	16.4[illegible]	0.5932	18.1	0.593	16.0[illegible]	0.5939	15.8[illegible]	0.5937
B. S. No. 30	109.0	15.7[illegible]	0.5852	16.0[illegible]	0.5855	16.0[illegible]	0.5848	18.0	0.585	16.0[illegible]	0.5855	15.7[illegible]	0.5854
B. S. No. 40	109.0	16.2[illegible]	0.5984	16.7[illegible]	0.5986	16.7[illegible]	0.5970	18.6	0.598	16.6[illegible]	0.5986	16.3[illegible]	0.5984
Means		16.0[illegible]	0.5924	16.2[illegible]	0.5925	16.3[illegible]	0.5917	18.2[illegible]	0.5923*	16.3[illegible]	0.5926	15.9[illegible]	0.5924

*The current values in this column were only given to three decimal places by the Reichsanstalt, but since the corrections for difference in value of the standard cell amounts to 5 in the next place for the rotating lamps, and is the same for all the lamps the mean is increased by 5 in the fourth decimal place.

tained for the individual lamps at the different laboratories, in the order in which the laboratories were visited. The first six lamps, B. S. Nos. 44, 45, 46, 49, 50 and 64, are the 50-volt stationary lamps, the remaining six, B. S. Nos. 4, 7, 8, 13, 30 and 40, are the 110-volt lamps that were standardized for mean horizontal intensity and are hereafter designated as the rotating lamps. The six lamps, three stationary and three rotating, which were left at the National Physical Laboratory, are not included in this table. They were used merely as a check on the constancy of the other 12 lamps.

In the first column are given the numbers of the lamps, in the second column the voltages at which the lamps were burned, and in the remaining columns the values of candlepower and current found at the respective laboratories. At the Bureau of Standards and at the National Physical Laboratory they were measured twice. The values given in the fifth and sixth columns are those obtained at the first visit to the National Physical Laboratory, but since, for lack of time, only a single set of readings was made, the results are not guaranteed by the National Physical Laboratory to a high accuracy. They are therefore omitted in the final comparisons of the units.

Table I. reveals several interesting and important facts in regard to the present stage of development of the science of photometry. A comparison of the mean values of the stationary and rotating lamps before being carried abroad and after their return gives some idea of the constancy and portability of seasoned incandescent lamps as secondary photometric standards. The lamps were carried about for two months, were packed and unpacked five times, were burned in all about two or three hours, and yet the mean value of the six stationary lamps was found to have changed by less than 3 parts in 1,000, while the mean value of the six rotating lamps apparently changed less than 1 part in 1,000. It is not to be inferred from this that the lamps necessarily remained as constant as the results would indicate, since it is impossible to measure with certainty even the mean value of the lamps with an accuracy better than several parts in 1,000. The constancy of the resistance of the lamp filaments as shown by the agreement between the mean current values is another indication of the constancy of the lamps and emphasizes the importance of accurate electrical measurements in the photometry of incandescent-lamp standards.

A second interesting fact, on which some light is thrown by Table I., is the ultimate accuracy of photometric comparisons. Of course, this accuracy depends largely on the nature of the sources to be compared, their color, relative intensity, constancy, etc. Moreover, any single observer with a particular set of apparatus may at any one time, or even at different times, obtain relative values between the two different sources to a remarkably high degree of accuracy. A very important question, however, is the accuracy with which different experienced observers, using different apparatus, can obtain the relative values of two light sources under favorable circumstances.

This question is partially answered by Table I. The conditions of comparison—at least for the stationary lamps—were as nearly ideal as could be realized with any known sources. The lamps were all of the same color (the voltages having been chosen initially to accomplish this); they were approximately of the same intensity, and those of each type burned at approximately the same voltage. The observers were experienced in photometry, and the measurements were made in laboratories of international reputation, but the apparatus and the methods of measurement employed were somewhat different.

In order to show the agreement among the different measurements, the results are expressed in a more convenient way in Table II. Since the units of the different countries are not the same, the values of the individual lamps are expressed in terms of the mean of the six lamps taken as unity.

TABLE II.

Relative Values of Individual Lamps in Terms of Mean.

Lamps.	Bureau of Standards	National Physical Laboratory.	Laboratoire Central.	Reichsanstalt.	National Physical Laboratory.	Bureau of Standards.	Mean Relative Values.
B. S. No. 44	0.998	0.998	1.001	1.007	1.003	0.999	1.001
B. S. No. 45	0.992	0.995	0.993	0.991	0.986	0.991	0.991
B. S. No. 46	0.992	0.995	0.994	0.986	0.997	0.993	0.993
B. S. No. 49	0.008	1.005	1.004	1.007	1.005	1.007	1.006
B. S. No. 50	0.996	0.993	0.990	0.991	0.991	0.994	0.992
B. S. No. 64	1.014	1.014	1.018	1.017	1.019	1.016	1.016
Means	1.000	1.000	1.000	1.000	1.000	1.000	1.000
B. S. No. 4	1.016	1.013	1.012	1.014	1.012	1.010	1.013
B. S. No. 7	0.994	0.989	0.981	0.986	0.996	0.993	0.990
B. S. No. 8	1.001	1.001	1.002	1.003	0.999	1.004	1.002
B. S. No. 13	0.986	0.986	1.002	0.992	0.986	0.989	0.990
B. S. No. 30	0.986	0.995	0.981	0.986	0.986	0.984	0.985
B. S. No. 40	1.016	1.027	1.021	1.019	1.020	1.020	1.020
Means	1.000	1.000	1.000	1.000	1.000	1.000	1.000

In the first column are given the numbers of the lamps, the first six being the stationary lamps and the last six the rotating lamps. The next six columns contain the relative values of the lamps as determined at the various laboratories indicated at the head of the respective columns. The last column contains the mean relative values of the individual lamps, being the means of the values in the preceding six columns. If these mean relative values are taken as the true values of the lamps, by comparing them with the values in the other columns, an idea is obtained of the accuracy with which the individual lamps were measured in terms of the six standards. It is seen that the greatest deviation from the true value is only 0.7 per cent. for the stationary lamps and 1.2 per cent. for the rotating lamps, whereas the average deviation for the measurements at any one laboratory is in no case as large as 0.3 per cent. for the stationary lamps, or 0.5 per cent. for the rotating lamps. The accuracy of reading is naturally somewhat less with the rotating lamps than with the stationary lamps, as the flicker for oval anchored filaments rotating at 180 revolutions per minute is quite perceptible and annoying, even to observers accustomed to it.

In comparing the relative values found at the different laboratories with the mean relative values it should be noted that the Reichsanstalt only certified the lamps to one-tenth of a Hefner candle, and therefore the relative values calculated from the Hefner-candle values given by that laboratory are only significant to within several units in the last decimal place in Table II. Moreover, as stated above, the first values given by the National Physical Laboratory represent only a single set of readings, and consequently the agreement between the two columns of values given by that institution should not be compared with the agreement between the two columns of values found at this bureau, and which represent the mean of a number of determinations.

In order to compare the unit of the bureau with those of the other laboratories, the values given in Table I. are grouped in a more convenient form in Table III. In this table the unit of each laboratory is expressed in terms of the unit of the Bureau of Standards, except that the Reichsanstalt unit is expressed in terms of 0.88 times the Bureau unit. The ratios are given as obtained both from the stationary and from the rotating lamps, and it is interesting to note the differences between the two values. In every case the ratio obtained from the rotating lamps is lower than that obtained from the stationary lamps. This difference, which amounts to 0.7 per cent. at one of the laboratories, may be due in part to errors incident to the rotating-lamp method of measuring mean horizontal intensity. It may also be due in part to small errors in electrical measurements. Although all of the stationary lamps were of one type, and all of the rotating lamps were of one type, these two types were not the same. The stationary lamps were 50-volt lamps, taking a current of 1.3 amperes, whereas the rotating lamps were 110-volt lamps, with currents of 0.6 ampere, so that the electrical conditions in the two cases were quite different.

TABLE III.

Values of Units of Different Laboratories in Terms of the Unit of the Bureau of Standards.

Units of Various Laboratories.	Values in Terms of B. S. Unit.		
	Stationary Lamps.	Rotating Lamps.	Means.
Bureau of Standards unit	1.000	1.000	1.000
Reichsanstalt unit	1.001×0.88	0.996×0.88	0.998×0.88
Nat. Physical Laboratory unit	0.987	0.981	0.984
Laboratoire Central unit	0.985	0.978	0.982

It is seen from Table III. that the unit of the Bureau is equal to $\frac{100}{88}$ of the Reichsanstalt unit to within the errors of measurement. Since the unit was originally obtained in this way nearly four years ago, it indicates that the Bureau has maintained, through incandescent-lamp secondary standards, a unit which, compared with the unit of the Reichsanstalt, has not changed appreciably in that time. But though the Bureau has been able to maintain for several years a constant unit by means of incandescent-lamp secondary standards, and could probably continue to maintain it in this way for an indefinite period, nevertheless the need of a suitable primary photometric standard is fully recognized, and an investigation of primary standards will be undertaken in the near future.

It is evident from Table III. that the value of the British candle obtained from the Hefner by the use of the fraction 0.88, which is supposed to represent the mean of the best determinations of the ratio, is not the same as the British candle defined in terms of the Harcourt (10-candlepower) pentane lamp at the National Physical Laboratory. The difference is about 1.5 per cent., according to the values given in Table III.; but, as will be seen later, there is an uncertainty in this ratio amounting to several per cent.

It is desirable to call attention to the approximate agreement between the bougie décimale, the British candle, and the candle in use in the United States in the testing of electric lamps. The difference of about two per cent. is small compared with the accuracy usually obtained in industrial photometry, and no serious results would follow a compromise by which the three countries would agree upon a unit to be the same for all. This highly desirable end will become more difficult of accomplishment each year, as a higher accuracy of photometric measurement is demanded, and even now a change in unit of over one per cent. would be felt in the United States. Unfortunately the unit of Germany is so different from all the others that it would probably be impossible to agree upon a unit common to the four countries, but the ratio of the Hefner candle to the candle of France, England and the United States could be accurately fixed.

The question of a uniform unit is to be distinguished from that of a uniform standard lamp in terms of which the unit is expressed. Thus at present the Carcel lamp in France has an intensity of 9.6 bougies décimales, and the Harcourt pentane lamp in England has an intensity of 10 British candles. Only in Germany has the standard an intensity of one unit, and even here in stating the intensity the word candle is affixed (Hefnerkerze). Of course it would be very desirable to adopt a common standard as well as a common unit, but the adoption of the unit is the more important of the two. As soon as an entirely satisfactory standard is presented its general adoption will probably follow, and this is much more likely to result if the adoption of a new standard does not entail the adoption of a new unit. The Hefner lamp was recommended by the Geneva Congress as a secondary standard, but owing partly to the fact that the Hefner was not found as satisfactory in other laboratories as it had been found at the Reichsanstalt, and partly, no doubt, because of the different value of the unit, its general adoption did not follow. The Carcel continues to be used in France, and the Harcourt pentane lamp is coming into general favor in England.

A bulletin from the office of the International Independent Telephone Association, Cleveland, Ohio, says that the Chicago convention will be the "most important gathering of telephone men the world has ever known." The headquarters and sessions will be at the Auditorium Hotel, the dates being June 4th, 5th and 6th. Plans are being made for a large gathering, and an elaborate programme is being prepared, including the discussion of technical, financial and operating conditions.

C-C Non-gap Lightning Arrester.

Perhaps the simplest lightning arrester on the market is that manufactured by the Woolley Electric Company of Clayton, Mo., under the name of the C-C Non-gap. The arrester is said also to be remarkably efficient. It consists primarily of a specially constructed rod of very high ohmic but non-inductive resistance cut in directly between the line and the ground without any intervening air-gap, so that it allows a constant but negligible flow of current to pass through it toward the ground. The peculiar composition of the rod is such that while it does limit this dynamic electricity to such an infinitesimally small quantity it at the same time has absolutely no impedance whatever for a static or lightning discharge. The enormous carrying capacity for abnormal discharges of such a path is recognized as being exceptionally high, in fact the protective value of any closed and completely connected path that is absolutely non-inductive and straight is, according to the manufacturer, probably the best it is possible to secure.

Fig. 1. Conducting Rod in Porcelain Box.

Fig. 3. 2,300-volt Type.

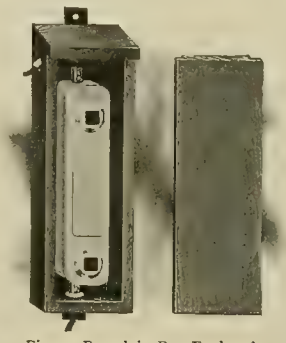


Fig. 2. Porcelain Box Enclosed.

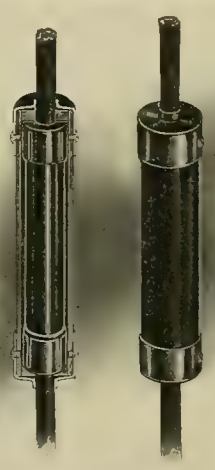


Fig. 4. Low-voltage Type.

C-C NON-GAP LIGHTNING ARRESTER.

The conducting rods are guaranteed to be thoroughly non-inductive and homogeneous in composition. It is said that they will neither heat, fuse nor shatter with the small constant dynamic load nor the sudden and severe lightning overcharge; neither will they change their resistance under conditions of operation.

The arrester is non-arcing and for that reason long-lived; it has no moving parts to get out of order nor coils to short-circuit; it offers one of the straightest paths of any arrester made and can take care of a discharge without any harmful after effect in the shape of a surging current.

Fig. 1 shows the conducting rod mounted in a porcelain box for station use and any voltages up to 700 volts. For line use these porcelain boxes are mounted in wooden ones, as shown in Figs. 2 and 3. Fig. 3 is the 2,300-volt type.

The new type T arrester shown in Fig. 4 is particularly interesting. To meet the increasing demand for a cheap and easily installed yet efficient arrester for lower voltages than 250 the manufacturers have just brought out this new type which is adapted for house protection, also transformer secondaries and series arc lamps. It embodies all of the C-C Non-gap standard principles. The only difference from the higher voltage type is in the housing of the rod, the method used being somewhat similar to an enclosed fuse. The principle can be easily understood by reference to Fig. 4. The adaptability of this arrester is one of its chief features. It may be tapped on wherever necessary without any support other than from its own wire. For series-arc service the arrester is connected across the terminals of each lamp to allow the discharge to shunt the lamp when traveling to the regular arrester to ground.

The Woolley Electric Company is represented in Chicago by George H. Erich of 358 Dearborn Street, who will carry a full stock of arresters.

New Moline Metallic-filament Lamp.

The interesting announcement is made that the Moline Incandescent Lamp Company of Moline, Ill., is putting on the market a new metallic-filament incandescent lamp. This new lamp is called the "Moline Jewel." Experiments have been in progress for many months in the development of this new lamp, and the Moline company has carried on these scientific investigations with an idea of not only producing a metallic-filament lamp, but with a purpose of turning out a filament that would prove a pronounced success and fulfill the requirements of the most stringent lamp specification.

Reference to the cut herewith shows that the 20-candlepower 50-watt "Moline Jewel" lamp is very little different in external appearance from the usual Moline standard type of lamp. The metallic filament (2½ watts per candlepower) is shaped and anchored as indicated in the picture. It is hardly necessary to say that this lamp also carries in its stem and all sealed in the bulb, the usual Moline "Guarantee Label."

An interesting fact to be taken into consideration with reference to the production of this new "Moline Jewel" metallic-filament lamp is that the company's factory capacity at Moline is now being increased to 6,000 lamps a day, with the idea of being fully prepared to fulfill every demand for the new lamp, and at the same time to be ready to furnish with all promptness the usual sizes, voltages and candlepowers of the company's standard carbon lamps, candelabras, Meridian, frosted and colored standard incandescent lamps.

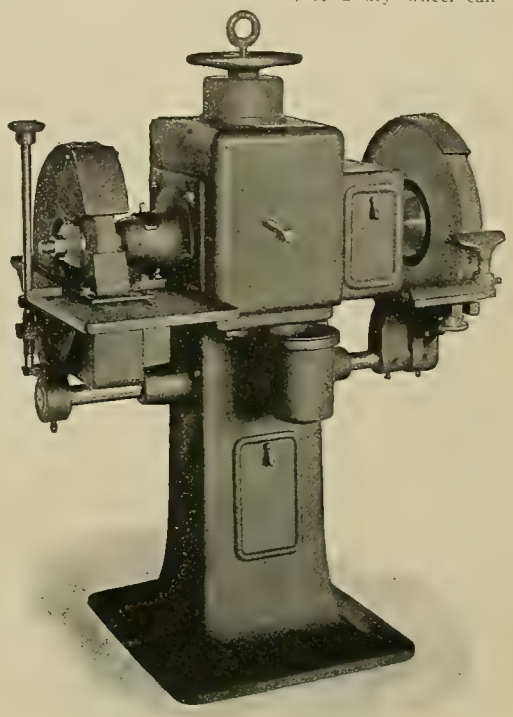
NEW MOLINE METALLIC FILAMENT LAMP.

The new "Moline Jewel" metallic-filament lamp may be seen not only at the Moline factory, but at the company's Chicago and New York offices. It is the purpose of the company also to present a number of these new lamps for inspection, and test if desired, at next week's meeting of the National Electric Light Association at the New Willard Hotel in Washington.

Readily Portable Electric Emery Grinder.

The accompanying illustration represents a type of electric emery grinder which, though designed to be stationary, can readily be rendered portable by simply loosening a few bolts. It can thus be moved from one place to another without regard to countershafts or line shafts.

Two wet or two dry wheels can be used in connection with the machine, or a dry wheel can be placed at one end and a wet one at the other. The wet wheel mounted on the left side of the motor is properly encased, and the water tank below the wheel may be elevated to any desired height by a turn of the vertical rod shown on the extreme left. The level of the water is thus raised in contact with the wheel, and a more even distribution is possible than with the older foot-pedal arrangement. Both wheels are provided with conveniently detachable rests for grinding, and the wet wheel has a catch pan into which the spray is thrown and returned to the water tank. A cast-iron water pot is conveniently located between the wheels.



READILY PORTABLE EMERY GRINDER.

The manufacturer of these machines—Stow Manufacturing Company, Binghamton, N. Y.—basis its claim for their superiority on the fact that the company's multi-speed motor used with them is specially calculated for this class of work. It is said to furnish every conceivable speed between the highest and lowest points; that is, a fraction of a turn of the hand-wheel on top of the machine will make a corresponding change in the speed of the motor, thus enabling the operator to get exactly the right speed for the size of emery wheel he is using. The motor is self-contained, no controller or rheostat being used. It is started and stopped by turning the short lever on the motor to the right or left.

The entire outfit is carefully proportioned, and as the base is large and the running parts carefully balanced, there is no appreciable vibration. It is built for direct current only. The one shown in the illustration is adapted for wheels not exceeding 2 by 18 inches in diameter.

The membership of the Schenectady branch of the American Institute of Electrical Engineers is now said to be over 900. The annual meeting of this branch was held on May 23d, about 500 members attending. Nearly all the old officers were re-elected. Following is the list: Honorary chairman, C. P. Steinmetz; chairman, D. B. Rushmore; vice-chairmen, E. H. Anderson, A. H. Armstrong, E. A. Baldwin, E. E. F. Creighton, William Dalton, G. H. Hill, E. B. Merriam, A. L. Rohrer, C. W. Stone; corresponding secretary, W. C. Andrews; recording secretary, J. M. Knox; treasurer, A. S. Kappella; librarian, H. E. White.

Chicago Edison and Commonwealth Electric Reports.

Both the Chicago Edison Company and the Commonwealth Electric Company in their annual reports for the year ended March 31, 1907, show substantial increases in gross earnings as compared with those of the previous year. The gross business of the Edison company shows an increase of 12.06 per cent. over that of 1906, while that of the Commonwealth company shows an increase of 40½ per cent. The Edison company's total surplus was increased $242,154 during the year and is now $1,411,855. The Commonwealth company added about $394,550 to the surplus, making the total surplus $1,366,383.

The earnings and expenses of the Edison company for the fiscal year ended March 31, 1907, were as follows:

Gross earnings (including merchandise sales)		$5,317,359.49
Expenses (including cost of merchandise sales)		3,610,110.62
Earnings for the year		$1,707,248.87
Charges against earnings:		
Interest on bonds and debentures	$365,249.45	
Depreciation reserve	100,000.00	
Dividends	999,845.50	1,465,094.95
Balance		$ 242,153.92

Following is the income account of the Commonwealth company:

Gross earnings (including merchandise sales)		$3,524,729.78
Expenses (including cost of merchandise sales)		2,588,158.63
Earnings for the year		$ 936,571.15
Charges against earnings:		
Interest on bonds and debentures	$406,021.76	
Depreciation reserve	136,000.00	542,021.76
Balance		$ 394,549.39

The total connected load of the Chicago Edison company on March 31, 1907, was the equivalent of 1,924,886 16-candlepower lamps connected—a good gain over the 1,660,108 lamps of March 31, 1906. During the year the capital stock was increased from $12,011,203 to $13,614,115.

For the Commonwealth company the load figures are: Lamps connected March 31, 1907, 1,313,852; March 31, 1906, 973,752. This shows the fine increase of over 31 per cent.

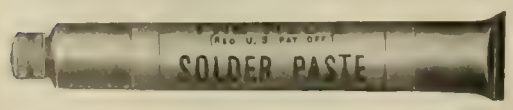
Singing Arc Lamps.

At the demonstrations of the telharmonium in New York city a feature is the singing arc lamps. The high-frequency currents from the various alternators of the dynamophone are superposed upon the normal direct current of the lamp, thus producing variation in the heat emitted from the arc. The heat fluctuates in synchronism with the telharmonic currents and produces thereby changes in the air which reach the ear as musical sounds. The accompanying illustration shows two Excello 10-ampere arc lamps being used as telharmonic receivers. The peculiar quality of the impregnated carbons used in these lamps renders them particularly well adapted for this work.

SINGING ARC LAMPS.

Red "E" Solder Paste.

Solder flux put up in a convenient form for special use where only a little paste is required, such as in line, laboratory or shop work, is now being put on the market by the Chase-Shawmut Company, Newburyport, Mass. The accompanying cut shows a collapsible tube designed to contain the paste, which may be carried in the pocket or tool bag with perfect cleanliness. The product, which is known as Red "E" solder paste, is said to be non-corrosive. It does not act like an acid, but cleans the surface, and acting as a flux makes the solder run freely. It is not materially affected by temperature. The material is put up in two sizes of tubes, one-half inch by four inches, and one inch by six inches. The company believes that line men and electricians generally will find that it possesses all the qualities attributed to it.



RED "E" SOLDER PASTE.

Electric Power for Steel Mills.

What is said to be the largest order for alternating-current generators ever placed by one interest with any manufacturer of electrical apparatus in this country, has recently been awarded by the United States Steel Corporation to Allis-Chalmers Company, Milwaukee. The Milwaukee company has received orders for 32 gas-engine-driven electric generators, aggregating 68,000 kilowatts, 16 of which are to be installed in the new plant at Gary, Ind., now in course of construction. The other 16 units are for the Homestead plant of the Carnegie Steel Company, the South Chicago and Bay View (Milwaukee) works of the Illinois Steel Company, and for the central furnaces of the American Steel and Wire Company at Cleveland, Ohio.

These are Allis-Chalmers standard type 25-cycle three-phase alternators, and will be direct-connected to Allis-Chalmers twin-tandem gas engines, operated on blast-furnace gas, which is the gas collected at the tops of furnaces, and formerly allowed to go to waste.

The use of electrical power in modern steel mills is now extended to cover practically all the machinery of the plant, the systems of telpherage, conveyors and appliances for handling hot metal being now universally driven from individual motors.

At the Gary plant of the Indiana Steel Company the rail mill will probably require the greatest amount of power. This mill is situated about a half mile from the power house in which the 10 huge units will be housed, and will consume approximately 10,000 kilowatts to operate the induction motors which drive the main rolls. These motors range in capacity from 2,000 to 6,000 horsepower, and three of them have overload capacity of 9,000 horsepower for an hour.

The breaking-down stands in the rail mill for reducing ingots to fair-sized blooms will be driven by two 2,250-horsepower motors. The blooms will then go to the blooming mill, which is operated by one of the 6,000-horsepower motors, and from these they will pass to the mills driven by two 4,500-horsepower motors, receiving their finishing passes in the mill driven by a third 2,500-horsepower motor. All the tilting and feed tables for the various passes, all hot saws, hot and cold pull-ups, the transfer tables, straightening machines and cold saws, and all auxiliary machinery of the mill will be driven by electric motors.

LAMP FACTORY AT EMPORIUM, PA.

Novelty Incandescent Lamp Factories.

Views of the lamp factory of the Novelty Incandescent Lamp Company at Emporium, Pa., and the X-L refilling factory at St. Marys, Pa., are given herewith. It is said that the combined daily output of the two plants is 10,000 lamps, and the company announces that it is in position to handle all orders promptly, having recently doubled the capacity of the factory at Emporium. The Elk lamp factory at that place is a two-story brick building 80 by 101 feet in ground dimensions. The company says that it is independent, but not of the "mushroom" variety. The officers of the company are: President and general manager, R. K. Mickey; vice-president, Josiah Howard; secretary, Joseph Kaye; treasurer, A. F. Vogt. The main offices of the company are at Emporium, with branches in New York, Syracuse, Pittsburg, Cincinnati, Chicago, Atlanta and Birmingham.

REFILLING FACTORY AT ST MARY'S, PA.

QUESTIONS AND ANSWERS.

Underwriters' Complaints of Defective Wiring.

L. G. M., Chicago: I notice in the Western Electrician from time to time reports on the electrical conditions of various towns and cities throughout the country, and would like to inquire what constitutes the principal electrical defects of buildings as complained of by the insurance companies.

ANSWER.

There are 57 electrical defects that underwriters may enumerate upon inspection. A few of these may be found in one building, while other buildings may have others. The violations of the National Electrical Code may be listed as follows:

1. Wires too near roof.
2. Wires not properly insulated from cornice, awning frames, etc.
3. Service wires not properly installed and insulated.
4. Wires undersized.
5. Circuit or line wires overloaded.
6. Wires not properly bushed through floors, walls or partitions.
7. Wires not protected from mechanical injury.
8. Wires not properly installed in elevator shaft.
9. Wires do not have sufficient support.
10. Wires supported by wood cleats, staples, etc.
11. Wires not properly bushed at outlets.
12. Wires do not have approved insulating covering.
13. Wires crossed or are in contact with gas or water pipe, or conducting material.
14. Lamp cord used in show windows.
15. Use of unapproved lamp cord.
16. Lamp cord used for circuit wires or excess lengths of cord.
17. Lamp cord used to support clusters.
18. Lamp cord subjected to moisture or corrosive vapors.
19. Pendant wires not supported independently of line wires.
20. Joints and splices not properly soldered and taped.
21. Signal-service wires not properly installed and bushed.
22. No protective device for signal wires.
23. Signal wires not properly installed.
24. No service cut-outs.
25. Use of open cut-outs.
26. Cut-outs not properly protected against mechanical injury.
27. Change in size of wires without fusible protection.
28. Use of canopy cut-outs in fixtures.
29. Outside cut-out not properly protected against the weather.
30. Cut-out cabinet unlined.
31. No service switch.
32. No service switch for series arc lighting.
33. Knife switches not properly installed.
34. Flush switches not provided with iron or steel boxes.
35. Snap switches not provided with a sub-base.
36. Outside switch not properly protected against the weather.
37. Fixtures wired with unapproved wire.
38. No insulating joint for combination fixtures.
39. Wood hanger boards.
40. No spark arrester for arc lamp.
41. Incandescent lamps too near inflammable material.
42. Unlined or broken sockets.
43. Use of metal sockets in damp places.
44. Sockets not properly protected from inflammable gases.
45. Sockets not provided with bushings.
46. Wooden, broken or unapproved rosettes.
47. Use of fused rosettes in places containing dust or gases.
48. Use of untreated or improperly constructed molding.
49. Molding used in damp places.
50. Molding not properly installed on walls.

51. Transformer in or on building.
52. Wood rheostat.
53. Rheostat not properly protected from combustible materials.
54. Unlined snap switch.
55. Uninsulated fixture canopy.
56. No magnetic release for rheostat.
57. System grounded.

In referring to the proportions of these defects under the heads of "Fair," "Poor," "Hazardous" and "Very Hazardous," the conditions are classed as follows: Fair equals 10 to 25 per cent. defective; Poor equals 25 to 50 per cent. defective; Hazardous equals 50 to 75 per cent. defective; Very Hazardous equals 75 to 100 per cent. defective.

Grounding of Trolley Circuit.

M. N., San Francisco, Cal.: Why does a trolley car have to be grounded on the rails to make it go, and what gives the different speeds available?

ANSWER.

The trolley wire represents one "side" or conductor of the circuit and the ground or rails the other. A good "ground" or connection to the rail is necessary in order to get the current necessary to run the car, since the resistance of earth or other substances on the track prevents the flow of current; i. e., increases the resistance.

The different speeds are accomplished by means of the controller connections. The high speed gives the greater power and occurs when the two motors are "bridged" or in parallel. This arrangement gives the largest torque, and is used in starting the car. The motors, by a throw of the controller, can be connected in series; they then divide the voltage of the line between them, each running upon one-half the voltage, at a lower speed, and giving less power. Street-railway motors are flexibly designed and are capable of wide speed variation.

Indiana Telephone Items.

The Home Telephone Company of Fort Wayne has just completed the task of removing one of its rural lines three-quarters of a mile west of its original location. This was made necessary because of the influence of the high-voltage electric transmission line which occupied the public highway subsequent to the telephone company. The question of cost of the removal will likely be settled by the courts.

The Laporte Telephone Company has increased its capital stock from $60,000 to $100,000.

At the recent annual meeting of the stockholders of the South Bend Home Telephone Company reports showed the net increase in the number of telephones for the year to be 465. Plans were adopted to make the increase 1,000 for the present year and also to carry out the extensive toll-line system planned by the company.

A deal whereby the first link of a chain of Independent toll-line connections has been forged has been completed and the Independent exchanges of the northern part of Indiana are now said to be getting direct service with 368 exchanges, 1,500 toll lines and 175,000 subscribers. Four other links are now in process of formation. Among the men financially interested in the big deal are Theodore Thorward of South Bend, E. B. Fisher of Grand Rapids, Mich., and H. A. Barnhart of Rochester, Ind. The deal just completed will give improved service to Fort Wayne, Lafayette, Muncie, Terre Haute and many other places. All of these towns will now be able to get connection with South Bend. Through connection with Indianapolis communication will also be had with Louisville, Ky., and St. Louis. A second link will be completed in about three months, extending to Lawton, Mich., and connecting with the toll lines out of Grand Rapids, Jackson and Detroit and all intervening places. With the completion of the big Michigan system work will be immediately started on the Ohio extension, the line being extended eastward from Bryan for the purpose of getting to the east. A Chicago connection is also planned. The improvements will cost in the neighborhood of $1,500,000.

S.

Telephone News From the Northwest.

The city of Yankton, S. D., has been enjoined by the Federal court at the request of the Northwestern Telephone Exchange Company from interfering with the company improving and extending its system. The city holds that the franchise of the company has expired and that it has none, and so proposes to prevent all work until the company applies for and accepts a new franchise. The court will hear the case on its merits.

Business men of Vermilion, S. D., propose an Independent telephone company there as well as to ask the council to oust the Northwestern, whose franchise has expired.

The Central Wisconsin Telephone Company of Black River Falls has increased its capital from $50,000 to $100,000.

The Munson Telephone Company has sold its system at Griswold, Iowa, to the Farmers' Mutual Telephone Company, which was recently granted a franchise.

The telephone systems at Bismarck and Mandan, N. D., are to be completely reconstructed.

The Farmers' Independent Telephone Company has been organized at Geneva, Neb., with a capital of $100,000. J. M. Ward is president and J. H. Morgan, secretary.

R.

Exhibitors at the Chicago Telephone Convention.

Visitors to the convention of the International Independent Telephone Association in the Auditorium Hotel, Chicago, on June 4th to 6th, will have an opportunity of inspecting the latest designs in telephones and telephone appliances. The programme published last week indicates also that the meeting will be of unusual interest. Following is a list of the exhibitors:

American Electric Fuse Company, Muskegon, Mich.; American Electric Telephone Company, Chicago; American Steel and Wire Company, Chicago; American Sewer Pipe Company, Pittsburg; Automatic Electric Company, Chicago; Belden Manufacturing Company, Chicago; Carnahan-Sherwood Company, Indianapolis; Central Telephone and Electric Company, St. Louis; Century Telephone Construction Company, Buffalo, N. Y.; Chance Manufacturing Company, Centralia, Mo.; Chicago Telephone Supply Company, Elkhart, Ind.; Frank B. Cook, Chicago; Durant Electric Supplies Company, Chicago; Electric Appliance Company, Chicago; L. M. Ericsson Telephone Manufacturing Company, Buffalo, N. Y.; Eureka Electric Company, Genoa, Ill.; Homer-Roberts Telephone Company, Chicago; Indiana Steel and Wire Company, Muncie, Ind.; International Telephone Manufacturing Company, Chicago; W. N. Matthews & Bro., St. Louis; Miller Anchor Company, Norwalk, Ohio; Monarch Telephone Manufacturing Company, Chicago; National Pole Company, Escanaba, Mich.; W. G. Nagel Electric Company, Toledo, Ohio; National Carbon Company, Cleveland; North Electric Company, Cleveland; Nungesser Electric Battery Company, Cleveland; Sterling Electric Company, Lafayette, Ind.; Select Telephone Manufacturing Company, Springfield, Ohio; Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; Swedish-American Telephone Company, Chicago; Universal Pole and Post Preserving Company, Circleville, Ohio; Vote-Berger Company, La Crosse, Wis.; Western Telephone Manufacturing Company, Chicago; Wire and Telephone Company of America, Rome, N. Y.; Dean Electric Company, Elyria, Ohio.

Ohio Independents Remain Independent.

The Ohio Independent Telephone Association, through President Frank L. Beam of Columbus, is sending out a contradiction of the stories recently published in Ohio newspapers respecting the relations of the Bell Telephone Company with the United States Telephone Company of Cleveland, the Citizens' Telephone Company of Delaware, Ohio, and the Marion County Telephone Company. The articles published would have it appear that the Independent companies mentioned were busy working out details of an agreement whereby they were to be merged with the Bell interests and withdraw from the long-distance field. President James S. Brailey, Jr., of the United States Telephone Company and President C. D. Young of the Citizens' company have both written President Beam denying the reports in toto.

GENERAL TELEPHONE NEWS

The Port Washington (Wis.) Telephone Company has been incorporated for $5,000 by W. B. Krause and others.

The Carter-Wabeno Telephone Company of Carter, Wis., has been incorporated for $4,000 by A. J. Johnson and others.

The Barrytown (Mich.) Rural Telephone Company has been capitalized at $10,000 by Henry Walroth and others.

The Mississippi Independent Telephone and Telegraph Company of Meridian, Miss., has been incorporated for $50,000.

The Centennial Telephone Company of Dillon, Mont., has been incorporated for $20,000 by P. I. Smith of Dillon and others.

The Lidgerwood (N. D.) Telephone Company has been incorporated for $25,000 by L. J. Christensen, J. Matthews and others.

The commissioners of Fort William, Ontario, have decided to install 450 new telephones in connection with the civic plant. Mayor Murphy may be addressed.

The North Union Telephone Company of Burlington, Okla., has been incorporated with a capital stock of $10,500 by Henry Welsh, T. Morgan and others.

The following-named telephone companies have recently been incorporated: Meridian (Okla.) Rural Telephone Company; Farmington (Mont.) Co-operative Telephone Company; Independent Telephone Company of Castos, Okla., capital stock $25,000; Benavides (Tex.) Telephone Company; Liberal (Mo.) Mutual Telephone Company; Deer Valley Telephone Company of Edmond, Okla., capital stock $10,000; Waterloo (Okla.) Rural Telephone Company; Clay Center (Kan.) Telephone Company, capital stock $40,000; Independent Telephone Company of Chillicothe, Tex.; Grand Central Telephone Company of Rozel, Kan., capital stock $9,000.

CORRESPONDENCE.

Continental Europe.

Paris, May 13.—The new central telephone building which is now in erection for the city of Hamburg will be the largest telephone exchange in Europe, or even in the entire world, it is said. It is being equipped by the Deutsche Telephonwerke, one of the leading German firms. Several new points are to be noted about the operation of the system, and I shall soon have occasion to speak of some of these in greater detail, but will mention for the present that the operators will not be obliged to take care of an undue number of calls, and there will be a great economy in jacks, cables and other apparatus and a much more rapid service. The present building replaces the four exchanges which are now running in the city. It is hardly possible that even in the largest of the present telephone exchanges the capacity exceeds 30,000 subscribers, while the new Hamburg exchange will take care of 80,000 subscribers. The three leading departments of the building are the city exchange, the interurban portion and the plant for furnishing the current. Optical signals of an improved pattern are to be among the leading features.

Steam-turbine plants are on the increase in France, and the French Thomson-Houston Company is now installing a number of Curtis turbines. Some of these are now running at Nice and in various places in the Mediterranean region. Not long ago the Société des Forces Motrices du Rhone had a steam-turbine dynamo set on the Curtis system installed in its central station at Lyons and the first trial came off not long since. This group showed a very good performance and the figures are as follows for an hour's test on a load of 978 kilowatts: Pressure at the inlet, 12.37 atmospheres; temperatures of the steam, 308° C.; consumption of steam, gross, 7.22 kilogrammes per kilowatt-hour; net, or reduced to 11 atmospheres pressure, as standard and 300° C., it figures 7.85 kilos per kilowatt-hour.

A project is on foot for an electric traction line which will mount the Zugspitze. However, a part of the line will be on a level and will use the ordinary tramway system, while on the steep portion a cable line will be needed. The first section is seven miles long, and it will be operated on the 850-volt direct-current system, while the incline road is 2.5 miles in length, and will use about 600 volts direct current. A steam plant will supply the current for both sections of the road, and it will be equipped with three 300-horsepower generating units. For the cable drum, a 600-volt, 100-horsepower motor is to be used, according to the present plans. The total cost of the undertaking will be about $1,000,000.

Among the new electric plants to be erected in Spain in the near future may be noted the central station which has been designed for San Feliu, while the work of construction has already commenced upon two new plants at Marmolejo, in the Caceres province. They will supply a large amount of motor current, beside the lighting. At Bilbao has been formed a company known as the Sociedad Electrica Loresmar, for the purpose of erecting central stations and operating them in various parts of the country. The shares of the new company have already been issued. At Barcelona the City Tramway Company has obtained a concession from the municipality for a new line of tramway running from Cataluña Plaza to Vallcarca.

A. DE C.

Great Britain.

London, May 17.—The Imperial Technical College is slowly being brought into existence. As an idea it has been moving since 1902, when Lord Rosebery suggested the unification and consolidation of the varied interests now controlling scientific education in Great Britain. The name of the new institution is to be "The Imperial College of Science and Technology," and the fact that the president of the board of education has presented a petition to the king in council praying for the grant of a charter has revived interest in the proposition. The new college will incorporate the Royal College of Science, the Royal School of Mines and the Central Technical College. There is to be a governing body of 40 members upon which the Institution of Electrical Engineers will be represented.

Some interesting tests of turbo-alternators have been carried out in connection with the Newcastle-upon-Tyne Electric Power Company. The machines in question are of the Parsons type, with a rating of 3,500 kilowatts, and as the results of trials made after they had been at work for six months, a steam consumption of 13.189 pounds per kilowatt-hour was obtained. It is said that this probably establishes a record for any class of steam engine or turbine.

I believe the last evidence has now been placed before the committee dealing with the radio-telegraphic convention of 1906. The final sitting was devoted to what may be termed rebutting evidence, which has been evidently deemed a necessary corollary to that given by the Marconi Company. The direct contradistinction of view taken in each case will provide the committee with a pretty problem. The report, which is to be submitted to Par-

liament, will probably not be ready for some weeks yet.

The extension of the City and South London Railway from Islington to Euston is now open to public use. The length of new line is only 1¼ miles, but it gives a most important connection with the main line termini of all the North London suburban railways. One feels a certain affection for this modest little railway company which started as far back as 1890 and was unheard of during the noisy proceedings of later years, when, to judge by the daily papers, American engineers had discovered tube railways and were going to demonstrate their possibility in London. Since 1890 several small extensions have been tacked on at both ends. The line is also unique in that a three-wire continuous current system is employed, and the results in generating costs and such like are exceptionally creditable. In fact, the electrical engineer, Mr. P. V. McMahon, two sessions ago secured the annual premium awarded by the Institution of Electrical Engineers for a paper describing the system and the results which he had obtained. The company has fluctuated somewhat in its dividends, but despite the electrification of the tramways overhead and the introduction of motor omnibuses a steady average has been maintained.

Owing to the turn which the electric-power question in London has taken the Administrative County of London and District Electric power bill, which caused the famous proceedings two years ago, has been withdrawn. The resumed debate upon the second reading of the London County Council will not now take place for a fortnight, owing to the intervention of the Whitsun holidays. G.

New York.

New York City, May 25.—Justice Fitzgerald of the Supreme Court granted yesterday the application of the rapid transit commissioners for an injunction restraining the Interborough Rapid Transit Company, the company which operates the subway, from delivering electric current to the New York City Railway or the surface railway company, on the ground that the city is the owner of the subway, having built it with an issue of $50,000,000 in bonds. When the conduits were put in there were a greater number than were actually required for the subway service, and these extra ducts have been used by the subway to transmit power to the surface lines.

W. C. McAdoo, president of the Hudson and Manhattan Railroad Company, after an inspection of the two upper Hudson River tunnels between Hoboken and Manhattan, says that he expects trains to be running in the tubes next October, as both tubes are practically finished, with the exception of a small gap in the Lackawanna yards and another under Sixth Avenue, near Fourteenth Street. The tubes connecting Jersey City and Manhattan are more than 75 per cent. completed under the river from the Jersey side. The steel work on the terminal building, which is to be one of the largest in the world, will soon be in place. This building should be ready for occupancy about May 1, 1908. The first passenger car has been delivered. It is made of non-combustible material throughout, even the materials in the cushions being fireproof. These cars have center as well as end doors and will thus prevent overcrowding. The trains will consist of six and eight cars and will be operated on a 1½-minute schedule during the rush hours. It has been estimated that between 60,000,000 and 70,000,000 people will annually pass through this great terminal.

The proposed Coney Island subway has met with more opposition, although the friends of this work have made strong efforts to have the present rapid transit board pass some measures calling for immediate action. The present board is soon to go out of existence, which will mean an additional delay till the matter can come up before a new board and be reconsidered. Chief Engineer Rice informed the board that he had had no instructions to make up the plans and consequently these have not even been drawn up. The cost of this new work is variously stated as from $20,000,000 to $30,000,000. F. B. Behr, the inventor of the monorail, sent a letter to the board accepting its terms for the franchise to operate an "L" mono-rail road through Brooklyn to Coney Island, but because of failure to comply with some of the conditions stated in the franchise no action was taken at that meeting. It is therefore improbable that any preliminary work will be actually started till the full conditions of the franchise have been complied with.

It is reported that one of the new turbines which was recently installed by the Allis-Chalmers Company in the Kent Avenue Station of the Brooklyn Rapid Transit Company has been ruined. The Allis-Chalmers Company says that its machine would not have been injured if handled properly, as it was just recently turned over to the Brooklyn Rapid Transit Company after having been successfully operated by the Allis-Chalmers employes.

The two hundred and sixty-eighth meeting of the New York Electrical Society was held at the Port Morris power station of the New York Central and Hudson River Railroad today. Through the courtesy of W. J. Wilgus, the vice-president, the invitation to the society was extended. About 200 members and their friends were in attendance, and after a short address by one of the Central's engineers the party was shown through the plant, which is an excellent example of modern plant design. Each unit of turbine, generator, condenser and auxiliaries, with its corresponding high and low-tension switches, can be totally isolated from the rest of the plant, which makes it equivalent to several smaller plants under one roof. Most of the party left the Grand Central's temporary terminal at 2:07 o'clock Saturday afternoon and were drawn by one of the new electric locomotives. Multiple-unit controlled trains are also in operation for suburban service. E. H. S.

Dominion of Canada.

Ottawa, May 25.—The administration of the act passed at the last session of the Dominion Parliament to regulate the exportation from Canada of electricity and "other fluids" will be under the direction of O. B. Higman, chief of the electrical branch of the department of inland revenue.

The Montreal Light, Heat and Power Company's statement, which will be out on the 1st of June, will show gross earnings for the year of over $3,450,000 and net earnings of over $1,920,000. The company has had a remarkable year, and it is worthy of note that the net earnings this year are nearly $200,000 in excess of what the total gross earnings were five years ago, when the company made its first report, the net earnings in 1902 being only $821,217.

The project of supplying the towns in Western Ontario with electric power from Niagara Falls has been advanced a step nearer completion when the representatives of 12 municipalities concerned in the scheme met in Toronto this week and approved the terms of the Ontario Power Company's tender accepted by the provincial government and the Hydro-electric Power Commission.

The town of Port Arthur, Ont., wants 3,000 horsepower of electrical energy and has requested the Ontario Hydro-electrical Power Commission to furnish it with that amount. The commission is now in negotiation with several private electrical power concerns for the supply needed.

The Hydro-electric Power Commission has received an offer from the New York and Ontario Power Company for a supply of electrical energy to serve the city of Kingston, Ont., and a number of points further east. The company has a plant at Wadington on the New York side of the St. Lawrence River, the capacity of which is about 33,000 horsepower, and it has been granted permission by the authorities of the state of New York to export energy to the Canadian side.

The Bell Telephone Company has ordered a new switchboard for the Ottawa exchange sufficient for 10,000 subscribers. It is being built by the Northern Electric Company of Montreal and will be placed in position next September. W.

Winnipeg, May 25.—Conditional on the exchange of bonds by present bondholders of the Brantford Electric Street Railroad Company the Grand Valley Radial Company and the Woodstock Railroad Company for those of a new organization, plans for the amalgamation of these companies and transfer of their interests to a new company have been consummated. The new company will operate under the name of the Grand Valley Radial Company and is headed by M. A. Verner, a Pittsburg capitalist. Track mileage is to be doubled and the system extended to Cainsville, Ont. The new line will be constructed on private rights by way of Burford and Cathcart to Woodstock, connecting Woodstock and the Ingersol line which will be extended to London. It is also planned to built by private right-of-way to Port Dover via Mount Pleasant, Waterford and Simcoe.

The ratepayers of Morden, Man., have voted in favor of raising money by the sale of debentures for the erection of a municipal electric-light plant. S. Scott, Morden, Man., is interested.

The Bell Telephone Company of Canada has decided to install a new telephone plant at Chatham, Ont., and put in an underground system. C. F. Size of Montreal is president of the company.

The Ontario government has decided that Port Arthur shall have the first chance to develop the electrical power at Silver Falls below Dog Lake on the Kaministiquia River. Several private individuals have applied for rights to develop the power at the falls if the city decides not to embark on the undertaking. R.

Ohio.

Toledo, May 25.—The full meaning of the recent organization of the Ohio Electric Railway Company which was incorporated at Columbus a week ago is just beginning to be realized. It is practically assured that the company is really the Schoepf syndicate and that by the time the details of the merging of the lines which it will control are worked out it will show the biggest traction corporation in this section of the country. This new company will practically control the operation of what is now known as the Indiana, Columbus and Eastern, which operates from Zanesville, Ohio, through Columbus, Springfield and Dayton to Richmond, and there connects with the Indiana lines of the same syndicate, giving direct connections west through Indianapolis to Terre Haute within a few miles of the Illinois border. In the northern part of the state the syndicate operates from Lima to Toledo. From Lima another branch is being built west to Fort Wayne and still another east to Bellefontaine. In the southern part of the state are the lines from Cincinnati to Dayton covering that territory. The company will apparently control about 1,200 miles of first-class interurban traction lines. J. B. Foraker, Jr., is said to be one of the members of the syndicate.

The annual session of the Society of Mechanical, Electrical and Steam Engineers was duly held at the Algonquin in Dayton last Friday and Saturday.

The villages of Anna and Cridersville are arranging to purchase their city and commercial light from the Western Ohio Electric Railway Company.

Telegraph, telephone and interurban trolley wires throughout the northern part of the state of Ohio suffered considerable damage the night of May 18th because of one of the worst electric storms that has been recorded during the month of May in some years.

P. J. Backus of Cleveland has just completed the details for his new electric wrecking crane. This crane is equipped with four 75-horsepower motors on the trucks, which give a speed of 40 to 50 miles an hour. Two 100-horsepower motors are used with the crane and are capable of lifting 40 tons. The crane is equipped with drop cabinet controllers and a ball-bearing rotating bed.

The Board of Public Service of Hamilton, Ohio, is offering for sale three generators, four arc machines, three engines, one switchboard and two condensers used at the city lighting station. S.

Indiana.

Indianapolis, May 25.—S. C. Dickey, general manager of the Winona Interurban Railway Company, announces that the company will be in the market for material and will let the contract for the construction of the Fort Wayne division as soon as the stakes can be set.

It has become the custom of Louisville people who wish to travel through Indiana to cross the Ohio River by interurban and purchase tickets from the Indiana side, where they are sold at two cents a mile. If purchased in Louisville three cents a mile is charged.

The Chicago, Lake Shore and South Bend Electric Railway Company, now building a rapid-transit line from this city to Chicago as a rival for the Murdock system, is pushing the work rapidly. The tracks are laid to the South Bend city limits, and the big power house at Michigan City is well under way, as is also the overhead construction. Every contract has been let, even for the cars, and the capital stock increased to $6,000,000. The Westinghouse single-phase system has been adopted for motive power.

The street-railway strike in Evansville has been declared off, a portion of the striking employes returning to the company's service. The officials refused to recognize the union, but treated with the union men individually.

The People's Electric Light, Gas, Heat and Power Company, Bloomington, Ind., has been transferred to the National Light, Heat and Power Company, and I. L. Meloon, the general manager, of New York, is in charge. The first improvements will be a day electric circuit, to include the city and quarries, the immediate construction of a new building and the installation of an 800-horsepower boiler. The entire electric-light system is to be rebuilt. This plant is one of four the National company has acquired recently in this state.

The Indiana State Board of Agriculture has awarded a contract to N. W. Gilchrist for the erection and equipment of a waterworks, electric-light and heating plant at the state fair grounds.

A mysterious explosion wrecked the electric-light plant at Clay City on May 22d, killing two men and injuring others. The plant will be rebuilt and re-equipped at once. M. R. Meker is the owner of the plant.

The Electric Light and Ice Manufacturing Company of Brookville has filed articles of incorporation. The capital stock is $75,000. Charles Andrews, D. J. House and others are directors. S. S.

Illinois.

Peoria, May 25.—Work has been commenced on the Lincoln-Mackinaw line by the Crescent Construction Company of this city. This is the line the Illinois Traction Company is building to connect this city with the lines south of here, connecting with the Peoria-Bloomington line that runs east from here at Mackinaw.

The first through car to make the trip from this city to Decatur was run this week to accommodate the G. A. R. delegates from this city. It is now possible to go from here to St. Louis via trolley by going from here to Bloomington, Decatur, Springfield and then south to East St. Louis. This is a roundabout way, but the completion of the Mackinaw-Lincoln line will make a cut-off, and a line that is much shorter than any steam road now operating will be the result.

The Chicago, Bloomington and Decatur Railroad

Company, one of the Illinois Traction Company's lines, has filed a certificate of increase of capital stock from $5,000 to $500,000.

The Interstate Telephone Company of Springfield has just issued a new directory. The first part, containing the names and addresses, together with the numbers, is printed on white paper; the rural subscribers are listed on salmon-colored paper, and the county subscribers are given on green paper. The book contains the names of about 3,200 subscribers, being an increase of about 500 subscribers since the last issue. The company now connects with about 7,000 subscribers in the county.

The Decatur-Champaign branch of the Illinois Central will be used hereafter for only interurban business, the company running through business via Clinton.

John Mandersheid, an employe of the lighting company at Paxton, was killed at that place early this week by receiving a shock while on a pole and falling to the ground, fracturing his skull.

The new storage battery at the lighting plant at La Harpe has been completed and the company is now in shape to give day and night service.

An ordinance has been introduced in the City Council at Springfield to reduce the rates now charged by the city for inspecting the wiring for lights and power. The ordinance also provides for a license fee of $25 for companies doing a wiring business and filing a bond for $1,000 to insure the city against damages.

Plans are expected here soon for the underground work that the Peoria Gas and Electric Company will build this year, the intention being to build the ducts this year and install the wires early next year.

The Peoria, Bloomington and Champaign Traction Company has filed a certificate of increase of capital stock from $5,000 to $500,000. V. N.

Pacific Slope.

San Francisco, May 22.—The strike situation shows no decided signs of an early settlement, as far as the United Railroads' carmen and the Pacific Telephone and Telegraph Company's union operators are concerned. There were reports that the telephone girls were on the point of coming to an agreement with the company during the last week, but nothing of a definite nature that is favorable has yet been disclosed. The United Railroads' officials assert that they are satisfied that the service is improving every day and that the opposition of the strikers and the strike sympathizers is weakening daily. The only reverse the United Railroads Company has suffered recently was the sympathetic strike of the station electricians and the wiremen employed on the system, on the 18th, but with the assistance of the station engineers and some of the skilled strikebreakers the "juice" has been kept going without interruption ever since.

The San Francisco Board of Supervisors is very anxious to take charge of the Geary Street Railroad Company's system, which is closed down on account of the strike, and change it over to a municipal electric road. It is estimated that it would take four months to equip the road as an overhead-trolley system. The supervisors favor establishing an underground-conduit system at an estimated cost of $750,000. The Geary Street franchise expired some time ago, and the company has since been paying the city a monthly rental for the privilege of operating its cars.

Captain B. F. Cheatham, constructing quartermaster, U. S. A., in San Francisco, has advertised for bids for furnishing materials and installing a complete electric-lighting system to furnish electric current for use at Fort Baker and Fort Berry on the north shore of San Francisco Bay, overlooking the channel leading in from the Golden Gate. Plans and specifications are on file at the quartermaster's office, 1086 North Point Street, San Francisco.

The city of Sacramento, Cal., through a committee, is taking steps looking toward the establishing of a municipal electric-lighting plant for public and commercial lighting. By invitaton, Prof. C. L. Cory of the University of California recently looked over the available sites for the proposed steam-power electric plant. He will report later to the committee, who will then make a recommendation to the supervisors as to the advisability of erecting the plant.

The Dominion government has decided to install wireless-telegraph stations along the seaboard of British Columbia, with a view to establishing communication with vessels arriving or departing and reporting shipwrecks on the dangerous west coast of Vancouver Island. Wireless plants will be installed at Bamfield and Cape Lazo on Vancouver Island, and at Prince Rupert and other points on the mainland of the province. The Canadian Pacific Railway is installing wireless-telegraph equipments on its coasting vessels, Princess May and Princess Royal. The latter vessel is approaching completion at Victoria, and the Princess May is plying between Victoria, B. C., and Skagway, Alaska.

The Home Telephone Company of San Francisco has announced that it very shortly will begin the erection of a six-story office and exchange building in a central location in this city. It will be of handsome and substantial construction. The local system will be installed as rapidly as possible under the circumstances.

The Central California Traction Company has an electric-railway system in Stockton and is now building to Sacramento by the way of Lodi. It is said that it will eventually have 250 miles of suburban and interurban lines, with Stockton as a center, and will be a feeder to the Southern and Western Pacific and the Santa Fe at Stockton. A.

PERSONAL.

F. A. Smith has been appointed electrical engineer for the city of Nelson, British Columbia.

George F. Chapman, vice-president and general manager of the United Railroads of San Francisco, died on May 24th of pneumonia. He was 44 years old and was a native of New Jersey.

W. H. Burke, who has been the purchasing agent of the Illinois Traction Company, with headquarters at Champaign, Ill., has been appointed assistant to General Manager Fischer, with headquarters at Springfield. A. C. Murray will be assistant general superintendent of the Southern Division, with headquarters at Staunton.

Charles Kenmouth Stearns, an electrical engineer, died recently at the Boston City Hospital. He was born at Newton Center, Mass., in 1864, and was a graduate of the Massachusetts Institute of Technology. He worked for the old Thomson-Houston Electric Company in Boston and in St. Paul, Minn., and, as an assistant engineer, he was employed in installing electric power on the Nantasket Beach branch of the New York, New Haven and Hartford Railroad. Of late he had done similar work for street railways. He was a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

ELECTRIC LIGHTING.

B. F. Blakeley will install an electric-light plant at Saltese, Mont.

The Francis (I. T.) Electric Light Company has been capitalized at $15,000.

An electric-light plant will be erected at Campbellsport, Wis., by W. L. Anderson.

The Gainesville (Tex.) Electric Light Company has increased its capital stock from $50,000 to $100,000.

The Southwestern Engineering and Construction Company will erect an electric-lighting plant at Russellville, Ark.

ELECTRIC RAILWAYS.

The first train of the new extension of the Douglas Park branch of the Metropolitan West Side Elevated Railway of Chicago was run on May 22d.

The daily newspapers report that the Westinghouse interests have secured the contract for converting from steam to electricity the suburban state railway lines in and near Genoa, Italy.

The Engineering Construction and Securities Company of Chicago has just closed a contract for the construction of an 18-mile electric road to run from Atlantic, Iowa, to Kimballton, Iowa. Work will be begun at once.

The Jamestown (N. Y.) Street Railway Company and the Chautauqua Traction Company are preparing to install a second Westinghouse turbine generator in the power station. Like the one at present in use, the new machine will develop about 2,500 horsepower and will be capable of furnishing enough power to run the two trolley systems. It is proposed to run the machines alternately for 24 consecutive hours.

All the United Railroads' trolley lines north of Market Street in San Francisco were put out of commission on the night of May 21st by men who connected by means of a wire or chain a high-power transmission wire with a trolley wire. The instant effect of diverting the 13,200 volts to the trolley wire was an explosion in the Tuerk and Fillmore sub-station. The switchboard burned out and the electrical display frightened hundreds of people.

POWER TRANSMISSION.

The Forest Power Company of Silver City, N. M., has been organized with a capital stock of $750,000.

Vernon A. Wright of Fergus Falls, Minn., and F. G. Barrows will construct a dam across the Ottertail River near that city and build a power plant for furnishing light and power to neighboring towns. The cost will be about $100,000.

The La Crosse Water Power Company has let contract to the S. Morgan-Smith Company of York, Pa., for two 4,000-horsepower wheels and two 250-horsepower wheels for the new power plant at Hatfield, Wis. R.

The Green Bay and Mississippi Canal Company of Appleton, Wis., has awarded the contract for a $75,000 electric power house to O'Keefe & Orbison Engineering and Consulting Company of Appleton. It is the intention of the canal company to furnish electric power for manufacturing industries in practically every city of the Fox River Valley and ultimately to extend its service to Milwaukee.

PUBLICATIONS.

Allis-Chalmers Company, Milwaukee, is sending out a folder on the steam turbines and generators it has recently put in service. An illustration is given of a 6,000-kilowatt turbine and generator lately installed.

The Lidgerwood Manufacturing Company, 96 Liberty Street, New York city, is sending out a well-printed pamphlet on Lidgerwood electric hoisting engines that operate at from 250 to 500 volts direct current. These hoists, provided with single or double friction drums, are used for general hoisting purposes, in connection with derricks, etc.

The Buckeye Electric Company, Cleveland, Ohio, is sending out "Document No. 9" on "Dispelling Darkness," in which are reviewed the primitive methods of illumination, each epoch of civilization having had its own mode of artificial lighting. The company wishes to remind the trade that it manufactures "the old" carbon filament lamp, the Gem 50-watt lamp, Gem high-candlepower high-efficiency units, Gem focal lamps, miniature, decorative, battery and candelabra line and the tantalum lamp.

An artistic catalogue, No. 22, of "Chicago Giant" rock drills and kindred appliances, is being sent to the trade by the Chicago Pneumatic Tool Company. The book contains 96 pages of matter referring to rock drills. Several pages are devoted to rock-drill steels and an interesting description is given of the method of lubrication used in the "Chicago Giant," one of the features of the drill. The Franklin air compressor, another of the company's products, is also given attention. The company will be pleased to forward the catalogue to those interested.

The Dean Electric Company, Elyria, Ohio, will shortly issue its Bulletin No. 104 on magneto switchboards, which will be the largest of the series of bulletins that the company has yet issued. It will be a continuation of the "text-book method" of keeping the telephone equipment buyer and user and the inspector and department head advised of the company's products. Considerable space will be used to explain the company's harmonic converter and party-line ringing system in daily use in many magneto exchanges. Detail switchboard installation and maintenance work will be covered in the bulletin.

The many noteworthy features and places of interest in Indianapolis, Ind., the latter including a number of well-known manufacturing establishments, are enumerated and briefly described and illustrated in a tasteful booklet written and designed by Russel M. Seeds of that city. The booklet was gotten up at the suggestion of the Indianapolis members to give information concerning the city to visiting members of the American Society of Mechanical Engineers who held their semi-annual meeting at Indianapolis on May 28th to 31st. Space is devoted to a short description of the plants of the Indianapolis Light and Heat Company, Atlas Engine Works, Pope Motor Car Company and other prominent manufacturing concerns.

Bulletin No. 1059 issued by Allis-Chalmers Company, Milwaukee, Wis., treats of its engine-type generators for direct current, known as type "I." Illustrations are given in one of which the generator is seen driven by an Allis-Chalmers horizontal cross-compound engine, and in another by one of the company's single-cylinder heavy duty engines. Direct-current generators of the type described in the bulletin are designed for general lighting and power service wherever machines suitable for direct connection to steam, gas or oil engines are required. They are built for standard pressures of 120, 240 and 525 volts and have speeds and outputs as indicated by tables appearing in the bulletin. In bulletin No. 1060 is described a new line of belted alternators designated as type "AB," which the company is now building for plants in which a belted generator of not exceeding 150 kilowatts output is required. They are of the revolving field, self-contained type, the two bearings being carried with end housings bolted to the stator yoke, the feet of which rest directly on the slide rails.

The Chicago Fuse Wire and Manufacturing Company, 170 Clinton Street, Chicago, is sending out its new catalogue, No. 19. It is asserted that it is the most complete catalogue on fuse material yet issued. It covers all enclosed fuses and blocks now used, namely, the National Electrical Code fuses and blocks and old code fuses, also fuse wire and fuse links. The company has for 18 years been making fuse wire and fuse links for the protection of apparatus and systems employing electrical energy. It is stated in the introduction that when the application of electricity came into use the open-link protector was subjected to much abuse by those who had a misconception of the importance of this class of apparatus, and as a result there arose a demand for a self-containing safety

device of the enclosed pattern in which the fusible element is surrounded by sand, which effectually prevents alteration of its rated and marked capacity, as well as overcoming the danger occasioned by the burning out of flashes or molten metal at time of operation. In order to satisfy the wants of customers in the entire field of fusible protectors, the company has equipped its factory with facilities for furnishing all types of old code cartridge fuse to any dimensions or voltages. The company's products include "Union" non-arcing enclosed fuses, "Union" enclosed fuse blocks, "Union" block fittings, "Union" enclosed plug fuses, and open fuse links, etc. The catalogue will be sent on request to those interested.

SOCIETIES AND SCHOOLS.

The instructors of the electrical engineering department of the Worcester (Mass.) Polytechnic Institute have moved into the new electrical machinery building of the Institute, and most of the class work is being done there. A set of unit switch-car control apparatus has been received from the Westinghouse Electric and Manufacturing Company.

MISCELLANEOUS.

The various plants of Walter Baker & Co., Ltd., at Dorchester, Mass., devoted to the manufacture of chocolate and cocoa products, are now operated electrically from a central power plant. The plant was designed for an ultimate capacity of 2,800 horsepower in boilers and 1,750 kilowatts in generating apparatus. The principle units are two Allis-Chalmers vertical cross-compound engines, each 22 inches and 48 inches by 48-inch stroke, operated at 120 revolutions per minute and direct connected to 750-kilowatt Allis-Chalmers generators. There are in addition two smaller units direct connected to 125-kilowatt alternators. The generators deliver three-phase alternating current at 600 volts which is transmitted directly to the mills for lighting and power use. The arrangement for lighting is done on a two-wire system at 110 volts, the voltage being reduced from the power feeders by transformers. There are over 100 induction motors in use.

The United States Civil Service Commission announces an examination on June 26th at numerous points in the United States to secure eligibles from which to make certification to fill a vacancy in the position of chief engineer in the Federal Building at Chicago, Ill., and vacancies as they may occur in the custodian service throughout the United States requiring similar qualifications. The salary of the specific position to be filled will be from $1,800 to $2,500 per annum, the entrance salary to be at $1,800. The examination will consist of these subjects: Letter writing, practical questions in mechanical and electrical engineering, including the operation of electric elevators, the machinery of electric-lighting plants, motors, systems of wiring and electrical distribution, heating and ventilating, plumbing and sanitary work, and experience. No application will be accepted from anyone who is not a graduate of a technical institution or an engineering college and who has not had at least two years' practical experience in the performance of duties of the character indicated under the subject of practical questions. The age limit is 18 to 55 years on the date of the examination. Applications may be made to the United States Civil Service Commission, Washington, D. C.

TRADE NEWS.

The Gradolph Electric Company has been incorporated to do business in St. Louis, Mo.

The International Electric Company has been formed in St. Louis, Mo., with a capital stock of $100,000.

The Columbia Incandescent Lamp Company held its annual conference of salesmen at the office and factory in St. Louis on May 23d, 24th and 25th. The meeting was well attended and the salesmen were most enthusiastic over the past business of the company in their respective territories, reporting prospects for the coming season as very bright. The business sessions were held during the day, with entertainment in the evening in the shape of dinners and visits to the summer gardens and theaters. Thus the conference was not only profitable in business instruction but enjoyable in social reunion.

The Wesco Supply Company of Fort Worth, Texas, and St. Louis, Mo., importer and jobber of electrical machinery and supplies, announces the establishment of a new branch office at Birmingham, Ala. This office will be in charge of Mr. W. W. Moore, electrical engineer, who for several years has managed the apparatus department of the company, with headquarters at St. Louis. Mr. Moore is a native of the South, and a very capable and well posted man in this particular branch of the electrical business. His wide acquaintance and many friends in his section assure the company in advance an extensive and profitable patronage through the newly established office.

BUSINESS.

The rapid growth of the business of the Benjamin Electric Manufacturing Company of Chicago is an evidence of the favor which the company's specialties have met. Not very long ago the company was obliged to increase its facilities, and only last month further enlargement of the plant was made in order to keep pace with the constantly increasing demand for Benjamin specialties. The Benjamin company is constantly adding to the convenience of the consumer of light by putting on the market up-to-date devices. Several new specialties along this line are promised.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 21, 1907.

853,971. Device for Collecting Miners' Checks. Frank C. Greene, Cleveland, Ohio. Application filed September 17, 1906.

In combination with the oscillatory track section of a dump are a swinging arm operatively connected with the track section and disposed to swing contiguously to a car thereon, an electromagnet mounted upon the arm and electrical connections for energizing the magnet during a part only of each oscillation of the arm.

853,989. Vacuum-tube Lamp. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed April 21, 1904.

An electric metal vapor lamp contains a material produced by electrolysis of a compound of hydrogen and carbon.

853,990. Automatic Electrical Cut-off. Robert H. McDowell, Alliance, Ohio, assignor to the Electric Filter Company, Alliance, Ohio. Application filed May 26, 1905.

An electrical circuit making-and-breaking means is operatively connected to the lower end of an angled shaft in the device which is provided with a faucet and valve.

854,013. Danger Signal for Portable Electric Tools. James I. Ayer, Cambridgeport, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed January 14, 1907.

An electrically heated tool comprises an electric heating circuit contained therein, opposite terminal plugs in the tool connected with the heating circuit and an insulating plate and socket piece also in the tool. The electric visual signal device described is removably mounted in the socket piece and operatively connected with the heating circuit. It is visible externally of the tool and gives warning of the presence of current in the tool. (See cut.)

854,015. Limit Switch. George Baehr, McKeesport, Pa., assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed November 3, 1906.

In a system of control for electric motors are combined a reversing controller, an electromagnet, a limit switch in the motor circuit normally held in a closed position by the electromagnet, a second switch actuated by a driven member for opening the circuit of the electromagnet when the limit of travel in one direction is reached, and means for bypassing the limit switch when the controller is reversed.

854,018. Process of Reducing Metallic Oxides. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company, a corporation of West Virginia. Application filed September 23, 1905.

The process consists in passing an electric current through a molten bath containing a metallic oxide, preferably by silica, and a basic flux, adding fresh portions of the charge and withdrawing the products as formed.

854,020. Branch Conduit Box for Electric Wires. Leon W. Bossert, Utica, N. Y. Application filed February 16, 1906.

A bushing, which is adapted to be held in place, complemented by a cover is adapted to receive a conductor pipe.

854,022. Wrapper Cutting and Registering Apparatus. James H. Brady, Louisville, Ky., assignor of one-half to David A. Keller, Louisville, Ky. Original application filed April 3, 1905. Divided and this application filed November 16, 1905.

An electric contact device in the apparatus is adapted to bear upon a web of paper during its course through the apparatus and to enter a perforation therein. Electric contacts are controlled by this device, these contacts controlling the circuit of an electromagnet, the latter effecting operation of the cutter.

854,023. Wrapping Machine. James H. Brady, Louisville, Ky., assignor of one-half to David A. Keller, Louisville, Ky. Application filed July 12, 1906.

The machine includes electromagnetically controlled devices adapted to automatically sever the web at certain points.

854,025. Telephone Transmitter. Ralph C. Browne, Salem, Mass., assignor to John Abbott, Winchester, Mass. Application filed April 25, 1906.

The transmitter described comprises means whereby current flows from one electrode to the other through a thin layer of granular material transversely to the line of pressure of a movable retaining wall.

854,028. Electric Wool-washing and Cleansing Apparatus. George D. Burton, Boston, Mass., assignor to the American Electrical Process Company, Boston, Mass. Application filed August 11, 1905.

The apparatus comprises a tank for holding an electrolytic solution, electrodes adapted to cause electric action in the solution, conductors for uniting the electrodes with a source of electricity, an agitating drum mounted in the tank and means for rotating the drum. A shield partition in the tank separates the electrodes from the main portion of the tank and the substances immersed in the solution contained therein.

854,039. Commutator Switch. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed September 12, 1906.

The switch embodies a base piece having a common terminal and battery terminals secured to it, and step-by-step mechanism between the terminals for connecting and disconnecting the battery terminals to the common terminal.

854,050. Electrical Driving Mechanism. Gustave C. Marx, Elizabeth, N. J., assignor to the Diehl Manufacturing Company, Elizabeth, N. J. Application filed January 11, 1906.

The apparatus comprises a tank for holding an electromotor constructed with a frame provided with bearings and having an armature shaft mounted in the bearings, an armature mounted upon the shaft, a clutch including a driving and a driven member disposed upon and relatively movable in the axial line of the shaft, and one of which members has a positive connection with the armature shaft and a fixed fulcrum on carried by the motor frame.

854,052. Apparatus for Conveying Loads Between Points of Varying Distance. Walther Mollier, Hamburg, Germany, assignor to Siemens-Schuckert Werke Gesellschaft mit Beschrankter Haftung, Berlin, Germany. Application filed January 20, 1906.

An endless rope is wound on two drums independently journaled on the apparatus. An electric motor operating one of the drums has its revolution number varying inversely with the load. Another motor is adapted to cooperate with the drum-operating motor when the rope has its normal tension, keeping its revolution number practically constant under all loads. Means are provided between the motors and actuated by them under an abnormal rope tension adapted to restore the normal tension of the rope.

854,072. Electric-lighting System for Railway Cars. William J. Bohan, St. Paul, Minn. Application filed December 3, 1906.

Combined with a car having swiveled trucks are a dynamo supporting frame carried by one of the swiveled car trucks and projecting into the car body through openings in the bottom thereof, a dynamo supported within the car body by the supporting frame, and means for driving the dynamo from one of the truck axles.

854,076. Photographic Printing Machine. Joseph C. Calhoun, Holland, Mich., assignor of one-half to George P. Hummer, Grand Rapids, Mich. Application filed May 17, 1906.

The machine comprises a case having a transparent panel, a movable platen opposite the panel, an electric light in the case, a switch to close and break the circuit of the light, clock mechanism adapted to shift the switch, and means for adjusting the mechanism to determine the time of exposure.

854,094. Electrical Conductor and Armor Therefor. Charles J. Klein, New York, N. Y., assignor to Ralph Abraham Schoenberg, New York, N. Y. Application filed September 22, 1906.

Combined with a number of electrical conductors is armor surrounding the conductors and comprising a number of flattened longitudinally tapering open-ended members, the end portion of each of which is fitted into the larger end portion of an adjacent member.

854,104. Vacuum-tube Lamp. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed May 25, 1904.

The lamp contains graphitic acid.

854,107. Magnetic Clutch. Alfred Pick, Yonkers, N. Y., assignor of fifteen one-hundredths to William W. Butler, Yonkers, N. Y. Application filed March 6, 1905.

Combined in the clutch described are a rotating magnet member and means for energizing it, an armature adapted to co-act with the member, and strips of non-magnetic material in the magnet member and in the armature, the whole so proportioned and arranged as to produce a demagnetizing force which will act immediately upon cessation of the energizing means.

854,120. Device for Amplifying Electrical Currents. John S. Stone, Cambridge, Mass., assignor to John A. Chrystie, Louis Duncan and Walter H. Turner, New York, N. Y. Application filed May 23, 1906.

In an apparatus for amplifying electric currents varying in accordance with sonorous vibrations are a microphonic transmitter comprising a fixed and a movable electrode and means maintaining the movable electrode in a condition of stable equilibrium during the operation of the apparatus.

854,121. System of Electrical Distribution. Simon B. Storer, Syracuse, N. Y. Application filed August 10, 1905.

In the system described are combined means for approximately maintaining a predetermined voltage or current intensity in such system including a Wheatstone bridge having in its branches resistances of different temperature co-efficients and an electric motor having one of its elements forming the cross connection of the bridge.

854,122. System of Electrical Distribution. Simon B. Storer, Syracuse, N. Y. Application filed August 10, 1905.

A device is employed for operating electric regulators including therein resistances having different tempera-

ture co-efficients, and motor field windings connected in series with the resistances.

854,123. Voltage Regulator. Simon B. Storer, Syracuse, N. Y. Application filed October 23, 1906.

In a system of electrical distribution are an electric circuit including therein the load of one or more translation devices, means to cut the load into and out of circuit, and separate means brought into action by the opening and closing of the circuit for automatically introducing a predetermined voltage into the system. (See cut.)

854,153. Electromagnetic Means for Transporting Non-magnetic Materials. Ethan I. Dodds, Pullman, Ill. Application filed April 27, 1906.

The method of transporting non-magnetic material such as glass, consists in resting such material upon an armature, the attraction of an electromagnet for the armature pressing the parts together.

854,164. Automatic Switch for Telephone Installations. Paul Hildebrand, Munich, Germany. Application filed August 24, 1905.

In a switch having a single transmitting and receiving wire are a switch dial at the speaking station and a switch disk at the exchange for each subscriber, a contact lever on the disk adapted to be operated from the dial, a zero or rest contact, a series of call contacts and a series of speaking contacts for each speaking station on each of the switch disks and means for electrically interconnecting the contacts and dials whereby subscribers can mutually connect themselves first by the call contacts and subsequently by the speaking contacts.

854,177. Electric Gas Lighter. Edmund H. Pryce, Yonkers, N. Y. Application filed July 11, 1906.

In an electrical circuit protector are an excess current operated device, circuit-controlling mechanism co-operating therewith, and means apart from the device for placing the parts thereof in position for another operation.

854,277. Means for Cooling Transformers. Frederick Darlington, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 25, 1906.

Combined with a receptacle containing an electrical translating device and an insulating liquid, is a liquid surrounding the receptacle having a greater thermal capacity than the insulating liquid.

854,278. Radiator. Frederick Darlington, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 25, 1906.

Combined are a receptacle, an electrical device located therein, a liquid in which the device is submerged and one or more sealed receptacles that are partially submerged in the liquid, the submerged portions containing another and more volatile liquid.

854,279. Telephone-exchange System. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 19, 1905.

In a telephone exchange system are subscribers' lines, and operators' plug cord-circuits for interconnecting the same, a cut-off relay for each cord-circuit, and connections therefor such that upon giving a clearing-out signal a subscriber will energize a cut-off relay to sever the cord from his line, without regard to the position of any connecting plug.

854,318. Electric Sterilizer. Julius B. Wantz, Chicago, Ill., assignor to the Victor Electric Company, Chicago, Ill. Application filed March 9, 1907.

The sterilizer comprises a receptacle having a bottom of convolute form in cross-section, and resistance-coils in tubular casings supported to extend in the troughs of the bottom.

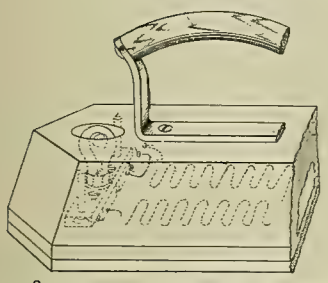
854,321. Dynamo-electric Machine. Joseph A. Williams, Cleveland, Ohio. Application filed February 28, 1906.

The machine has a non-rotatable armature winding, a rotatable inductor core passed axially through the winding and having on one side of the winding diametrically opposed wings and having on the other side of the winding diametrically opposed wings lying in a plane at right angles to that of the first-named wings. Magnetic pole pieces on opposite sides of the winding have faces concentric with the core, the centers of the pole faces being substantially 90 degrees apart.

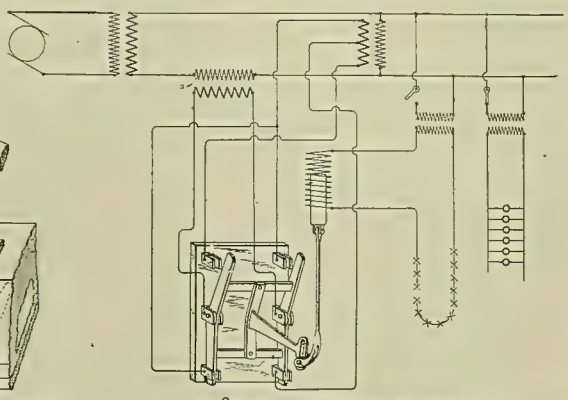
854,326. Battery Plate and Process of Making Same. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed August 14, 1906.

The process consists in arranging the parts to be united in close proximity, and depositing a globule of superheated lead or alloy while free from oxide between the meeting surfaces of the parts to weld them together.

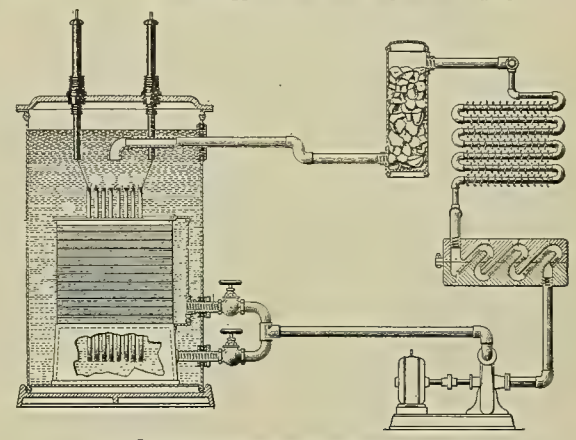
854,327. Indicating Mechanism for Electric Fuses or Cut-outs. Leonard B. Buchanan, Woburn, Mass. Application filed September 14, 1906.



NO. 854,013.—LAMP SIGNAL IN FLATIRON.



NO. 854,123.—VOLTAGE REGULATOR.



NO. 854,312.—MEANS FOR COOLING TRANSFORMERS.

Combined are a handle, a gas valve actuated thereby, a circuit interrupter, a magneto actuated by the handle, an electromagnet in series circuit with the interrupter and the magneto, and an armature for the magnet for breaking the circuit at the interrupter every time the armature is attracted by the magnet.

854,200. Process of Making Storage-battery Electrodes. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company West Orange, N. J. Application filed March 30, 1905.

The process consists in introducing within a perforated electrode pocket a loosely packed mass of flakes, foils or scales containing metallic cobalt, and in them subjecting the same to a welding temperature to secure integrality thereof.

854,203. Telephone-exchange Apparatus. Claude D. Enochs, La Crosse, Wis., assignor to the Vote-Berger Company, La Crosse, Wis. Application filed April 24, 1905.

The apparatus includes a subscriber's circuit, a line jack connected with the circuit at the central station, a cord plug circuit adapted to co-operate with the line jack, a battery connected with the conductors of the cord plug circuit, and a repeating coil and ballast connected in series with each of the conductors.

854,204. Telephone-exchange Apparatus. Claude D. Enochs, La Crosse, Wis., assignor to the Vote-Berger Company, La Crosse Wis. Application filed April 24, 1905.

In combination with a line circuit for conducting undulatory, pulsatory or intermittent electric currents are a signaling instrument connected with the line circuit, and a steadying resistance in series with the signaling instrument.

854,205. Circuit-closing Device. Frederic W. Erickson, New York, N. Y. Application filed January 29, 1907.

Details are described.

854,217. Electric Conductor. Oliver T. Hungerford, Belleville, N. J. Application filed February 15, 1901.

The conductor comprises a wire incased by a sheath of felt mounted directly upon the surface of the wire and having the irregular interstices between the fibers of the felt filled and its fibers saturated with an insulating compound.

854,218. Insulated Electric Conductor. Oliver T. Hungerford, Belleville, N. J. Application filed January 11, 1904.

The patent is similar to patent 854,217.

854,257. Electric Heater for Curling Irons. Frederick A. Tobler, San Francisco, Cal. Application filed October 4, 1906.

A socket is secured to the casing of the heater, the whole being mounted on a base. There is a heating chamber within the casing, and a heating coil around the same. Suitable contact anvils are fixed about the periphery of the coil in which the respective terminals of the coil are fixed.

854,272. Heat Coil. Frank B. Cook, Chicago, Ill. Application filed November 7, 1903.

854,296. Electromotor of the Induction Type. Frank M. Lewis, Brighton, England. Application filed November 21, 1904.

A multipolar induction motor has a field winding provided with means for reversing the regular succession of poles in one-half of the field structure, and an armature having two sets of windings, one a high resistance squirrel-cage and the other composed of short-circuited continuous windings of low resistance.

854,300. Vacuum-tube Electric Apparatus. Daniel McF. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed February 7, 1906.

Combined with a vacuum tube are a valve controlling the supply of gas to the tube, a valve chamber, a spring diaphragm closing the chamber and connected to the valve, and an actuating electromagnet operating on the diaphragm and valve in response to changes in the electrical resistance of the gas or vapor within the vacuum tube. (See cut on next page.)

854,309. Supporting Means for Electric Apparatus. Emerson G. Reed, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 3, 1906.

Combined with a transformer comprising a laminated magnetizable core, a supporting frame therefor, and a number of coils, are an enclosing casing and adjustable means for supporting the transformer in the casing.

854,311. Transformer-coil Support. Charles E. Skinner, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 13, 1905.

In a transformer, combined with a winding comprising a number of coils, is an extensible frame for maintaining the relative positions of the coils that comprises a number of supporting beams and separating rods.

854,312. Means for Cooling Transformers. Charles E. Skinner, Wilkinsburg, and Samuel M. Kintner, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1905.

In combination with a transformer the core and winding structures of which are provided with ventilating apertures having non-communicating inlet ends, and an insulating liquid in which the transformer is immersed, is a system of circulation for the liquid comprising means for directing independent streams of the liquid respectively through the core apertures and the winding apertures. (See cut.)

854,315. Insulator. Henry D. Stauffer, Oregon, Ill. Application filed July 24, 1905.

Details are described.

854,316. Electrical Apparatus. Wilbur H. Thompson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 23, 1906.

A transformer comprises a main coil, a number of secondary coils, and independent magnetizable core members whereby the secondary coils are severally and magnetically interlinked with the main coil.

The mechanism is adapted to be supported upon the exterior of the shell or case of an enclosed electric fuse. It comprises an indicating-device, actuating means therefor, a fuse-wire, and means for electrically connecting the opposite ends of the fuse-wire with the exterior of the terminals of the fuse.

854,337. Trunk-line Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 10, 1901.

In a telephone system having a pair of telephone lines are a cord circuit and a trunk circuit adapted by their connection with the lines and with each other to unite the lines for conversation, a source of current associated with the cord circuit, and a second source of current associated with the trunk circuit, and a signal associated with the cord circuit adapted to be actuated by current over the called telephone line from the second source during conversation.

854,344. Electrical Signaling Apparatus for Engines. George J. Exterkamp, Covington, Ky., assignor of one-half to John A. Thobe, Covington, Ky. Application filed February 25, 1907.

There are circuit connections between the electric signal and the binding posts of collars mounted upon stub axles.

854,362. Generation and Distribution of Energy. John F. Kelly, Pittsfield, Mass. Application filed April 15, 1903. Renewed May 21, 1904.

Combined are a main multiphase alternating-current generator, an auxiliary multiphase alternating-current generator supplying alternating currents to the field windings of the main generator, a commutator connected to the field windings and means for connecting the brushes of the commutator in derived circuit from the armature circuits of the main generator.

854,363. Magnet Box and Armature of Magnet Contained Therein. Charles D. Lanning, Boston, Mass. Application filed January 26, 1906.

In electromagnetic apparatus are a magnet-container, a magnet therein, an armature lever pivoted to the container, diamagnetic pieces between the armature and magnet poles, a container-cover, and means thereon to control the lateral movement of the armature lever and maintain the armature and the diamagnetic pieces in co-operative alignment with the cores of the magnet when the cover is applied to the container.

854,369. Receptacle and Plug for Electrical Connections. Walter S. Mayer, Philadelphia, Pa., assignor to the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa. Application filed December 12, 1906.

The device embraces a receptacle, contact members located therein, the members comprising body portions and spring contact portions, means for electrically connecting the ends of the circuit wire to the contact members, and stop lugs or projections connected to the body portions to limit the movement of the spring contact members.

854,396. Safety Attachment for Electrically Heated Vessels. James I. Ayer, Cambridgeport, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed January 14, 1907.

An electrically heated apparatus contains a chamber to be heated, a heating circuit therefor, and an automatic cut-out in the circuit, including a post extending outside of the chamber for conveying heat from the latter to operate the cut-out, and a fusible nut on the outer end of the post, externally of the cut-out.

854,401. Telegraph Transmitter. John Burry, Ridgefield Park, N. J. Application filed July 21, 1904.

A telegraph instrument for transmitting distinctive combinations of current impulses over a number of circuits comprises in combination a number of circuits, means for controlling the strength, means for varying the direction, means for determining the order of succession of the impulses sent over the circuits, and keys adapted to engage and operate the means in distinctive combinations.

854,413. Device for Removing Static Electricity from Stock. William Fullard, Plainfield, N. J., and Charles M. Donham, Portland, Maine. Application filed June 5, 1906.

The device is provided with a tank, means whereby the atmospheric air is heated without being mixed with the products of combustion, means for forcing the air into and from the air tank and a distributing pipe in communication with the air tank for directing the hot air downwardly against the stock.

854,421. Magneto Armature. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Application filed October 13, 1906.

An armature has a winding providing spaces between the sides of the winding and the sides of the armature, and insulating members laid over the winding and provided with flanges integral therewith that extend into the spaces to prevent the leakage of current to the metal of the armature.

854,425. Dynamo-electric Machine with Commutating Poles. Henry R. King, Hinsdale, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed November 2, 1906.

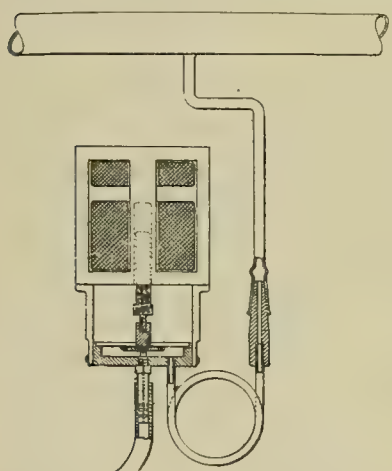
Combined with a direct-current dynamo-electric machine having compensating field windings acting upon the armature coils undergoing commutation, are a magnet in series with the armature circuit, and means for variably energizing the compensating field windings, controlled through the agency of the magnet. (See cut.)

854,431. Press or Sad Iron. James B. Replogle, Chicago, Ill. Application filed September 6, 1906.

A press or sad iron comprises a body of para-magnetic material comprising a core and a shell, each terminating at substantially the smoothing surface of the iron, and at the terminal portions magnetically separated, and an electro-magnet-coil mounted on the core.

854,436. Electrical Switch. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company, Philadelphia, Pa. Application filed May 26, 1904.

Combined are a pair of fixed contacts, a number of independent members for engaging the contacts, a toggle for each member, means for interconnecting the toggles whereby the members are simultaneously operated, and means for engaging the interconnecting means for restraining the members.



NO. 854,300.—VACUUM-TUBE ELECTRIC APPARATUS.

854,437. Tachometer. Harry Shoemaker, Jersey City, N. J., assignor of one-half to Cornelius D. Ehert, Philadelphia, Pa. Application filed July 30 1906.

In a tachometer are a multipolar permanent magnet constituting a rotatable magnet system, an indicating member comprising a magnetizable mass carrying a short-circuited winding and disposed in the field of the magnet system, indicating means carried by the indicating member, and means for opposing the movement of the indicating member.

854,438. Magneto Armature. Charles F. Splitdorf, New York, N. Y. Application filed November 1, 1906.

An armature with windings has core plates provided with heads at one end and the opposite ends reduced, the core plates being placed within the windings with their heads alternating on opposite sides of the windings providing spaces between adjacent heads, filling pieces within the spaces between the heads, and means for securing the plates and filling pieces together.

854,439. Portable Combination Telephone Set. Alfred Stromberg, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 23, 1903.

Combined with a supporting frame are a transmitter mounted at the lower end thereof, a receiver pivoted at the upper end thereof, the receiver and transmitter being normally substantially in position for use, spring means for automatically disconnecting the instrument from circuit when not in use, and means for connecting the instrument in circuit upon the exertion of a pressure therewith against the ear of the user, to bring the instrument in exact position for conversion.

854,442. Electric Motor Truck. Benjamin R. Van Kirk, Philadelphia, Pa., assignor to Burnham, Williams & Co., Philadelphia, Pa. Application filed November 30, 1906.

In a car truck are a frame, boxes in the frame, axles mounted in the boxes, and motor casing carried by one of the axles and overhanging the wheel base of the truck, the overhanging portion of the motor being supported by beams.

854,455. Lock for Electric Switches. Frank W. Brandow, Pittsfield, Mass. Application filed December 12, 1906.

In an apparatus having a sparking device, batteries, separate circuits connecting their respective batteries with the sparking device, and contact points in their respective circuits, are a switch in both the circuits and swinging at one end between the contact points and into and out of connection therewith, and a lock having a bolt operating on a line between the contact points.

854,472. Sanitary Attachment for Telephone Transmitters. Josiah W. Dolson, New York, N. Y. Application filed July 3, 1906.

A frame designed to be attached to the mouthpiece of the transmitter has an opening for registering with the opening in the mouthpiece. A roll of webbing is adapted to be drawn across the opening.

854,489. Trolley-pole Support. John Gribben, Sharpsburg, Pa., assignor of one-half to David J. Morgan, Pittsburg, Pa. Application filed January 23, 1907.

Details are described.

854,493. Cluster Socket. Gustav A. Harter, Chicago, Ill. Application filed November 22, 1906.

A unitary cluster socket comprises a body of plastic insulating material having embedded therein in inseparable connection therewith suitable lamp sockets, contacts, connections, and an attaching part having a projecting threaded portion.

854,508. Process for Producing a Bleaching, Sterilizing or Conditioning Agent. Sidney Leetham, York, England, assignor to the Ozonized Oxygen Company, Limited, Manchester, England. Application filed July 16, 1904.

The method described consists in first subjecting air to dark electrical discharges, and then subjecting it to sparking electrical discharges, the air being maintained in a condition to prevent complete decomposition of ozone.

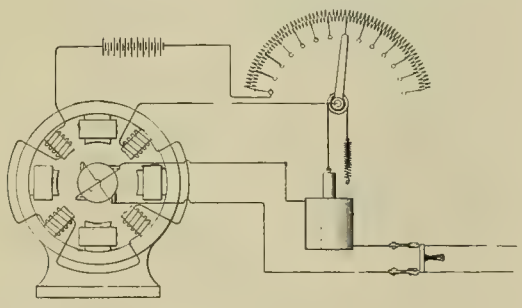
854,525. Phonograph System. William Patten and James Patten, New York, N. Y. Application filed March 31, 1905. Renewed March 7, 1907.

A talking-machine system comprises a reproducer capable of creating electrical undulations corresponding to the subject impressed on the record of the talking machine.

854,543. Party-line Telephone System. Guy E. Terhune, William M. Eidson and William B. Huston, Willow Hill, Ill. Application filed November 11, 1905.

Combined are a generator for energizing the line so as to signal a distant station, electrically-operated mechanism for indicating that the line is busy, and means controllable by the electrically-operated mechanism for short-circuiting the generator when the line is busy.

854,552. Telephone Switch. James S. Alsobrook, Wood Station, Ga. Application filed June 30, 1906.



NO. 854,425.—DYNAMO WITH COMMUTATING POLES.

Combined in a telephone line are a line switch and conductors connected thereto, a telephone switch, an auxiliary switch in conjunction with the telephone switch, for restoring the line when left open, and a circuit breaker whereby only the bells on the line wanted are energized, when a call is made.

854,554. Electric-light Fixture. John F. Barrett, Chicago, Ill. Application filed March 16, 1906.

Details are described.

854,562. Electric Conductor or Cable. Sidney G. Brown, London, England. Application filed October 8, 1904.

An electric conductor or cable has a copper conductor associated with iron or magnetic material of approximately the same segmental form in transverse section twisted together in an axial direction.

854,578. Pick-up for Non-insulated Electric Wires. Edward J. Heath, St. Louis, Mo. Application filed August 23, 1906.

A tool for electrical workers is described.

854,627. Letter Box. Norman T. Cheney, Batavia, Ill. Application filed March 10, 1906.

Combined with a letter box are an exteriorly arranged mail holder comprising a fixed jaw, a hinged jaw, means for urging one jaw toward the other, an arm carried by the hinged jaw and provided with a contact piece, an electrical circuit including an alarm, and a pair of contact plates in circuit arranged within the sweep of the contact piece of the arm.

854,645. Fire Escape. Fritz Jäger, Gladbeck, Germany. Application filed November 14, 1906.

An electric switch is connected with alarm devices and adapted to be operated by one of a number of arms fixed at right angles to an upper ladder near a window on each floor of a building. When the ladder is put into operation the alarm devices are operated.

854,662. Electric Condenser. Ignacy Moscicki, Fribourg, Switzerland. Application filed February 17, 1904.

The condenser described comprises a vessel of insulating material containing an electrolyte and two coiled tubular dielectrics, the coils of one surrounding the coils of the other, both being immersed in the electrolyte contained in the vessel. Each tubular dielectric contains an electrolyte conductor. Conducting terminals are inserted within the tubular dielectrics and immersed in the electrolytic conductors contained therein.

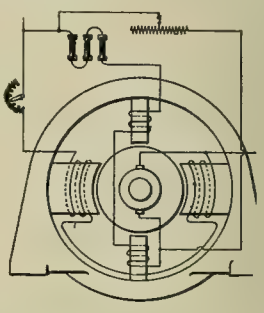
854,688. Controller-operating Means. Arthur J. Brown, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis. Application filed August 27, 1906.

A controller for street car motors is described.

854,702. Machine for Handling Dirt and Saving Gold. Maro L. Proctor, Elkhart, Ind., assignor to Czarra & Proctor, Elkhart, Ind. Application filed February 27, 1905.

The machine includes a magnetic separator and a sluice adapted to receive the material not attracted by the separator.

854,704. Dynamo-electric Machine. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis. Application filed August 27 1906.



NO. 854,704.—DYNAMO-ELECTRIC MACHINE.

The machine patented comprises an armature, main and commutating windings, and resistances in shunt and in series respectively to the commutating winding and arranged to be varied to cause the current in the commutating winding to vary in greater ratio than the main current. (See cut.)

REISSUE.

12,654. Process for the Production of Aromatic Alcohols and Their Derivatives. Charles Mettler, Munich, Germany. Application filed June 29, 1906. Original No. 815,548, dated March 20, 1906.

The process described consists in exposing the aromatic esters in a dissolving agent capable of conducting the electric current in the cathode-space of an electrolytic apparatus, in using for the cathode a material of a specially-high cathodic tension, neutralizing the cathode liquid, then separating the reaction product and finally distilling.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on May 27, 1907:

428,586. Double-pole Switch. G. H. Alton, Lynn, Mass.
428,616. Sliding Clamp for Electric-welding Apparatus. H. Lemp, Lynn, Mass.
428,617. Electrical Apparatus for Welding Rings. H. Lemp, Lynn, Mass.
428,618. Transformer for Heavy Currents. H. Lemp, Lynn, Mass.
428,619. Method of Welding Rings by Electricity. H. Lemp, Lynn, Mass.
428,620. Reactive Coil. H. Lemp and W. H. Moody, Lynn, Mass.
428,633. Method of Measuring Electric Currents. E. W. Rice, Jr., Lynn, Mass.
428,647. Turn-off for Alternating-current Circuits. E. H. Thomson, Lynn, Mass.
428,649. Electric Meter. E. H. Thomson, Lynn, Mass.
428,651. System of Electrical Distribution. E. H. Thomson, Lynn, Mass.
428,653. Guard-wire Protector and Lightning Arrester for Electric Railways. E. H. Thomson, Lynn, Mass.
428,669. Electric Locomotive. E. Dummer, Newton, Mass.
428,676. Electric Circuit-closer for Clocks. Henry C. Karr, Washington, D. C.
428,688. Electric Low-water Alarm. J. Morehead, Detroit, Mich.
428,698. Single-cord Multiple Switchboard System. C. E. Scribner, Chicago, Ill.
428,705. Regulator for Dynamo-electric Machines. E. H. Thomson, Lynn, Mass.
428,723. Electric-light Hanger. C. L. Jeffers, Manchester, N. H.
428,732. Electric Motor and Generator. F. J. Sprague, New York, N. Y.
428,735. Brush-holder for Dynamo-electric Machines. F. A. Weller, Lynn, Mass.
428,742 and 428,743. Commutator Block for Dynamo-electric Machines. C. F. Brush, Cleveland, Ohio.
428,746. Galvanometer. A. E. Colgate, New York.
428,774. Burglar Alarm. E. Hayward and E. S. Simms, New York, N. Y.
428,781. Galvanic Battery. J. S. Nowotny, Cincinnati, Ohio.
428,782. Electric Motor or Dynamo-electric Machine. S. M. Potter and H. E. Morgan, Philadelphia, Pa.
428,854. Electric Programme Clock. J. L. McCaskey, Waynesborough, Pa.
429,093. Electric Railway. R. M. Hunter, Philadelphia, Pa.
429,094. Electric Motor. R. M. Hunter, Philadelphia, Pa.

NATIONAL ELECTRIC LIGHT CONVENTION NUMBER.

Western Electrician

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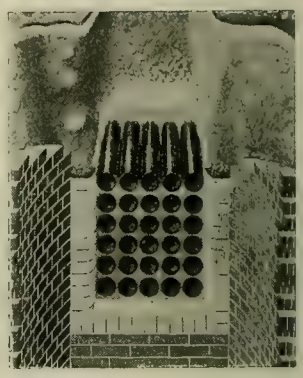

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For Underground Systems

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Patent Cable Racks

Used by the largest Electric Light and Telephone Companies in the country

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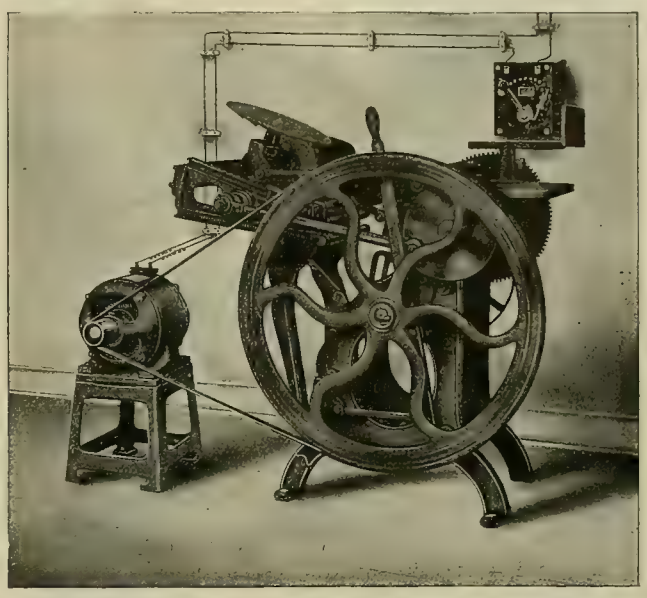
Variable Speed Single-Phase



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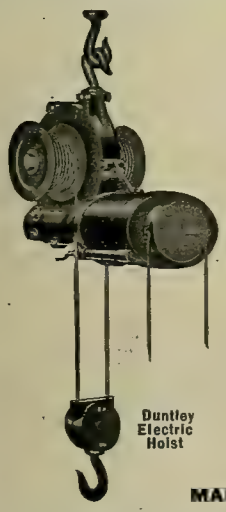
WE SHIP TOOLS ON TRIAL to responsible parties



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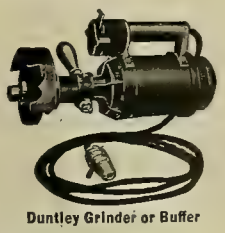

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Absolutely no corrosion under any conditions

Especially recommended for measuring instruments and apparatus in which the wire is repeatedly heated and cooled.

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Reliable, Efficient and Permanent Lightning Protection

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Because they offer an absolutely straight and non-inductive path, complete, continuous and connected all the way to the ground. No air gaps, non-arcing, no moving parts nor coils, cannot induce a surging discharge and guaranteed for two years.

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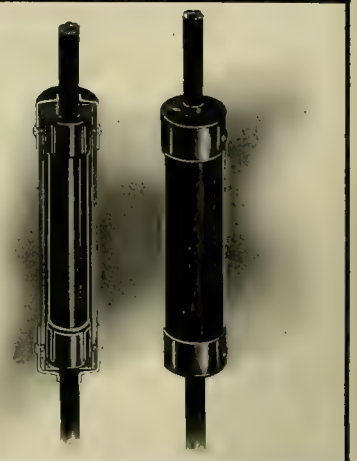

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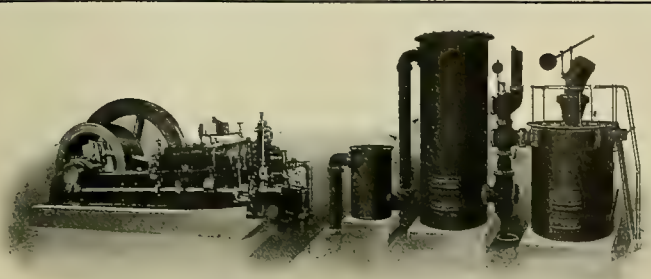


MUENZEL GAS ENGINE AND SUCTION GAS PRODUCER POWER SYSTEM

THE early gas engines were designed for the use of illuminating gas and gasoline, but the high cost of these fuels has led to the design of various forms of apparatus for the production of a cheaper fuel.

¶ The best success has been had with various forms of apparatus known as gas producers supplying what has been generally termed "producer gas," of which the combustible portion consists mainly of carbon monoxide and hydrogen.

¶ While the pressure producer and gas engine system was a long way ahead of the steam engine and boiler combination, there still remained a great deal to be perfected in that direction.

¶ We have had our best engineering talent following up the development of the Gas Engine and Gas Producer, and after careful investigation of the various systems now in use, decided that the invention of Mr. Max Muenzel, Managing Director of the G. Luther Co., Braunschweig, Germany, was the most practical and showed the highest state of development of any investigated.

¶ We are ready to make reasonable delivery of plants from 25 to 300 H. P. and guarantee you a saving of from 50 to 75 per cent. in your fuel bill and operating expenses over that of any gasoline or steam plant.

¶ We have over 30 plants in successful operation. Let us send you the names of these firms.

MINNEAPOLIS STEEL AND MACHINERY CO.
MINNEAPOLIS

WHITNEY Hot Wire Meters

are the ideal instruments for the measurement of alternating current. They are unaffected by changes in temperature, are equally correct on direct current and on varying frequency, and are not affected by magnetic fields. The ammeters of this type work on shunts. Made in both portable and switchboard forms.

Send for description of mechanism and prices.

Whitney Electrical Instrument Co.

Machado & Roller, Gen'l Sales Agents

Monadnock Bldg., Chicago — 203 Broadway, New York

THE EVERSTICK ANCHOR, THE ANCHOR OF MERIT

Your money's worth or your money back is the way we sell anchors.
Installed with a tamping bar in less than half minute after hole is bored

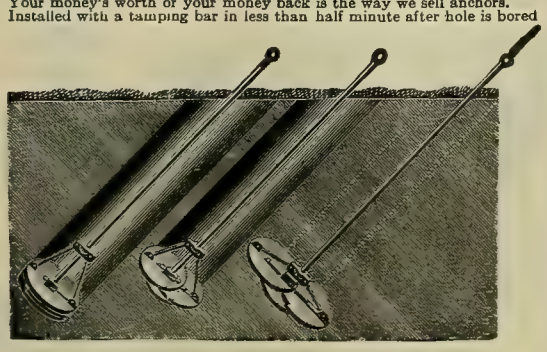
SIZES OF ANCHORS

No. 5, 5x9
No. 6, 6x11
No. 8, 8x15
No. 10, 10x19

THE BEST ANCHOR MADE.

LOW IN PRICE.

Made of Malleable Iron.



1 2 3

Fig. 1—Represents Anchor placed at bottom of hole.
Fig. 2—Partially expanded.
Fig. 3—Fully expanded.

Write for Prices.

THE EVERSTICK ANCHOR CO., 17 South Main St., St. Louis, Mo.

A Great Electrical Novelty

Type D, Patent Feb., 1905.

Dimensions: Base, 14 ins. Height to top of Dome, 25 ins.
Quality: Base of Metal
Finish: Black and Verde Catch Basin and Dome of Leaded Glass

A PORTABLE Electric - Luminous FOUNTAIN

No Water Connection Self - Contained

Suitable for all kinds of decorative, table and utilitarian effects.

High Class Representation Desired Throughout the U. S.

Write for further Designs and Prices

New York Electric Fountain Co.

Dept. G. — *114 W. 39th St., NEW YORK CITY*

DOUBLE YOUR LIGHTING EFFICIENCY

BY USING

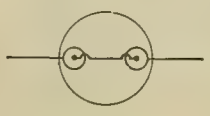
BENJAMIN SERIES DEVICES

WITH

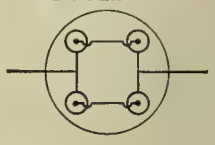
Cat. No. 12 1-2
2-4-6 Lt.

Two 110 Volt { GEM FILAMENT 2.5 W. P. C. —OR— TANTALUM 2 W. P. C.

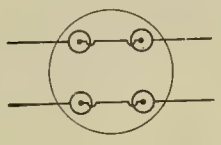
Cat. No. 74 1-2
2-4-6 Lt.



LAMPS IN SERIES

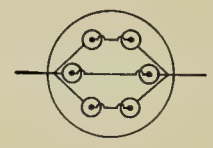


220 Volt



On

INSTEAD OF



Circuits

Cat. No. 412 1-2. 2 Lt.

220-Volt Carbon Filament Lamp.
4 W. P. C.

220-Volt Carbon Filament Lamp.
4 W. P. C.

Cat. No. 19 1-2
2 Lt.

Save Your Current

Cat. No. 92 1-2. 2 Lt.

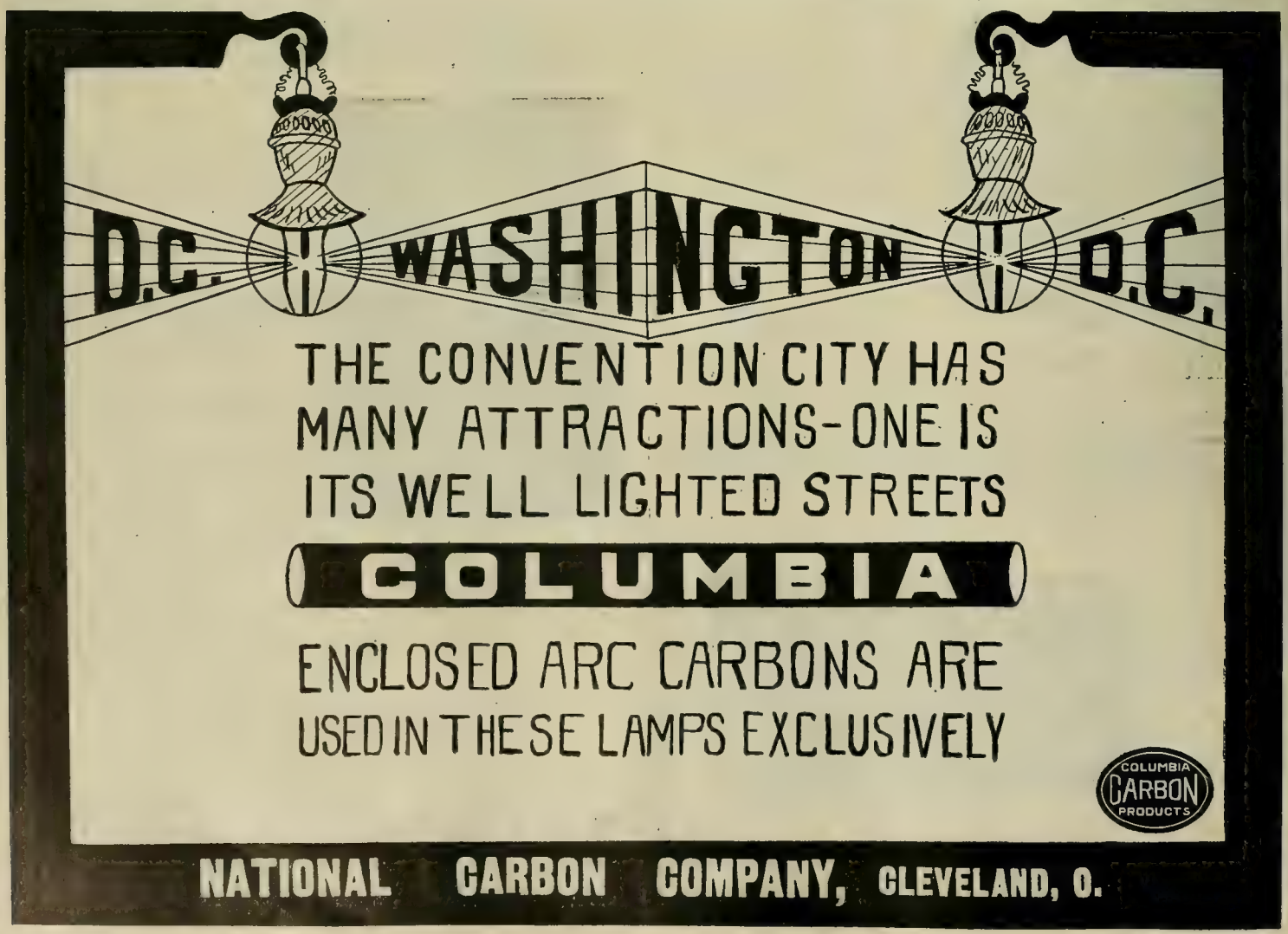
Increase Your Light

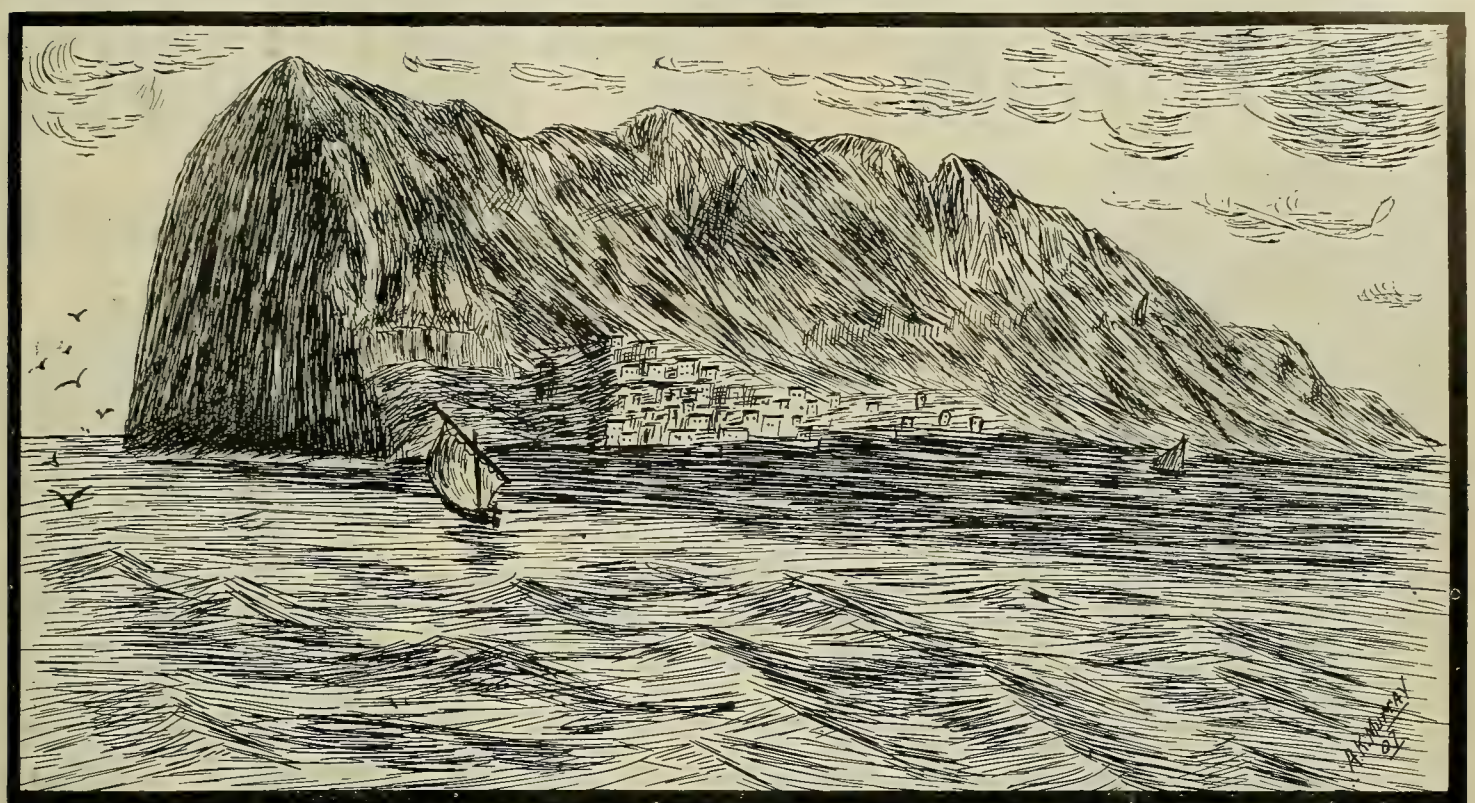
Cat. No. 22 1-2
2 Lt.

Write for Descriptive Literature and Prices

BENJAMIN ELECTRIC MFG. CO.

New York
Chicago
San Francisco





THE ROCK OF THE SCHOTT SYSTEMS GIBRALTAR

Towers Above Them All

LIKEWISE

The Schott Systems

OF

Central Station Heating

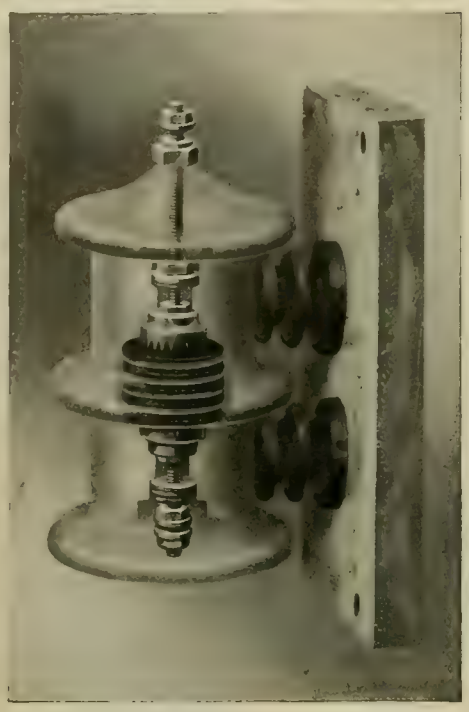
Lead all other heating systems in Design, Construction and Efficiency of Operation.

The Schott Regulated Steam System
The Schott Balanced Column Hot Water System

W. H. SCHOTT, Engineer

American Trust Bldg., CHICAGO

PROTECTION IS CHEAPER THAN INSURANCE



INTERNAL CONSTRUCTION OF ARRESTERS. MODELS A, B AND C.

Shaw Non-Arcing Lightning Arresters

Are a Positive Protection to

RAILWAY POWER AND LIGHTING CIRCUITS

What central station managers and constructing engineers want today for the protection of their electric equipment against the abnormal potential discharges to earth, is not a complicated piece of apparatus consisting of many parts with theoretical utility, but a simple and positive device constructed on lines of practicability and uniformity, and especially designed for actual service under most adverse conditions.

MODEL A.

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LORD ELECTRIC COMPANY

904 FLAT IRON BLDG., NEW YORK, N. Y.

NOW

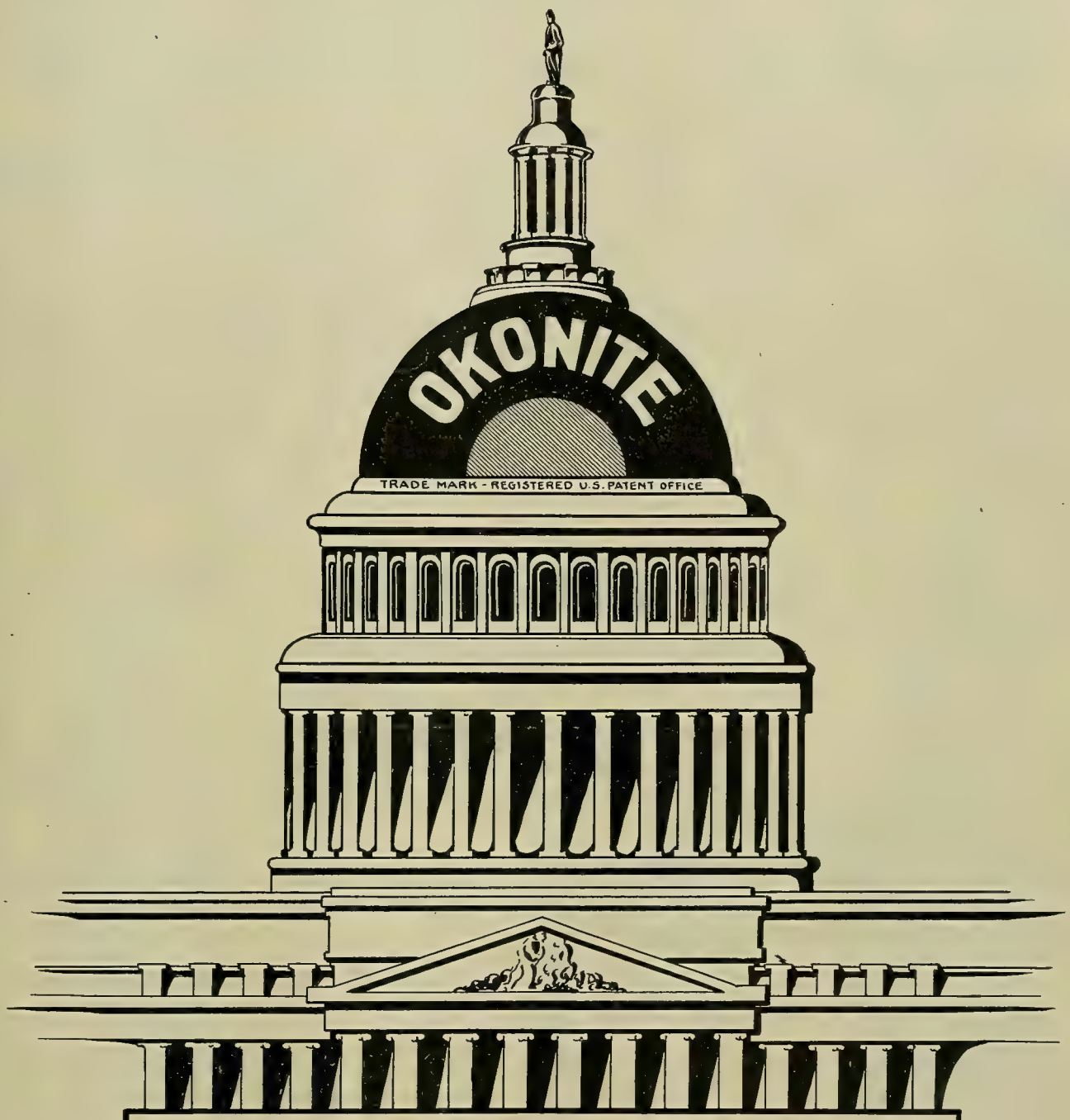
Send in your order and copy for an attractive advertising announcement for the

Western Electrician's National Electric Light Convention Report Issues

to be dated June 8th and 15th.

The first report number will go to press June 5th.
The final report number will go to press June 12th.
PLEASE FORWARD COPY TODAY.

Western Electrician, 507 Marquette Bldg., Chicago



The Nation's Capital Insulator

The Standard For Rubber Insulation

Man'frs. Adv. Bureau, N.Y.

"EXCELLO" FLAMING ARCS

(TRADE MARK)

"The Standard of Excellence by Which All Others Are Judged"

SEEN AND SOLD EVERYWHERE

3,000 C. P. Direct or Alternating Current, Inside or Outside.

MANUFACTURE AND SALE PROTECTED

EXCELLO ARC LAMP CO.

26 East Twenty-first Street NEW YORK

CHICAGO DEPOT — F. B. BADT & CO.

A-B ARC LAMPS

FOR ALL CIRCUITS

If you intend installing arc lamps, either an entire equipment or an addition to your present plant, an investigation of our product will prove advantageous. We furnish arc lamps for all circuits, and regulators, transformers, switchboards, etc., for series A. C. systems.

Write us for prices, bulletins and information.

THE ADAMS BAGNALL ELECTRIC CO.

General Offices and Factory
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The Constantly Increasing Demand For

"SHAWMUT" SPECIALTIES

is sufficient evidence that

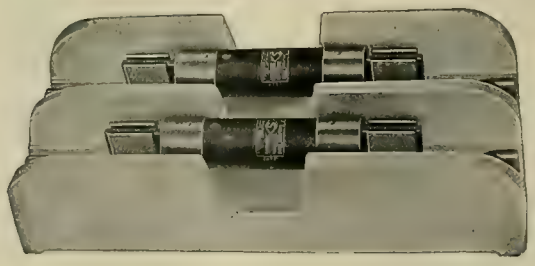
Superior Articles bring **Results**

Why not use

"SHAWMUT"

National Electrical Code Standard Fuses and Bases?

250 VOLTS 0-600 AMPERES 600 VOLTS



Full description and prices in Bulletin No. 36

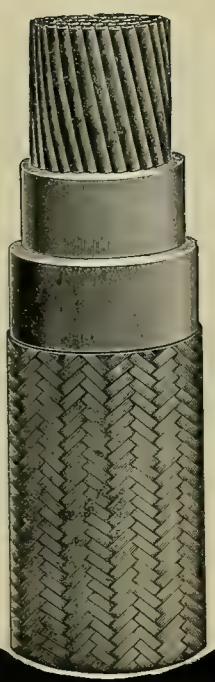
CHASE-SHAWMUT CO.

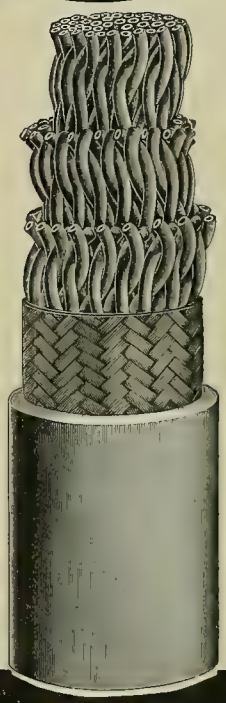
NEWBURYPORT, MASS.

PARANITE
RUBBER COVERED
WIRES
AND
CABLES

PARANITE TRADE MARK

PARANITE TRADE MARK





Underground
Aerial
Submarine
and Inside Use

Telephone, Telegraph

—AND—

Fire Alarm Cables

ALL WIRES TESTED AT FACTORY

Indiana Rubber and Insulated Wire Co.,

JONESBORO, INDIANA.

CO — OP —

BE A CO-OPERATOR

IF a selling plan were presented to you which you believed would yield a greater return of business per unit of money and time expended on it than you can now secure, you would lose no great amount of time in adopting it, would you?

If such a sales plan were directed toward increasing your sales as against your competitors in the electrical field for business either already existing or from the natural growth, it would merely be one of many such plans which you are daily figuring on.

BUT if such a sales plan concerned itself with creating new and more business which otherwise would not exist—if it was directed along broader and more effective lines than you can afford to undertake in educating the public to the largest use of electrical service for light, heat and power, etc.—if this were to be brought about through concerted and concentrated effort and money of all the men in the business, eliminating the object of profit from its operation and competition among ourselves in its execution—it certainly would merit your careful consideration, would it not? (See next page.)

CO-OPERATIVE ELECTRICAL—

CLEVELAND—

—ERATION

BE A CO-OPERATOR

THE Co-operative Association presents just such plans.

Their merit has been passed upon favorably by special committees representing all the branches of the electrical business, manufacturers, contractors, jobbers and central stations.

$50,000 has been spent in executing some of them. $75,000 additional has been underwritten in the last 60 days, and the complete plans call for an ultimate expenditure of $360,000 annually, which is being underwritten in the form of membership stock subscriptions from all branches of the business.

THIS Association opens up the opportunity and supplies the organization and the plans for commercial team work—co-operation along original, progressive and effective lines for cultivating and increasing the ultimate market—the great money-spending public.

This is our common market, whether we reach it direct or through and against one another.

Take note of the importance attached to this proposition at the forthcoming Convention of the National Electric Light Association, Washington, June 4th to 7th, 1907.

You ought to be numbered among the Co-operators. We will welcome a chance to tell you the why, when, how, what and how much of the proposition.

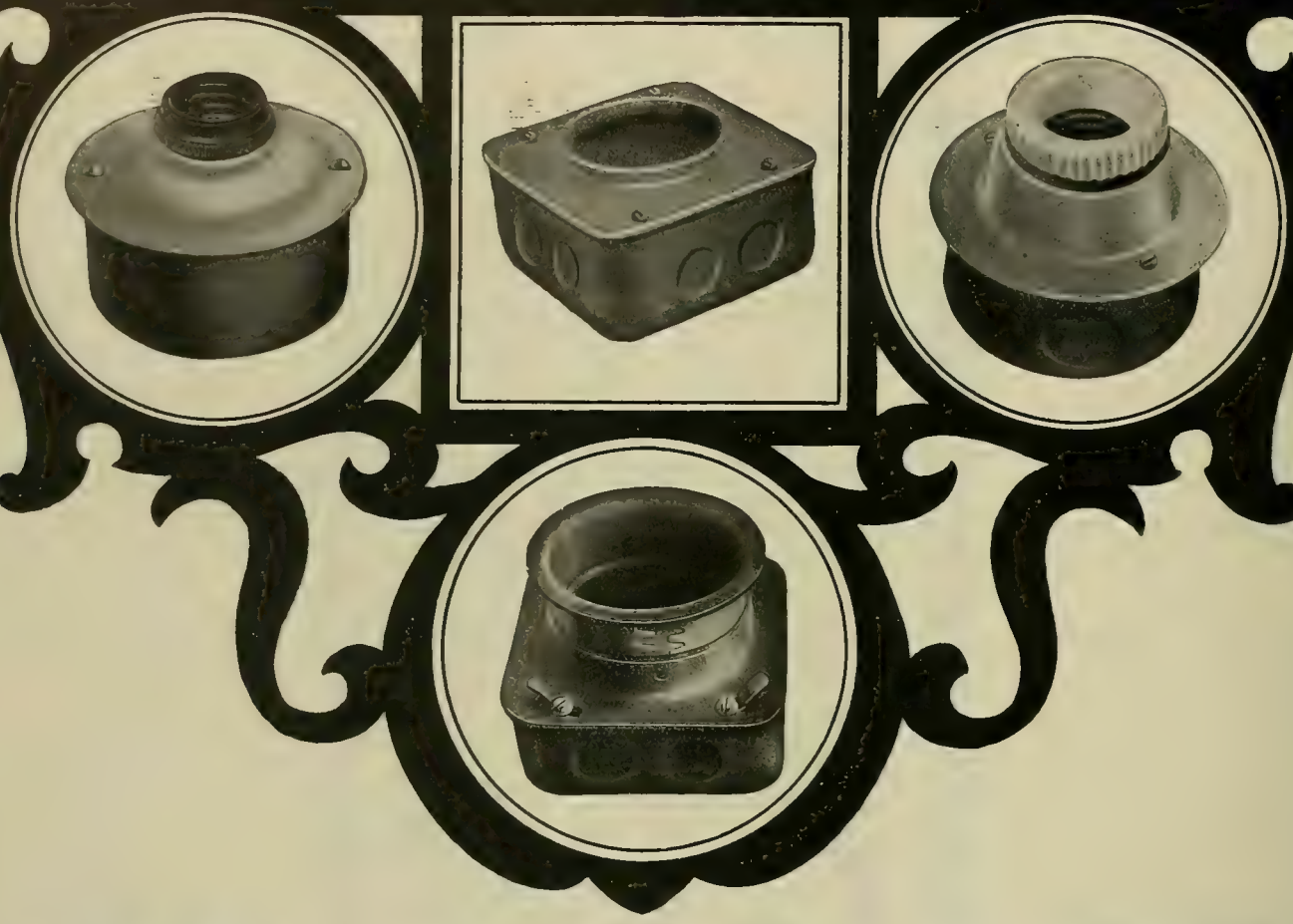
Write us for the Association's Constitution and By-Laws—Edition de Luxe.

Be-a-co-operator.

—DEVELOPMENT ASSOCIATION

—OHIO

BOSSERT



STEEL DRAWN BOXES

are the choice of the architect, contractor and everyone who uses outlet boxes. They form an ideal arrangement for conduit outlets and comply strictly with the underwriters' requirements.

The following are some of their good points:

Drawn from one piece of sheet steel, under heavy pressure, making them absolutely indestructible.

Fire and nail proof.

Cannot be bent or broken by carelessness or settling of buildings.

Made up with a sufficient number of outlets to meet all ordinary requirements, the holes being hermetically sealed with a steel disc, which can be removed by a sharp blow of a hammer.

The removal of these discs leaves a clean, round hole, the exact size of the conduit, entirely obviating the necessity of filing or reaming.

They are a decided saving in time and material over the ordinary cast-iron knock-out boxes.

Any kind of a box necessary to a complete electrical installation can be furnished by us. We invite you to send us your specifications or drawings of special boxes, upon which we will be glad to quote you.

We Also Manufacture

Monitor Conduit Bushings,
Flexible Conduit Bushings,
Erickson Conduit Insulators,
Armored Conductor Bushings.

MAY WE MAIL OUR NEW PAMPHLET?

BOSSERT ELECTRIC CONSTRUCTION CO.

Chicago Office, 269 S. Canal Street

Utica, N. Y.

CUTLER-HAMMER

BULLETIN 10

TELLS ABOUT MOTOR STARTING RHEOSTATS with no-voltage release.

BULLETIN 10½

TELLS ABOUT multiple switch STARTING RHEOSTATS for large motors.

BULLETIN 13

TELLS ABOUT MOISTURE PROOF RESISTANCE motor-starters. Ideal for damp locations.

BULLETIN 24

TELLS ABOUT starting and REGULATING RHEOSTATS as does also Bulletin 25.

BULLETIN 32

TELLS ABOUT FIELD REGULATORS for front and rear of switchboard.

WHO WE ARE WHERE WE ARE WHAT WE DO

This issue of the WESTERN ELECTRICIAN will reach many new readers, some of whom, perhaps, are not as well posted concerning the business of THE CUTLER-HAMMER MFG. CO. as we would like them to be. This advertisement is for them—not for our old friends who know all about us.

The business of this company is the design and manufacture of ELECTRIC CONTROLLING DEVICES. We do not make motors, nor generators, nor any appliances for electric heating or lighting (except Theater Dimmers) but we do make every conceivable device for CONTROLLING the electric current. For sixteen years we have devoted all our energies to this one branch of the electrical industry. The knowledge gained during this period in solving all manner of problems involving ELECTRIC CONTROL is freely at the disposal of our customers.

The plant of THE CUTLER-HAMMER MFG. CO., at Milwaukee, is the largest factory in the world devoted exclusively to the manufacture of ELECTRIC CONTROLLING DEVICES. The works occupy an entire city block and overflow into a five-story building across the way, recently purchased to provide the additional space demanded by our growing business. In addition to the Milwaukee plant this company operates a second factory in New York City and maintains District Offices in New York, Boston, Pittsburg and Chicago.

We invite inquiries from all who use generators or electric motors for any purpose. The performance of the motor depends to a great extent on the controlling device that governs it. CUTLER-HAMMER CONTROL is adapted to all types and sizes of motors and though sometimes higher in price than competing apparatus is nevertheless used to a far greater extent than any other. You can verify the truth of this assertion by noting the controlling device most frequently met with in electrical installations in your own locality.

We invite correspondence, also, from those who have difficult problems to solve involving applications of ELECTRIC CONTROL. We are daily in receipt of letters asking how best to accomplish this or that result. Nearly always the problem, though new to the writer, is an old one to us, and we are frequently able to send blue-prints showing how the same conditions were successfully met in former cases. Central Station Managers, Makers of Motor-Driven Machinery, Consulting Engineers, Electrical Contractors and the Man on the Switchboard are cordially invited to avail themselves of our facilities.

What we want YOU to do is to tell us what you WANT to do. We'll show you HOW to do it.

The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

New York Office 136 Liberty St. | **Chicago Office** Monadnock Bldg. | **Pittsburg Office** Farmers Bank Bldg. | **Boston Office** 176 Federal St.

BULLETIN 92

TELLS ABOUT THEATER DIMMERS, "Simplicity" type—used by leading theaters everywhere.

BULLETIN 84

and a dozen other Bulletins TELL ABOUT PRINTING PRESS CONTROLLERS.

BULLETIN 75

TELLS ABOUT MACHINE TOOL CONTROLLERS as do also Bulletins 76, 77, 78 and 79.

BULLETIN 73

TELLS ABOUT controlling devices for small MOTOR-DRIVEN PUMPS.

BULLETIN 71

TELLS ABOUT FLOAT SWITCHES and PRESSURE REGULATORS.

BULLETIN 40

TELLS ABOUT SPEED REGULATORS as do also Bulletins 41, 42, 43, 44, 45 and 61½.

BULLETIN 49

TELLS ABOUT ORGAN REGULATORS complete with chain and weight.

BULLETIN 51

TELLS ABOUT ELEVATOR CONTROLLERS as do also Bulletins 52, 53, 54, 56, 57 and 72-B.

BULLETIN 59

TELLS ABOUT radial arm reversible CONTROLLERS for CRANES and HOISTS.

BULLETIN 66

TELLS ABOUT reversible DRUM CONTROLLERS for CRANES and HOISTS.

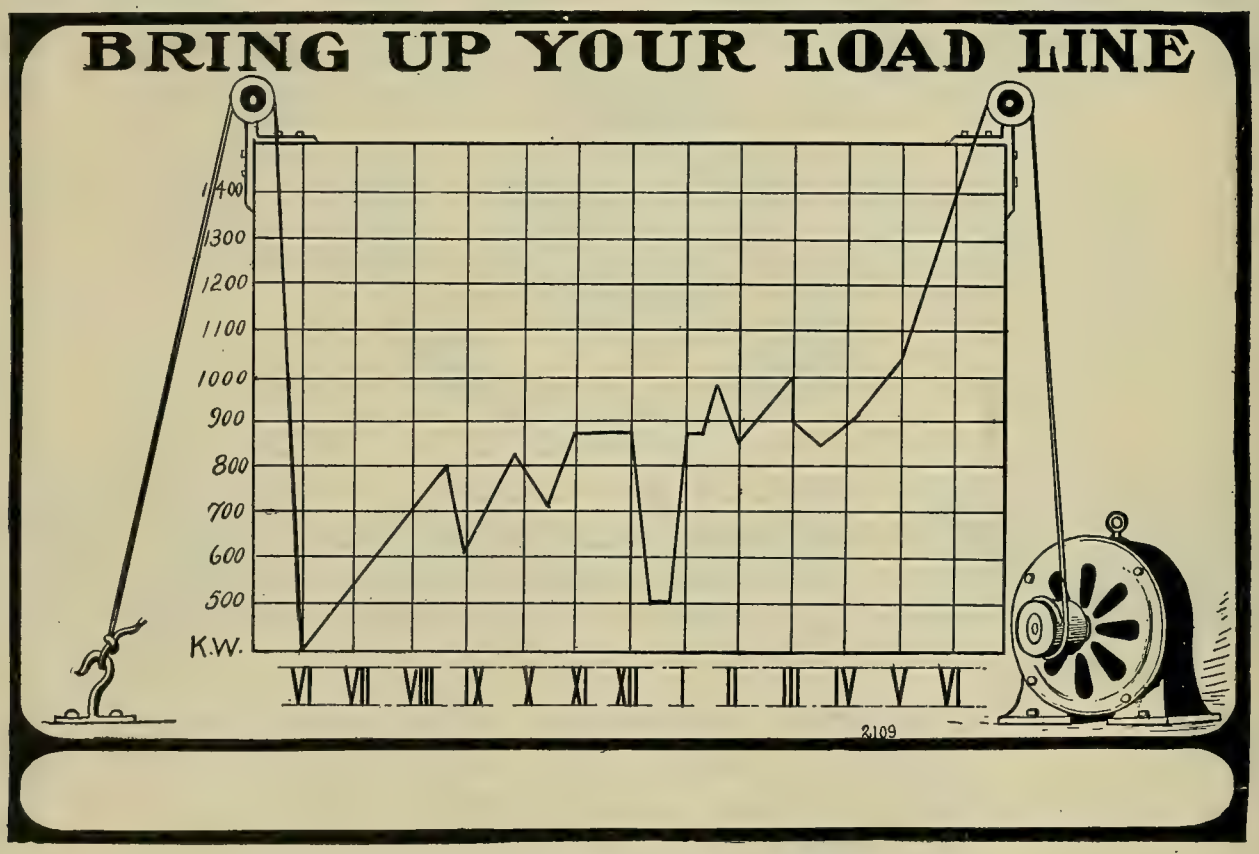
CUTLER HAMMER CONTROL

WAGNER ELECTRIC MFG. CO.

ST. LOUIS, U.S.A.

MOTORS

SINGLE-PHASE ═══ POLYPHASE



FRANKLIN & WILLIAMS' ALTERNATING CURRENT

Wagner motors are entirely automatic in action. They will start full load from rest without any manipulation other than the simple throwing of a switch. If the line is interrupted for an interval of time, these motors will not get in trouble when current comes on again.

They are ideal for remote control. The simple throwing of a switch at the station will start these motors, even though they be ten miles away.

The Wagner Single-phase Motor is so simple a child can start it, and its simplicity makes it marvelously free from repairs and trouble.

Write for Single-phase Motor Bulletin No. 75-H, and for Polyphase Motor Bulletin No. 74-H.

DISTRICT OFFICES IN ALL OF THE PRINCIPAL CITIES.

"ELECTRA"

ELECTRA

TRADE MARK

CARBONS

There is no substitute for "ELECTRA" CARBONS. "Electra" Carbons have sustained their reputation for years of exacting use and critical comparison.

"Electra" Carbons are made for all types of Arc Lamps and also for Flaming Arcs.

HUGO REISINGER

11 BROADWAY, NEW YORK

OUR 1907 CATALOG IS NOW READY FOR DISTRIBUTION

We believe it to be the most comprehensive catalog that has appeared to date on this subject. It contains 48 pages of concise description, cuts, prices and useful tables covering our products.

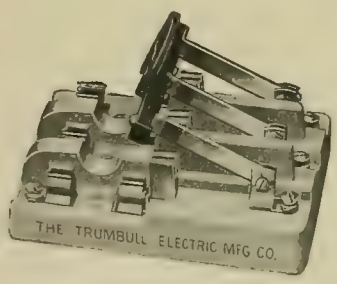
Magnet Wire—Electrical Cordage
German Silver Resistance Wire
Cotton Sleeving—Rosin Core Solder
Office and Annunciator Wire
Field Coil and Electromagnet Winding
Switchboard and Jumper Wire
Magnet Winding Machines and Revolution Counters

BELDEN MANUFACTURING COMPANY

192 MICHIGAN ST., CHICAGO.

COMBINATION SWITCHES

FOR N. E. C. FUSES



WRITE FOR BULLETIN

ADAPTED FOR WIRES ENTERING FROM EITHER TOP OR BOTTOM

DIMENSIONS

Nos. 704 and 724 D P, 3½ x 6 Ins.
" 705 and 725 3 P, 4½ x 6 "

THE MOST COMPACT ARTICLE OF ITS KIND ON THE MARKET

We Mount Them in IRON BOXES—Fire and Weather Proof

No. 704 D P	(wires	enter	from top),	list	$1.10,	Std. Pkg.	$0.25
" 724 D P	("	"	bot.),	"	1.10,	"	.25
" 705 3 P	("	"	top),	"	1.55,	"	.25
" 725 3 P	("	"	bot.),	"	1.55,	"	.25

THE TRUMBULL ELECTRIC MFG. CO.

NEW YORK 136 Liberty Street — PLAINVILLE, CONN. — BOSTON 65-67 Oliver Street

If all Central Stations would install

FEDERAL ELECTRIC SIGNS

on the "Free" proposition their total income from electric signs (judging from present sign incomes of Federal Central Station customers) would be

$20,000,000

Look at our Porcelain Enameled Steel Signs on display at the convention and talk to our representatives about the "Free" proposition.

FEDERAL ELECTRIC COMPANY
Lake and Desplaines Streets
CHICAGO, ILL.

Gould Storage Batteries

Have asserted their efficiency and economy by a long record of unbroken successes under widely varied conditions.

No elaborate technical argument, no experimental test data, can establish the same thorough confidence in the mind of the prospective purchaser as the fact of demonstrated money-saving, money-earning power.

Such a record the Gould Storage Battery Company offers as conclusive proof of the unequaled merit of its batteries and systems of battery regulation and control.

We invite the most critical comparison of our plate, our designs, our boosters and our systems of control with those of any other make or type in the world; we invite searching investigation of the records of plants installed, and will do all in our power to facilitate such investigations.

Bulletins of notable installations mailed free upon request.

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San Francisco,
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Toronto, Ont., 62-64 Wellington Street, West

Gould Storage Battery Co.

MAIN OFFICE
341-347 Fifth Avenue
New York City

Works: Depew, New York

THE DALE COMPANY

(Established 1888)

9TH AVE., 13TH AND HUDSON STS., NEW YORK CITY

THE LARGEST M'F'RS OF

Wireless Clusters, Portables, Lighting Specialties, Gas, Electric and Combination Fixtures in the United States.

WHY THE DEMAND? Because **DALE'S** Wireless Clusters are **LABOR SAVING.** Try them on one installation to **PROVE** what we claim.

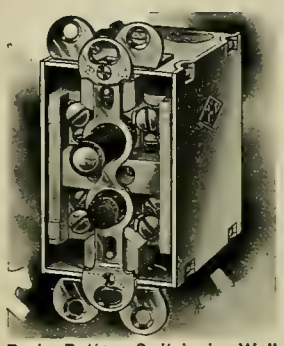
In addition to a large stock of the above, other product of our manufacture is carried by

WM. P. CROCKETT CO., Western Ag'ts.

Write for Catalogs

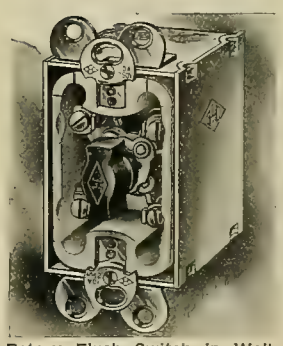
269-71 So. Canal St., Chicago

"DIAMOND H" SWITCHES AND RECEPTACLES



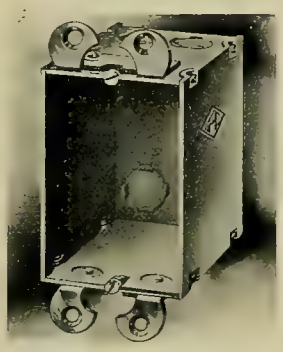
Push Button Switch in Wall Case

Are constantly being brought nearer to perfection. Slight improvements are always being made with the object in view to improve them faster than their new features can be copied by others. In simplicity of design, constructive strength and mechanical excellence they are unequaled.

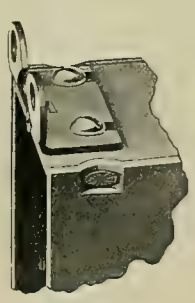


Rotary Flush Switch in Wall Case

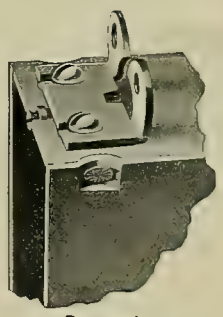
"Diamond H" wall cases are also well and strongly made, and have recently been fitted with reversible ears, making them suitable for either old or new work. Send for descriptive circular.



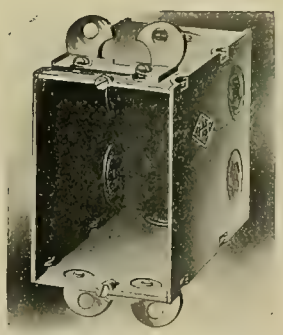
"Diamond H" Wall Case with Ears in Regular Position. To Use for Wiring Old Walls



Regular



Reversed



"Diamond H" Wall Case with Ears Reversed. To Be Plastered in for New Work

"Diamond H" Automatic Flush Receptacle. Plug Ready to Insert

"Diamond H" Automatic Flush Receptacle. Plug Inserted.

HART MFG. CO. HARTFORD, CONN.

NEW YORK BOSTON CHICAGO DENVER
SAN FRANCISCO TORONTO, CAN. LONDON, ENG.

Okonite Wires and Cables

Men who know and appreciate the worth of a perfectly insulated wire insist that all wiring specifications read OKONITE WIRES AND CABLES. They have found through actual experience that it saves time and money to use OKONITE right at the start. As General Western Agents our stock of OKONITE is always complete.

Shipped Today

Orders for regular material received before noon are shipped the same day received. Our large stock, unequaled facilities and personal attention to all orders enable us to put your orders through promptly. Better send us your next order. Our promptness will get and hold your business.

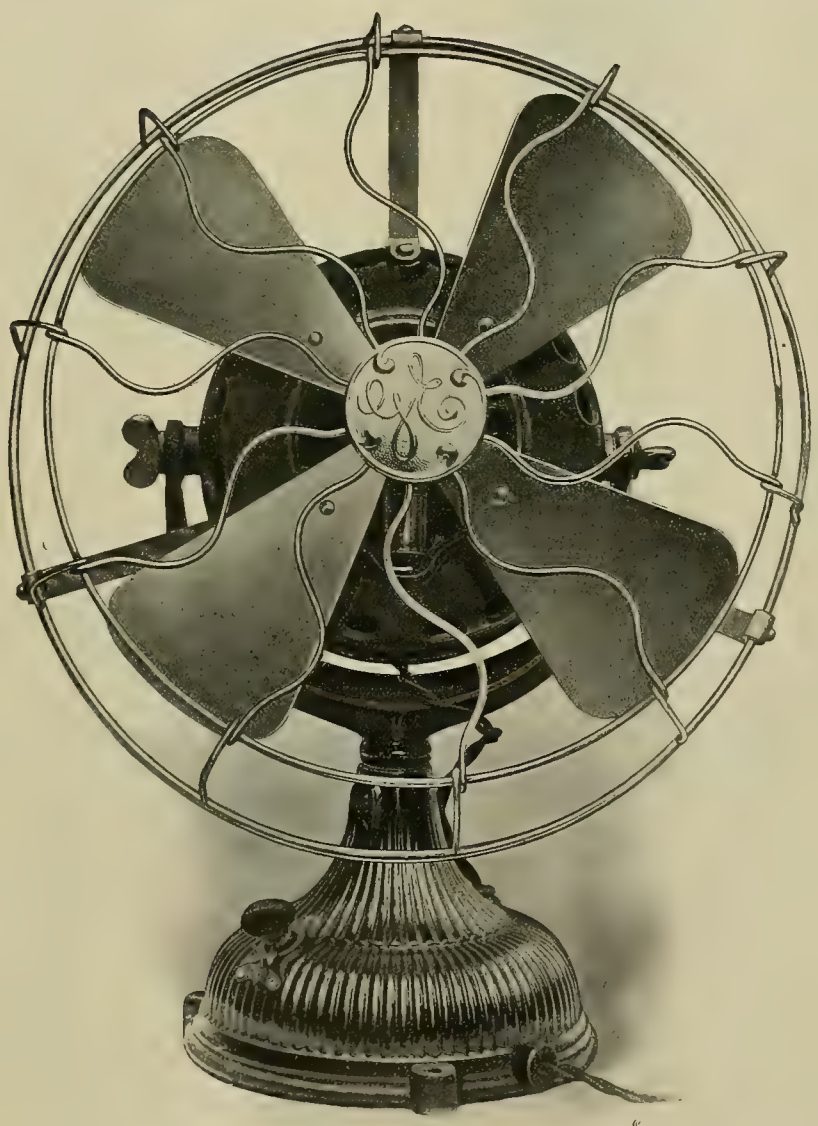
Electrical Supplies

264-266-268-270 Fifth Avenue - - Chicago

"GE"

And Other Reliable Makes of Alternating and Direct Current

Fan Motors for 1907



Electric Lighting Supplies Tantalum Lamps

Electric Cooking and Heating Utensils

Chicago Edison Co.
Commonwealth Electric Co.

General Offices, 139 Adams St., Chicago

VICTOR INSULATORS

A STOCK ARTICLE THAT MEANS US

No. S190 Floor Tube for 23,000 volts

If you have been looking for this, here it is. Solid porcelain, tested and ready for your order.

MR. BUYER,
MR. MANAGER:

We have decided to make our product right, whatever the cost to you. You try us when you think we are not looking or when you think we think you are not looking.

WE HAVE TRIED IT. IT PAYS.

NOTE---Please do not confuse or connect with this company Mr. Fred M. Locke or M. F. Locke.

PORCELAIN BUS-BAR INSULATOR

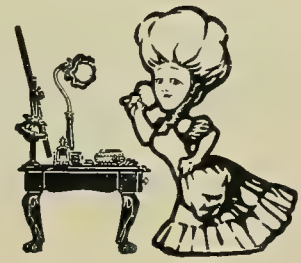
No. 269—Bus-bar insulator

This insulator is representative of a general line of insulators which have been in use for some time to provide strong, reliable support for wire, tube or flat-bar conductor supported vertically or horizontally.

This insulator can be supported on our pins Nos. 2, 4, 8, 20, 34 or 200, and will be found entirely ample for 12,000 volts. The cap is made of cast-iron cemented in place upon the insulator. The two studs are not attached directly to the cast part, but are threaded into a short steel bar which is attached centrally to the iron cap and by swiveling may be adjusted to any size bus-bar up to 2½ inches high by 2½ inches wide. It is intended when once the bus-bar is in place that superfluous length of the studs be cut off.

Weight, each	6 lb.
Size, pinhole	1 inch
Code Word	Koppelriem

THE LOCKE INSULATOR MFG. CO.
VICTOR, N. Y.



When guarded by The Light Brigade
from the Edison System the home
will always be safe from darkness.

The New York Edison Company
55 Duane Street

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FOR ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
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OF THE

"Unit Accumulator"

Type for All Purposes

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SPECIAL TELEPHONE

BELL WORK, ETC.

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BATTERY CONNECTOR

A PERFECT CONTACT no matter how hard the JOLTS or VIBRATION

WON'T SHAKE LOOSE

STACKPOLE BATTERY CO.
Electros Ready ST. MARYS, PA.

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Are You Awake
to the fact that the FAN SEASON IS HERE?
It's time to have your fans equipped with the MODERN ATTACHMENT PLUGS "HUBBELL" of course.

21 Plugs for 21 Purposes
ONE CAP FITS THEM ALL
We have a sample plug for you. Send for it!

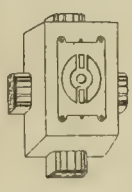
HARVEY HUBBELL, Inc., Main Office and Factory, BRIDGEPORT, CT.

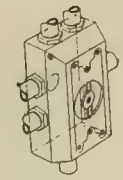
D & W FUSE COMPANY

PROVIDENCE, R. I.

ENCLOSED FUSES AND CUT-OUTS

DELTABESTON MAGNET WIRE





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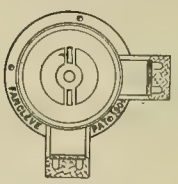
Specialties



Members of the National Electric Light Association and friends attending the convention at Washington are cordially invited to *DROP IN* and examine the line.

JOHN L. GLEASON, Patentee and Manufacturer
JAMAICA PLAIN, - - MASS.

DROP IN

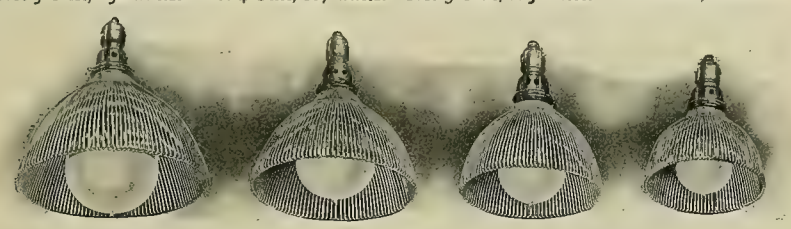
General Electric Company

GEM UNITS

Most inexpensive general small lighting unit devised or obtainable, keeping down central-station investment costs.

The Form B Holophane Group

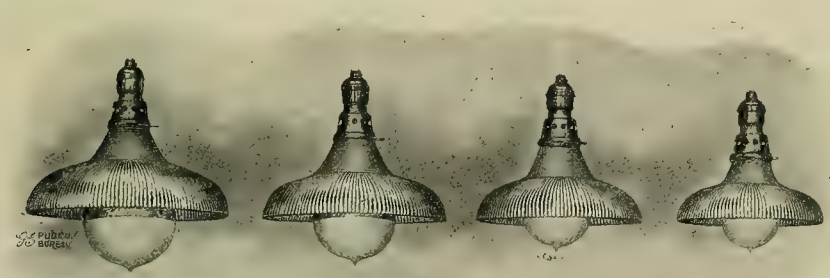
No. 5 Unit, 250 watts. No. 4 Unit, 187 watts. No. 3 Unit, 125 watts. No. 2 Unit, 100 watts.



Form B Units furnish higher values and a wider area of uniform light distribution beneath the lamp than any other form of reflector or electric lamp available for uniform lighting.

The Form C Holophane Group

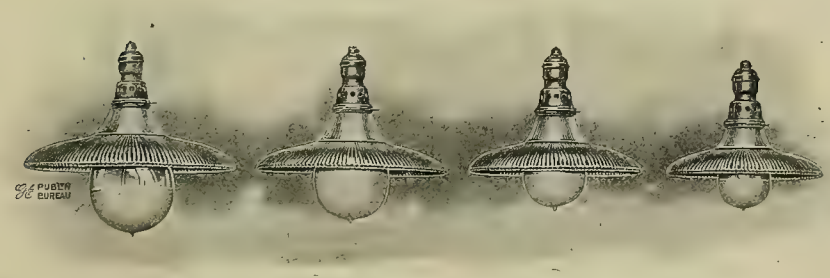
No. 5 Unit, 250 watts. No. 4 Unit, 187 watts. No. 3 Unit, 125 watts. No. 2 Unit, 100 watts.



Form C Units concentrate illumination uniformly in a restricted area and are well suited to rooms with high ceilings wherever concentration of light is desired.

The Form D Holophane Group

No. 5 Unit, 250 watts. No. 4 Unit, 187 watts. No. 3 Unit, 125 watts. No. 2 Unit, 100 watts.



Form D Units are perfectly adapted for general interior illumination, giving a practically uniform illumination over an area equal in diameter to the height of the lamp above it.

These units are business builders giving maximum returns to central stations with maximum satisfaction to customers

1321

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ECK DYNAMO & MOTOR COMPANY
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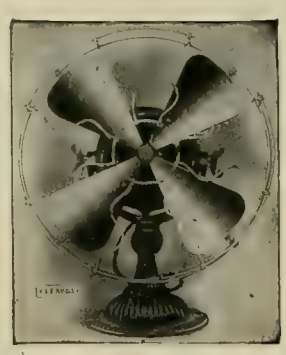
Wesco Fan Motors



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Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
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Measure low and high voltages, besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.
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Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.

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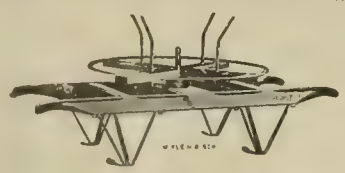
OUR CATALOGUE SHOULD BE ON THE FILES OF EVERY SUPERINTENDENT.



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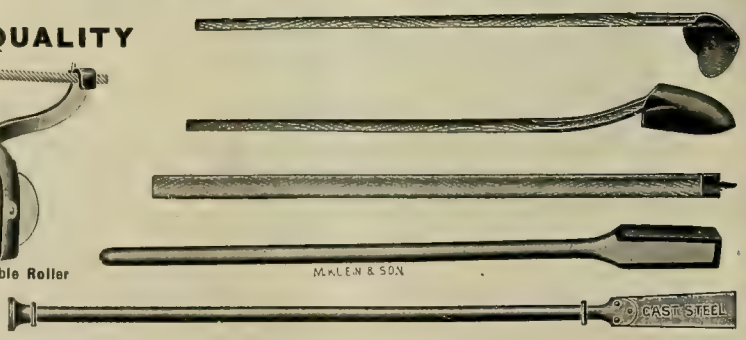
"Matlock" Cable Roller



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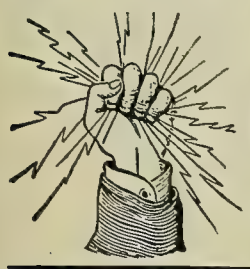
PROVIDENCE, R. I.



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FOR
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Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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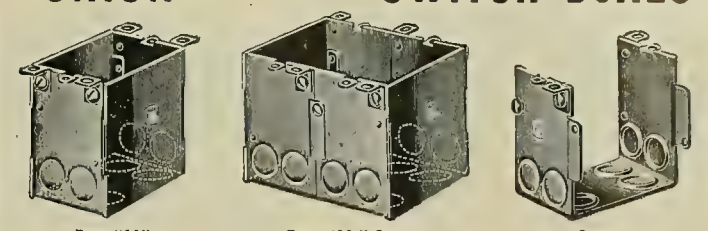

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Patented April 2d, 1907.

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WEIGH YOUR COAL AUTOMATICALLY BY AVERY SCALE

These eight "Avery" Automatic Machines are weighing coal to the boilers at the Power Station, Newcastle, England. Four more machines have since been installed here.

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As Supt. or general foreman, up to date on all kinds of construction, overhead and also interior, 16 years of practical experience mostly on central stations. Am married. Do not use liquor; best of references as to ability and character. Address Box 717, care Western Electrician, 507 Marquette Building, Chicago, Ill.

WANTED

Experienced motor salesman to travel for large manufacturer. Familiarity with central station motor and power practice essential. State age, experience and salary expected. Give references. Address Box 718, care Western Electrician, 510 Marquette Building, Chicago.

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One 200 to 300-K. W. 2080-volt, single-phase, 125-cycle direct-connected or direct-belted unit, complete with exciter and panel with instruments. The whole outfit must be in first-class condition. Give price f. o. b. cars. Address Rockland, Thomaston and Camden Street Railway, Rockland, Me.

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WANTED

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A CONCERN MANUFACTURING ELECTRICAL RAILWAY APPLIANCES AND SUPPLIES, WANTS SEVERAL TECHNICAL GRADUATES TO ENTER THEIR ENGINEERING DEPARTMENTS AND LEARN THE DETAILS OF THE WORK. WRITE, STATING AGE, EXPERIENCE, REFERENCE AND SALARY EXPECTED, TO BOX 724, CARE

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6399—250 K. W. General Electric generator, 60 cycles, mono-cyclic, 2,400 volt, 200 RPM, direct connected to Ames horizontal, compound engine, 15½ and 26x18.
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BELTED A. C. GENERATORS 60-Cycle, 3-Phase.

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1136—100 K. W. General Electric, 2,300 volts type A. T. B., class 8-100-900.
1448—70 K. W. Thomson-Houston, 2,200 volt, class A-70, 515 RPM.

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25-cycle, 60-cycle, 133-cycle, single-phase, 2-phase and 3-phase of various sizes and makes. Write for prices. Let us know your needs and we will quote you low prices.

Machinery For All Power Station Purposes.

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POWER PLANT AUXILIARIES BEST DRIVEN BY NORTHERN MOTORS

Pumps, Blowers, Conveyors, Fans, Crushers, etc., easily arranged for Northern Motor Drives. Motors readily applied to old belted machines as well as new.

CONVENIENT, ECONOMICAL, RELIABLE POWER

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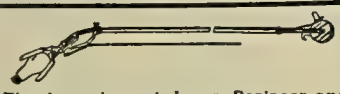

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"AMERICAN" STORAGE CELLS
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125-VOLT GENERATORS

Lights.		
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1	140	Edison, 8½ K. W.
2	150	Western Elec., M. P.
1	180	Amer. Eng. Co., M. P.
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1	210	Milwaukee, M. P.
1	210	Eddy, M. P., comp.
1	210	Westinghouse, M. P.
1	300	Jenney, self-oiler.
1	350	Amer. Eng. Co., M. P.
3	400	Westinghouse, M. P.
1	450	Quaker City, M. P.
3	540	Eddy, M. P., 30 K. W.
2	600	Card, M. P., comp.
1	650	Westinghouse, M. P.
1	1300	Western Elec., M. P.
2	1350	Gen. Elec., M. P., direct connected to Ames tandem comp.
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All machines actually in stock and fully guaranteed. Send for monthly Bargain Sheet with net prices.

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One 2½ K.W. 125 Volt Sprague direct connected to 4 H. P. Meitz & Weis Kerosene Engine (new).
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POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD: CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

THE COMMUTATOR COMPANY, Minneapolis, Minn.

Manufacturers of COLD DRAWN COMMUTATOR SEGMENTS.
We duplicate any segment made without cost of dies or special tools.
Electric light companies and repair men given special attention.

HIGH TENSION TROUBLES?

DRY AND IMPREGNATE BY VACUUM

LARGEST ELECTRICAL FACTORIES IN U. S. AND ABROAD NOW USE OUR—THE PASSBURG—SYSTEM.
INVESTIGATE—YOU MAY BE SURPRISED.

J. P. DEVINE CO., BUFFALO, N. Y.
428 BRISBANE BLDG.

TRANSFORMERS

KUHLMAN ELECTRIC CO., - - ELKHART, IND.

Crimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds**.

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York
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CHICAGO EDISON COMPANY REPAIR SHOPS

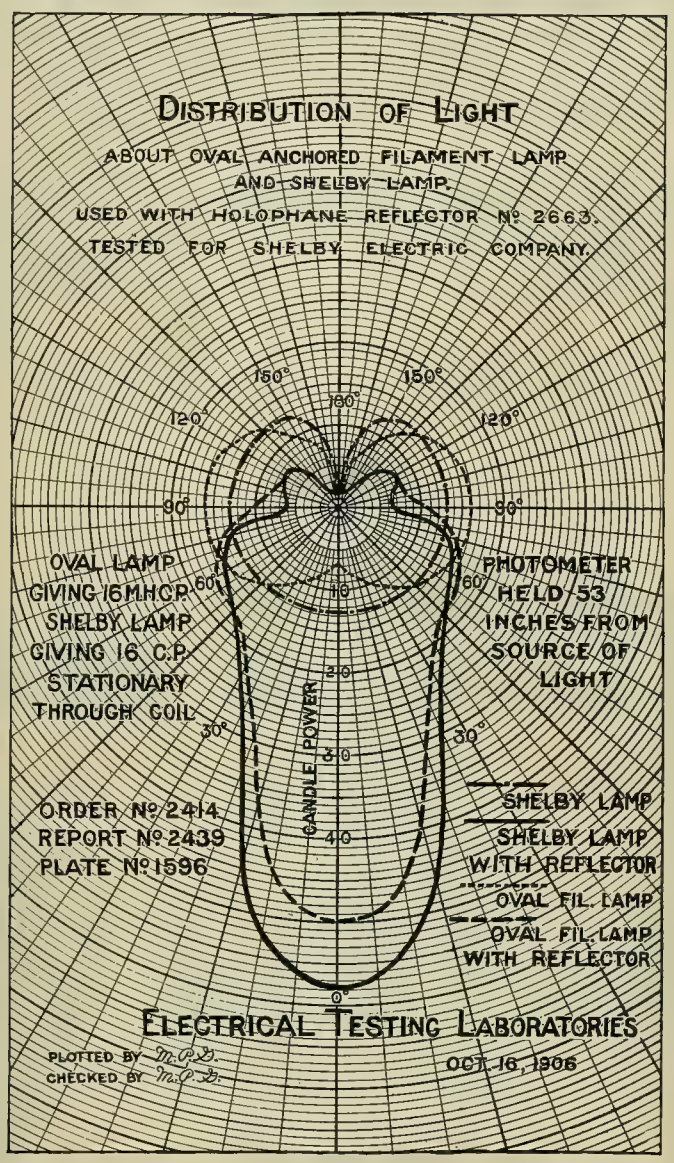
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

FIRST CLASS EQUIPMENT THROUGHOUT

High-Grade Machine Work of All Kinds. Correspondence Solicited.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

AN EXPLODED IDEA



The Above Test Proves that With or Without Reflectors

SHELBY USEFUL LIGHT LAMPS

DELIVER MORE LIGHT WHERE YOU WANT IT

BOTH LAMPS GIVE THE SAME SPHERICAL CANDLEPOWER

SHELBY TYPE, 59 CANDLEPOWER BELOW **OVAL TYPE, 50 CANDLEPOWER BELOW**

ALMOST 20 PER CENT. MORE USEFUL LIGHT. ***SEND US YOUR ORDERS***

THE SHELBY ELECTRIC CO. - - - Shelby, Ohio

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ATLANTA, BALTIMORE, BOSTON, CHICAGO, CINCINNATI, CLEVELAND, DETROIT, INDIANAPOLIS, LOUISVILLE, NEW YORK, OMAHA, PHILADELPHIA, PITTSBURG, PORTLAND, SAN FRANCISCO, ST. LOUIS, WASHINGTON, D. C.

AMERICAN CIRCULAR LOOM CO.
TRADE MARK REGISTERED

"CIRCULAR LOOM" AND "ELECTRODUCT"

American Circular Loom Co.

CHELSEA, MASS.

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SAN FRANCISCO—John R. Cole Co., 766 Folsom Street
CHICAGO—Thomas G. Grier, 128 W. Jackson Boulevard

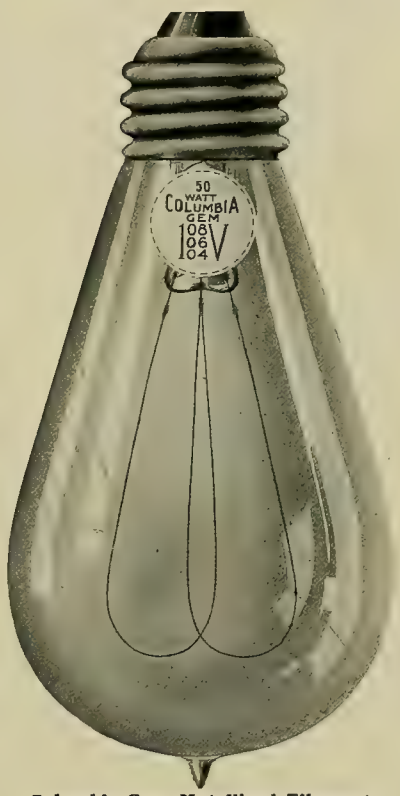
THE NATION'S CHOICE

COLUMBIA LAMPS GIVE MOST LIGHT

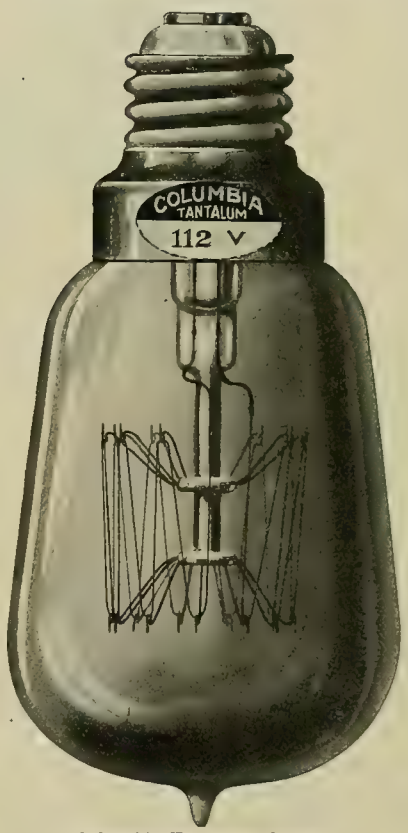
ESTABLISHED IN 1889

Three Columbia High Efficiency Units of Illumination

Regular Type of Columbia 90 to 130 V.
Note special style of filament giving maximum downward illumination.



Columbia Gem Metallized Filament
Consumes 50 watts at 20 cp. horizontally or 2½ watts per cp.



Columbia Tantalum Lamp

Horizontal cp.	22
Total watts	44
Watts per cp.	2

We are in position to take care of all orders for regular and special lamps, such as Candelabra and Miniature, Street Series, Turn Down, Gem High Candlepower Units and Gem Prismo (Meridian Type).

Special prices on future delivery orders, covering yearly requirements where in excess of 400 lamps.

Place a trial order during the Summer and make your tests in advance of Fall and Winter requirements. Correspondence solicited.

THE COLUMBIA INCANDESCENT LAMP COMPANY

LOOK FOR THE LICENSE LABEL IN THE STEM

MAIN OFFICE AND FACTORY
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CHICAGO: Central Electric Company MEMPHIS: 26 Randolph Building.
MEXICO: Sanford & Cia., Monterey.

LOOK FOR THE LICENSE LABEL IN THE STEM

WESTINGHOUSE LAMPS

THE NAME IS
YOUR
GUARANTEE

ALL TYPES
ALL CANDLES
ALL VOLTAGES

WESTINGHOUSE LAMP CO.

510 WEST 23d STREET, NEW YORK

Sales Offices:

Atlanta, Baltimore, Boston, Buffalo, Butte, Salt Lake City, Charlotte, Chicago, Cincinnati, Cleveland, Columbus, San Francisco, Dallas, Denver, Detroit, Joplin, Kansas City, Seattle, Los Angeles, Louisville, Milwaukee, Minneapolis, New Orleans, Syracuse, New York, Philadelphia, Pittsburg, Richmond, St. Louis

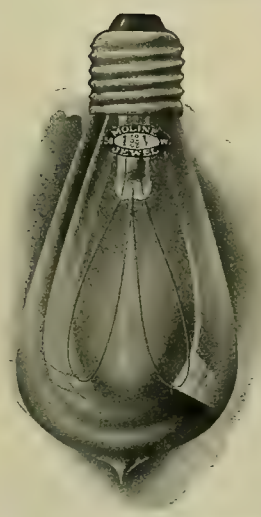
Factories:

512-534 West 23d Street, New York, N. Y.
and Bloomfield (Watsessing), New Jersey

LAMP ANNOUNCEMENT!

NEW "MOLINE JEWEL"

METALLIC FILAMENT LAMP



The "MOLINE JEWEL"
20 C. P. 50 WATT
(2½ Watts per C. P.)

Look for the "Guarantee Label" in the stem

WE hereby announce to the trade that we are now prepared to furnish in almost any reasonable quantity the ***METALLIC FILAMENT INCANDESCENT LAMPS*** in all standard voltages and candlepowers.

We call attention to the pertinent fact that our factory capacity is now being increased to 6,000 lamps per day. Consequently, it goes without saying that the MOLINE INCANDESCENT LAMP CO. is now ready also to furnish its usual sizes, voltages and candlepowers of STANDARD CARBON FILAMENT INCANDESCENT LAMPS. Candelabra lamps can likewise be furnished in any reasonable quantity, also the usual types of Meridian, frosted and colored standard incandescent lamps.

Write for "Interesting" Prices

MOLINE INCANDESCENT LAMP CO.

MAIN SALES OFFICE AND FACTORY:
MOLINE, ILL.

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358 Dearborn Street
GEO. H. ERICH, Mgr.

NEW ORLEANS, LA.
216 Bourbon St.
S. J. STEWART Mgr.

NEW YORK
136 Liberty Street
D. W. MOOR Mgr.

There Are Only Two Points

TO CONSIDER IN BUYING LAMPS

First Cost and Cost in Use

THIS MEANS

Guaranteed Rated Candle Power.

Low Current Consumption Per Candle Power and Long Life

Buy Right for First Cost

Or in Other Words, Buy Economy and Keep on Buying Economy

WITH THESE LAMPS ALL COSTS ARE LOW

QUALITY ONLY IS HIGH

The Economy Electric Co.
Warren, O.

When making up your lamp orders do not overlook the fact that PEERLESS LAMPS occupy a prominent position in the very center of the front row. We propose to maintain this position and we invite your inspection.

Warren Electric & Specialty Co., Warren, Ohio

COLONIAL LAMPS

Carried in Stock by All Leading Jobbers

Prompt Shipment and Quality Guaranteed

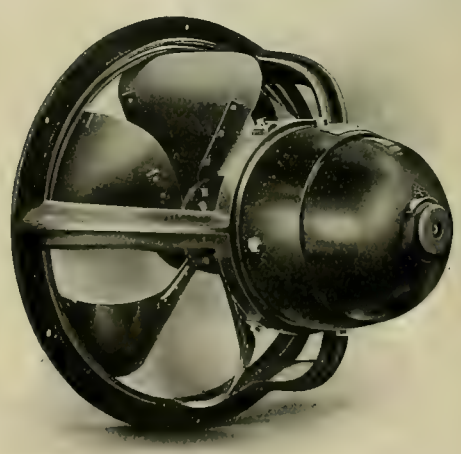
THE COLONIAL ELECTRIC CO.

WARREN, OHIO

PEERLESS MOTORS

FOR

DIRECT-CURRENT SERVICE



We give particular attention to adapting our STANDARD motors to special requirements.

PROMPT SHIPMENTS PERFECT MACHINES
and
SATISFIED CUSTOMERS
have
DOUBLED OUR OUTPUT DURING THE PAST YEAR

THE

PEERLESS ELECTRIC CO., Warren, Ohio

A Complete Line of Incandescent Lamps for the Central Station

See Exhibit Space 2

STANDARD "FEMCO"
2 to 150 candlepower
20 to 250 volts
Supplied in Straight Side, Round, Tubular and Reflector

Street Series Lamps

"NOVI" TYPE
8 to 50 cp. 80 to 250 volts
3.1, 3.6 and 4 watts per candlepower

FRANKLIN TANTALUM
2 watts per candlepower
25 and 50 candlepower
100 to 130 volts

FRANKLIN "GEM"
90 to 130 volts
Meridian Gem and High Efficiency Units

Miniature Lamps

We Solicit Correspondence with Lighting Companies Having Rigid Specifications

The Franklin Electric Manufacturing Co.

General Office: HARTFORD, CONN.

Factories: HARTFORD and MIDDLETOWN, CONN.

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Pacific Coast Representatives

SAN FRANCISCO
Holabird-Reynolds & Sayles Co.

LOS ANGELES
Holabird-Reynolds Elec. Co.

Good Store—Good Light

PARDRIDGE & BLACKWELL'S NEW STORE

DETROIT, MICH.

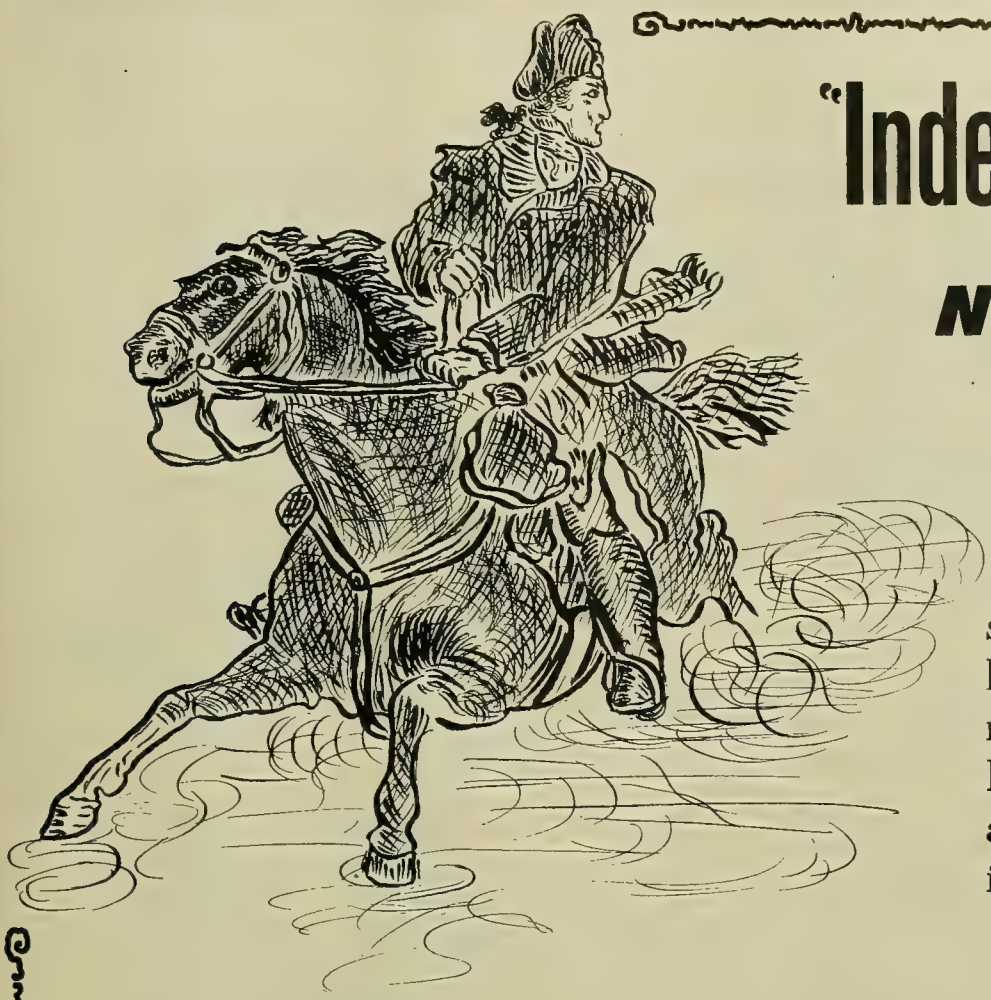
7 Floors—100 x 220 feet—1900 Nernst Glowers installed

Appreciating the business-bringing importance of perfect illumination, Messrs. Pardridge & Blackwell chose NERNST LAMPS to light their handsomely equipped new store in Detroit.

A thorough investigation always results in the choice of the Nernst system on account of its daylight color value, superior distribution, high efficiency and low current consumption.

NERNST LAMP COMPANY, Pittsburg, Pa.

New York	Boston	Baltimore	Philadelphia	Atlanta
Cleveland	Detroit	Saginaw	Columbus	Cincinnati
Nashville	Chicago	Peoria	St. Louis	Denver
Omaha	Ft. Worth	San Francisco	Seattle	Fargo



"Independence Now and Forever"

We emulate "the spirit of '76!" You know what that means! Like Paul Revere, we would awaken you to independence.

We operate two large and well-equipped factories, that are independent in every sense of the word.

WANTED—for our St. Marys refilled factory—ONE MILLION BURNED-OUT STANDARD LAMPS suitable for renewing.

IMPORTANT—Henceforth "ELK ENERGY" will be our trade axiom. You'll find "ELK ENERGY" in our factory, in our salesmen and in the lamp itself, which means long life, honest rating, and all-around efficiency.

"ELK" new lamps are guaranteed to be as good as any lamp made—bar none.

"EXCEL" renewed lamps are also worthy of your consideration.

Dealers, consumers and central stations should get our proposition. All lamps are guaranteed in every way.

ELK

The ONLY Independent Pennsylvania Lamp Company

XL CP V

Novelty Incandescent Lamp Co.

Main Office: EMPORIUM, PENNSYLVANIA

W. E.
"UNIVERSAL"
FAN AS
"BRACKET TYPE"

KEEP COOL THIS SUMMER

HAVE YOU ever seen the "Hawthorne Universal" Two-in-One fan-motor? The reason we call it Two-in-One is this. See that lever at the side? Twist it around—turn motor at right angles with base and you have a bracket type. It's a desk and bracket type combined, the latest development in fan-motors.

YOU WANT a fan-motor that's going to last, that will operate without much attention, that's neatly designed and doesn't accumulate dirt. The "Hawthorne Universal" runs noiselessly, has three speeds, and has especially constructed fan blades, which have just the right pitch, giving maximum efficiency, and effecting a great saving of current.

We can make immediate shipments and the time to buy is now—early. Send for our new 1907 Catalog No. 4007-F today.

WESTERN ELECTRIC COMPANY

CHICAGO

Chicago	Saint Louis	Cincinnati	Pittsburg
New York	Saint Paul	Denver	Los Angeles
Philadelphia	San Francisco	Kansas City	Seattle

W. E.
"UNIVERSAL"
FAN AS
"DESK TYPE"

METER TALK

No. 15

AFRICA is the most ancient and the most recent conquest of the human race; and David Livingstone did more than any other explorer of modern times in the way of bringing it to the notice of the world, and placing it within the sphere of advancing civilization.

This great man—after spending the best part of his life in traveling over 20,000 miles of jungle, stream and lake—prophesied "that the next generation would see much of this dark continent brought into touch with the rest of the world;" and as proof of the fulfillment of this prophecy, there are, today, numerous prospering towns, each having its electric lighting plant with Duncan meters accurately measuring the energy delivered to its patrons.

Send for Bulletin, Testing Chart, and Discounts.

Duncan Electric Mfg. Co.

LAFAYETTE, INDIANA

HOW OFTEN DO YOU

HAVE A FASTENING TO MAKE TO BRICK, STONE, TILE OR CONCRETING?

STAR SCREW ANCHORS

STAR EXPANSION BOLTS

SAVE TIME, LABOR and EXPENSE AND MAKE A FASTENING THAT HOLDS. Write for Catalog and Samples.

STAR EXPANSION BOLT CO.

Factory and Gen'l Offices: BAYONNE, N. J.

SALES OFFICES 142 Lake St., Chicago 147 Cedar St., New York

USE

Kearney Cable Clamps

For turning corners with 000 to 1,500,000 C. M. Cables

They make stronger corners and save cable, time, labor and money. They do away with splicing and tapping at corners and dead ends.

W. N. MATTHEWS & BRO.
203 N. 2nd St. ST. LOUIS

WEIGHS 4 POUNDS
MADE IN ONLY ONE SIZE

SPEER HIGH-GRADE CARBON BRUSHES

SPEER CARBON CO.
ST. MARYS, PA.

Electric Signs and Letters

Send for special circular of stock signs ready for shipment. Our construction is approved by the National Board of Fire Underwriters

HALLER MACHINE CO., 321 S. Clinton Street, CHICAGO

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on Electrical Subjects, and think Electrical Thoughts. We have the books. Send for a catalogue.

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WESTERN ELECTRICIAN

BINDERS $1.00 EACH.

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Remember those two words, remember to write them in your order, and you can forget your belting troubles. Shultz Sable is a

RAWHIDE BELTING, SURFACE TANNED

by a process that is exclusively ours. The surface tanning produces a kid-like surface that clings and pulls where oak-tanned leather belting slips and burns; and the long, unbroken, unseparated rawhide fibers underneath insure the long life that makes Shultz Sable the cheapest belting you can buy, measured by length and efficiency of service.

To prove that it has 33 per cent. more pulling power than any oak-tanned belt, we will send you a Shultz Sable Rawhide Belt

ON SIXTY DAYS' TRIAL

with the distinct understanding that if it disappoints you in any way, it is not to cost you a cent.

Send NOW for the Sable Booklet, and remember, in buying, that Sable Belting is BLACK.

SEND FOR BOOKLET No. 40.

SHULTZ BELTING CO.

ST. LOUIS, MO.

NEW YORK, 111 Chambers St. BOSTON, 114 High St.
PHILADELPHIA, 116 N. Third St.

Holophane Arc Cluster

The Cluster that is recommended by the best posted men in the field of illumination.

Write for prices, discounts and full particulars to

(Patent applied for)

The Cluster that is made for GEM, STANDARD and TANTALUM LAMPS

THE HOLOPHANE COMPANY (Sales Dept.), 227 Fulton Street NEW YORK CITY

LIGHTING FIXTURES, UP-TO-DATE CATALOGS

EXPRESS PREPAID TO DEALERS

CATALOG No. 15 contains ELECTRIC FIXTURES only. CATALOG No. 14 contains COMBINATION and GAS FIXTURES. CATALOG No. 13 illustrates GAS FIXTURES only CATALOG No. 12 is a small book containing ELECTRIC, COMBINATION and GAS FIXTURES carried in stock for IMMEDIATE SHIPMENT.

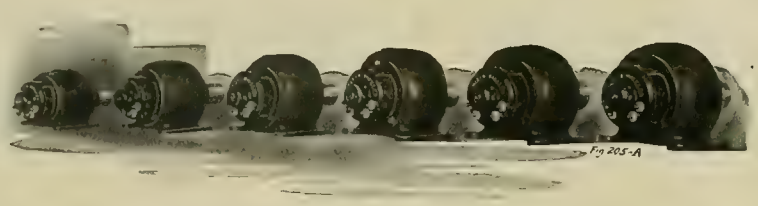
ALL ABOVE CATALOGS 1907 ISSUE.

Get our Catalogs and they will get the business for you.

BEARDSLEE CHANDELIER MFG. CO.

176, 178, 180 So. Clinton Street, CHICAGO

It Is Perfectly Safe to Recommend C-W Motors



The Celebrated Form L Motor, 1-10 to 5 H. P.

The Central Station Manager who recommends C-W motors can rest easy.

It is hard even for a novice to put a C-W motor out of business.

C-W motors have a pleasing habit of doing more than is expected of them. Some of the reasons for this are given in Bulletin 64T.

C-W generators are described in Bulletin 74T and 80T.

CROCKER-WHEELER
COMPANY

ALTERNATING AND DIRECT CURRENT MACHINERY

AMPERE, N. J.

CHICAGO OFFICE - - - - - OLD COLONY BLDG.

EDISON
PRIMARY BATTERIES

IT makes no difference whether you wish a current for running an electric fan or operating railroad signals, the current must be heavy enough for the work and obtainable whenever desired.

You can get in Edison Primary Batteries just the type you need for your purpose, whatever it is, and when you get an Edison you are sure of your current. There is no waste through local action, no lessening of the voltage as the elements are used, and when the cells are exhausted renewals are to be had at a very small cost.

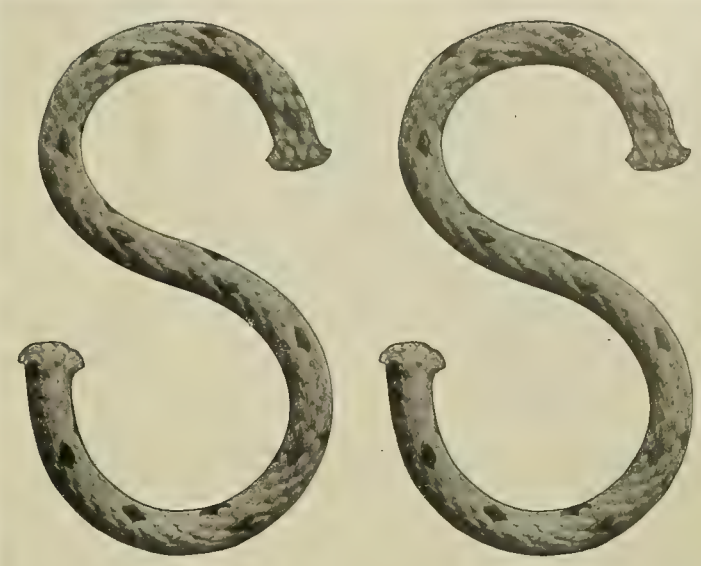
The important thing is reliability; the next important thing is cost. The Edison Batteries are the cheapest and most dependable form of electrical energy.

We send free a booklet "Battery Sparks," which will prove of interest.

Edison Manufacturing Company

31 Union Square, New York 304 Wabash Avenue, Chicago

25 Clerkenwell Road, London, E. C.



SAMSON SPOT CORD

WATERPROOFED FOR

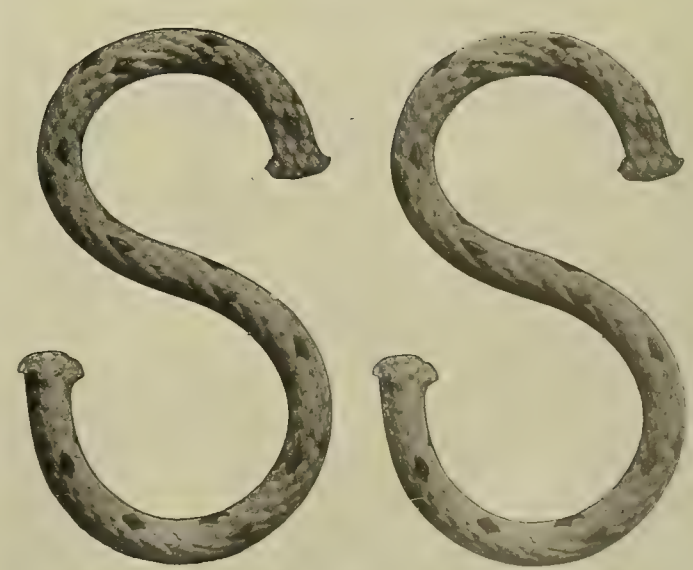
ARC LAMP and TROLLEY CORD

Has no rough or soft places to wear by abrasion. Hard and smooth, thoroughly waterproofed. The colored spot is our trademark used only in this extra quality cord.

SOLD BY ALL DEALERS

SAMSON CORDAGE WORKS

BOSTON, MASS.



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WHY IT'S SUPERIOR

Sleeve splicing or wiped joints unnecessary.
Absolutely moisture proof.
Made of pressed steel, heavily galvanized. Very light and easy to handle.
Has a sliding galvanized sheet metal cover which furnishes added protection.
Equipped with self-soldering nozzle—expert cable splicer unnecessary.
Can be installed and terminal added at any future time.
Can be furnished separately or combined with terminal.
Write today for further information and prices.

Frank B. Cook. 235 W. Lake St. CHICAGO

Reduced Telephone Rates

IN CHICAGO

If the franchise of Chicago Telephone Company in the City of Chicago is extended, the following rates have been proposed for the Chicago Exchange.

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50 calls per month : :	$5.00
Next additional 50 calls in the month	5 cents each
Third 50 calls in the month : :	4 cents each
All calls in the month beyond 150 :	3 cents each

RESIDENCE RATES WITH UNLIMITED SERVICE:

Single line : : : :	$75.00 per annum
Two-party line : : :	60.00 per annum

NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
Extension telephones : : : $1.00 per month

CHICAGO TELEPHONE COMPANY,
203 Washington Street, Chicago.

No. 148

TELEPHONE SYSTEMS

FOR
OFFICES
FACTORIES
HOTELS
AND
COMPLETE EXCHANGES

Send for Bulletin 13 W.

American Electric Telephone Company
6560 State St., - Chicago, Ill.

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THE TELEPHONE

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352 pages.
Cloth, Price $1.00.

An up-to-date, practical treatise on the construction, theory, installation, care and management of telephones and their appliances.
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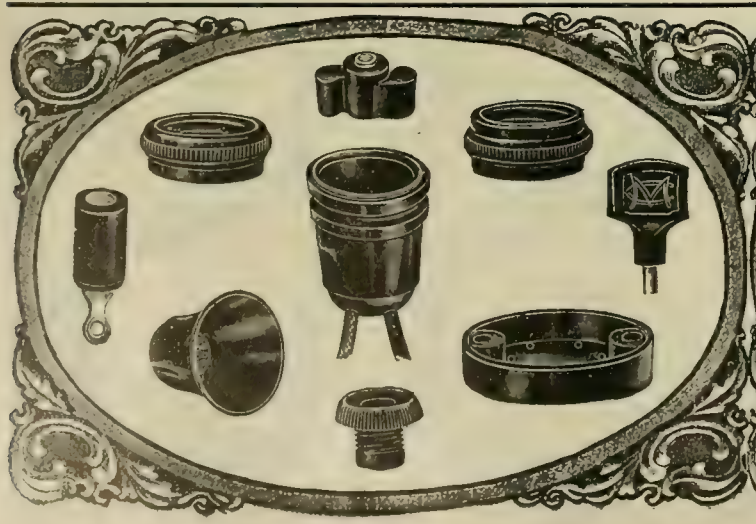
DO NOT fry, sizzle, pack or go dead. Talk loud, clear and distinct.

We manufacture complete telephone exchange equipments of the highest grade. Correspondence solicited.

INTERNATIONAL TELEPHONE MFG. CO.
Harrison and Clinton Streets CHICAGO



YES!

IF IT'S MADE OF
NON-CONDUCTING COMPOSITION
WE CAN SUPPLY IT.

Bushings, Rings, Collars, Coil Plugs, Battery Covers, Switch Boxes, Switch Keys, Socket Keys, Handles and Mouthpieces, Receiver Shells, and all other Composition Devices.
Special Heat-Resisting Stock for Automobile Parts.
Stock for Storage Batteries Guaranteed Absolutely Acid-Proof.

WRITE FOR PRICES

Dickinson Mfg. Co.
SPRINGFIELD, MASS.

"It might interest you

to know that the total maintenance expense of parts for our entire plant of 3,000 switches for the past eighteen months has been $10.24." writes Supt. J. A. Duncan of the Sioux City Telephone Company, Sioux City, Iowa. (This company operates our AUTOMATIC TELEPHONE SYSTEM.)

"A like sum

would perhaps take care of the repair cost on operators' chairs in a manual exchange of the same size," adds Mr. Duncan. (We'll be glad to send you a copy of his letter if you'd like to see it.)

It occurs to us

that the one item of switchboard cords alone for a manual exchange of 3,000 lines would amount to at least $150 in eighteen months. That is fifteen times the cost of all repair parts on the Sioux City automatic exchange.

That is only one

of the many economies of the AUTOMATIC SYSTEM. These economies all help to swell the profits. And the AUTOMATIC, being the best service, commands the highest rates. Low production cost plus high selling price equals big dividends. That is what led to the adoption of the AUTOMATIC TELEPHONE SYSTEM in the following cities:

Aberdeen, S. D.
Akron, Ohio.
Allentown, Pa.
Auburn, Me.
Auburn, N. Y.
Battle Creek, Mich.
Beaver Falls, Pa.
Bellingham, Wash.
Butte, Mont.
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Champaign, Ill.
Chicago, Ill.
Cleburne, Texas.
Columbus, Ga.
Columbus, Ohio.
Dayton, Ohio.
Denver, Colo.
El Paso, Texas.
Emaus, Pa.
Fall River, Mass.
Grand Rapids, Mich.
Hastings, Neb.
Havana, Cuba.
Hazleton, Pa.
Holland, Mich.
Hopkinsville, Ky.
Jonesboro, Ark.
Lake Benton, Minn.
Lewiston, Me.
Lincoln, Neb.
Los Angeles, Cal.
Manchester, Iowa.
Marianao, Cuba.
Marion, Ind.
Medford, Wis.
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Mt. Olive, Ill.
New Bedford, Mass.
Oakland, Cal.
Ocean Park, Cal.
Omaha, Neb.
Pentwater, Mich.
Portland, Me.
Portland, Ore.
Princeton, N. J.
Richmond, Ind.
Riverside, Cal.
Rochester, Pa.
Rushville, Ind.
San Diego, Cal.
San Francisco, Cal.
Santa Monica, Cal.
Saskatoon, Sask., Can.
Sioux City, Iowa.
South Bend, Ind.
Spokane, Wash.
Springfield, Mo.
St. Marys, Ohio.
Tacoma, Wash.
Toronto Junction, Can.
Traverse City, Mich.
Urbana, Ill.
Van Wert, Ohio.
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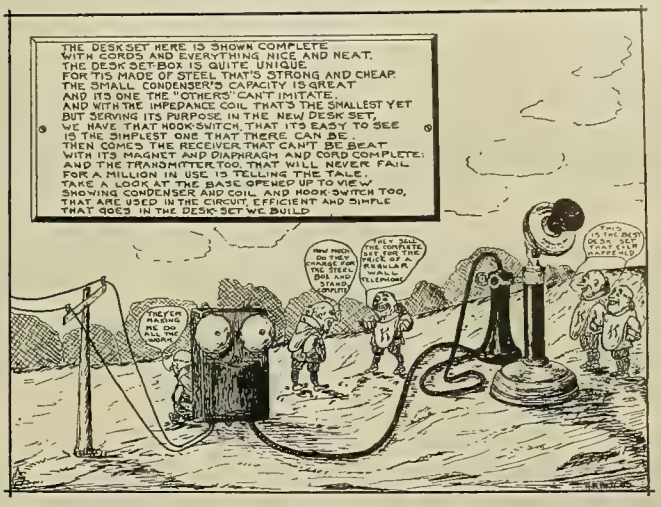
Woodstock, N. B., Can.

AUTOMATIC ELECTRIC CO.
Van Buren and Morgan Streets, CHICAGO, U. S. A.



THE KELLOGG DESK TELEPHONES

are so well designed and constructed that they reduce the cost of maintenance to a minimum. They are as cheap as wall telephones and of such a high grade that oftentimes they alone bring new subscribers for an exchange.

The fine finish is lasting.

There are no sharp corners to tarnish nor crevices to collect dirt and dust.

The simplicity and efficiency of the desk set as a whole and of every part cannot be equaled by any other make.

Write our Department **F** for bulletins and prices on magnets and common battery apparatus.

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Our own experience and the testimony coming to us daily from our customers gives us confidence that we are making a telephone, which, in talking and ringing qualities, is superior to anything that has been upon the market. The instrument under your own installation will tell the story.

May we send you one or more upon trial?

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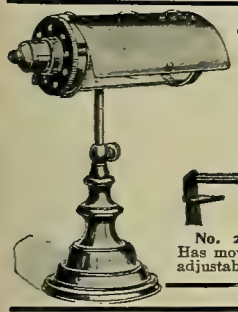

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No. 2A. Kinsman Roll-top Desk Lamp. Has movable eye shade, inner glass cylinder, adjustable arm, etc.

The "KINSMAN & WARD"
Desk Lamps and Portables

Have many advantages over any desk light, shade or reflector in the market.

Send for booklet illustrating other styles, also for prices.

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Clamps on Desk Without Marring it.

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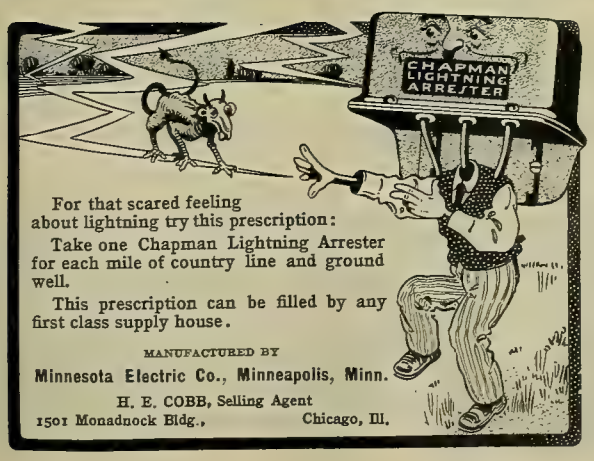

For that scared feeling about lightning try this prescription:

Take one Chapman Lightning Arrester for each mile of country line and ground well.

This prescription can be filled by any first class supply house.

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ACME WIRE CO., NEW HAVEN, CONN.
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We **Produce** and **Wholesale** the Best Cedar Poles that Money and Experience can Furnish. Our Assortment is yet Complete—Everything at Competitive Prices. "We can deliver the goods." Try us with your next order. We never neglect an old customer or lose an opportunity to secure a new one. Your inquiries solicited.

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Poles and Piling.
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Ship in Barge Lots.
30,000 Cypress Poles and Piling, all lengths and sizes. Prompt Shipment and First Class Material Guaranteed.
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MICHIGAN WHITE CEDAR BEST TO LAST. 40,000 Poles in stock. 100,000-150,000 after April 1st. **POLES AND TIES**
We have been in the Cedar Pole and Tie business 25 years. 50,000 Trolley Ties at Bay City yard.
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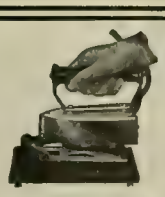
CEDAR POLES, POSTS, TIES
H. M. LOUD'S SONS CO., Au Sable, Mich.
Please Address Cedar Department.

ELECTRIC HEATING APPARATUS
By the Simplex Enamel Method of construction the resistance is imbedded in an insulating coat of enamel burned on to the heater itself, and so arranged as to insure an absolutely uniform temperature.



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Chicago Office: MONADNOCK BLOCK CAMBRIDGE, MASS.

Idaho Cedar Poles
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Experts. Consulting Engineers.
1504 Monadnock, Chicago

YOU DON'T KNOW
how many customers you fail to get by not having your name in this Directory.

A LITTLE CARD
in this Directory may bring a big customer.

RUEBEL & WELLS,
CONSULTING, MECHANICAL AND ELECTRICAL ENGINEERS,
Suite 301 Chemical Building,
ST. LOUIS, U. S. A.

IF ONLY ONE
person or firm or corporation should look in this Directory for your address and fail to find it, you might fail to make a lump of money.

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SUITE 1505 CHEMICAL BLDG., ST. LOUIS.

TRY IT. Keep your name and address in this directory where it will be seen by possible clients.

Long Distance Phone Central 2448
SCHOTT, W. H.
ENGINEER AND CONTRACTOR.
SPECIALTIES—Central Station Heating Plants, Water Works Steam Plants, Electric Light, Gas and Street Railway Plants.
1100-1128 American Trust Bldg., - CHICAGO

D. C. & WM. B. JACKSON,
MEMBERS
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MICHIGAN COLLEGE OF MINES
F. W. McNair, President
Located in the Lake Superior district. Mines and mills accessible for practice. For Year Book and Record of Graduates apply to President or Secretary, Houghton, Michigan.

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WESTERN ELECTRICIAN.
Immediate Returns.

Engineering MECHANICAL, ELECTRICAL, STEAM, CIVIL.
Complete and short courses. Thoroughly equipped engineering shops. Shop work from the beginning. Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA

POLES·TIES·POSTS· THE PORTER CEDAR CO. SAGINAW, MICH.
PRODUCERS WE WANT YOUR INQUIRIES ALWAYS

Cedar TORREY CEDAR CO., CLINTONVILLE, WIS. Poles
Large Stock Constantly on Hand

MICHIGAN and IDAHO CEDAR POLES
Best selected stock, all sizes; prompt shipments. Pine or Washington Fir Cross Arms, all sizes. Brackets and Locust and Oak Pins; High Voltage Pins a specialty. Write to
TOLEDO, OHIO — THE F. BISSELL COMPANY
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CEDAR
TELEPHONE AND TELEGRAPH
POLES

ESCANABA, MICH. KELLIHER, MINN. WHITNEY, MICH. NEWHALL, MICH. ITASCA, WISC. BRAINERD, MINN.

L'ANSE, MICH.

Look around and you will see where our yards are located, and will be convinced of our ability to fill all orders promptly. Our prices are right and poles carefully inspected. A trial order will convince. Write us, we are always pleased to quote prices.

NATIONAL POLE CO.
SUCCESSOR TO CEDAR DEPARTMENT
PITTSBURG & LAKE SUPERIOR IRON CO., - ESCANABA, MICH.

BLACKDUCK, MINN.

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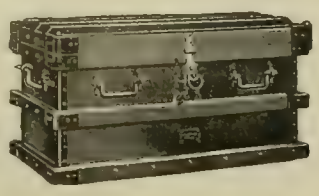
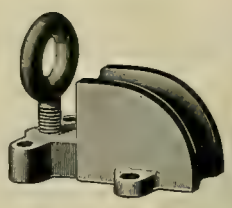
The BEST TOOL CHEST on the MARKET

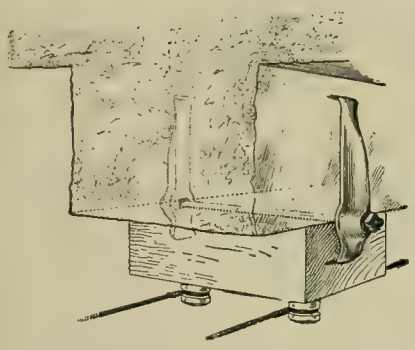


Made of American Sheet Steel, Connecticut Oak and **Vandermans'** Patented Construction. Freight allowed on chests east of the Mississippi River. *Write us today on postal card* for our new catalogue of Tool Chests, Pipe Bending Forms, Vises, Joint Runners and other specialties. Our goods are for sale by all dealers and jobbers in the United States and Canada.



The Vanderman Plumbing & Heating Co., Willimantic, Conn.

The Security Concrete Clamp

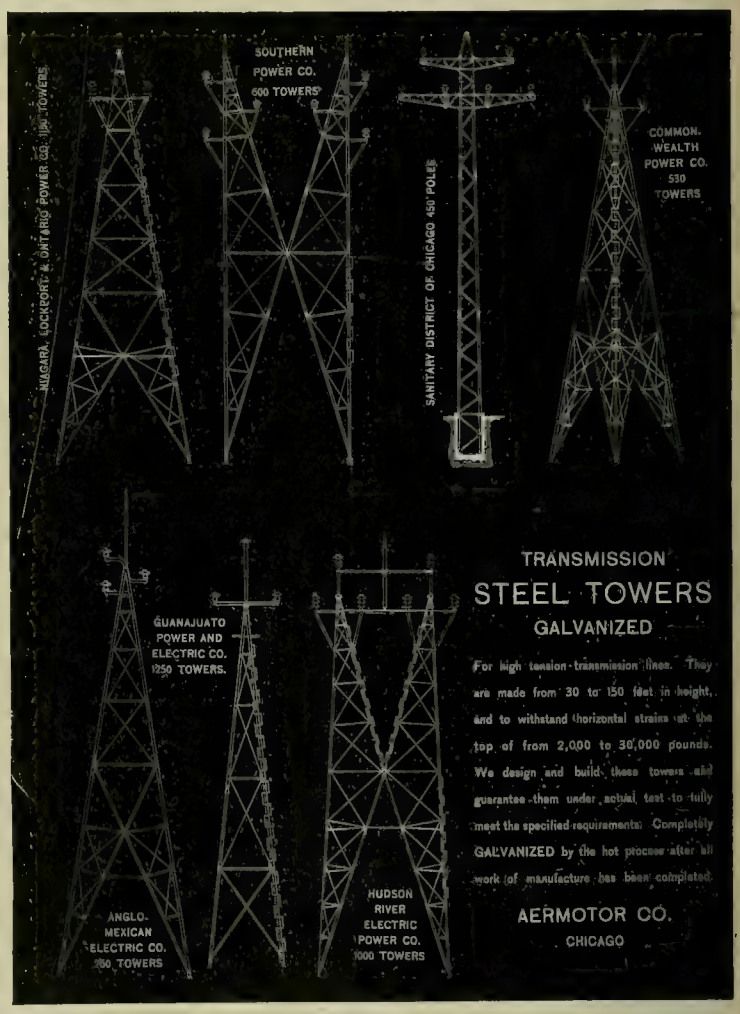


For supporting insulators in concrete buildings, etc. A very necessary device. The security is very strong—it is security itself—it cannot become loosened—cannot slip or break and will practically outlive even the wires themselves. You should write us for further information and prices. Mention the "Security Book."

TOLEDO, OHIO · THE F. BISSELL COMPANY

THE F. BISSELL COMPANY. TOLEDO, O.,
226-230 HURON ST.

You will confer a favor upon the advertiser by telling him--when you write him--that you saw his ad. in the Western Electrician.



THE BABCOCK & WILCOX CO., 85 LIBERTY ST., N. Y.

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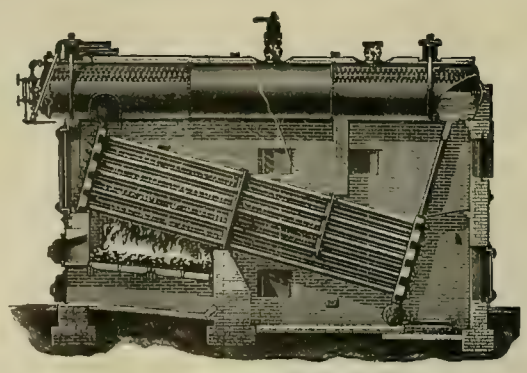
CLEVELAND, 706 NEW ENGLAND BLDG.
MEXICO CITY, 7 AVENIDA JUAREZ.
HAVANA, CUBA, 116 1-2 CALLE DE LA HABANA



200 Pounds Working Pressure

WATER TUBE STEAM BOILERS

STEAM SUPERHEATERS

Our Book, STEAM, mailed free on application.

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TUBULAR FEED WATER HEATER OIL SEPARATOR AND PURIFIER

WITH SEAMLESS BRASS TUBES

is the only heater that has a **cool settling chamber** and is **guaranteed** not to get foul with scale, and that **will continue to heat as hot after years of constant use** as when new. This is the **only** feed water heater that has an oil separator that is **at all times surrounded by the cool feed water when it first enters the heater**, and is **guaranteed to extract more oil from exhaust steam** than can be extracted by any other device in the market. This heater is **guaranteed to give perfect satisfaction** or the manufacturers will **pay all cost** of placing and removing, also freight both ways.

FOR PRICES AND DISCOUNTS WRITE

THE STEWART HEATER CO.

25 Norfolk Avenue
BUFFALO, N. Y.

Electric Emery Grinders

as manufactured by

STOW MFG. CO.

BINGHAMTON, N. Y.

General European Agents

Selig, Sonnenthal & Co.

85 Queen Victoria St., London, England

Portable Electric Grinders

We build these in four sizes:

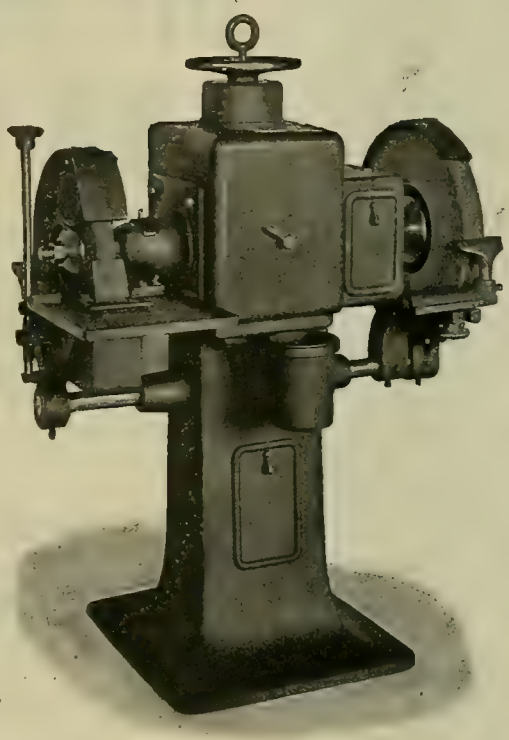
No. 4—¾ H. P. Motor
Emery Wheel capacity 6x1¼ in.

No. 5—1½ H. P. Motor
Emery Wheel capacity 8x1¼ in.

No. 6—2 H. P. Motor
Emery Wheel capacity 10x1½ in.

No. 8—3 H. P. Motor
Emery Wheel capacity 12x2 in.

For 110 or 220 volts they are furnished as shown in cut. For 500 volts with wood truck for better insulation. This latter is extensively used by street railways for grinding rails in bonding.



The

Stow Multi-Speed Motor

is used in these machines.

RESULT:

Wide Range of Speed
Infinite Variation in Speed

A fraction of a turn of the regulating wheel on top of motor will make a corresponding change in speed of emery wheel

Mechanical Regulation of Speed

No rheostats or controllers to fill up with dust and burn out.

Stationary Electric Grinders

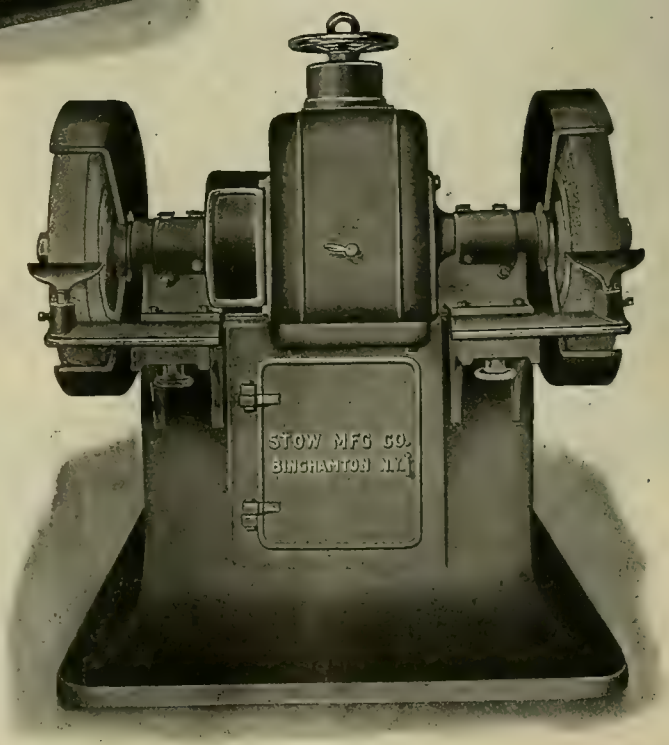
Perhaps **Semi-Portable** would be a better name for this machine, because by loosening a few bolts it can be readily changed from place to place without regard to counter shafts or line shafts.

We build these machines in two sizes, the smaller taking two dry wheels, 2x18-inch or one 12-inch wet wheel and one 2x18-inch dry wheel.

The larger tool will carry two 3x24-in. wheels.

We build these machines for direct current only.

WRITE US FOR DETAILS AND PRICES



1877 ★ PERFECTION ★ 1907

Did you ever stop to consider your loss in exhaust steam? We will show you how to turn every thermal unit of it into money. Thirty years of experience enables us to claim our **Underground Steam Heating System** the most perfect underground system in existence. Write us today. Procrastination in this case is your own loss. Let us show you how to greatly increase your profits.

Cut out this coupon and mail it to us at once:

AMERICAN DISTRICT STEAM CO.
Lockport, N. Y.

Gentlemen:—Please send me your free booklet, "The Story of District Steam Heating."

Name _____

Address _____

American District Steam Co.

Main Office: LOCKPORT, N. Y. **Western Office: Monadnock Bldg., CHICAGO**

Canadian Office, 77 York Street Toronto.

NOTICE TO TELE

Synopsis of proposed ordinance of the Chicago Telephone Company prepared by the Committee of Gas, Oil and Electric Light of the City Council and now ordered printed.

This ordinance is the result of negotiations between the Committee and the Telephone Company extending over a period of nearly sixteen months, during which time an extended investigation was made by a Commission of three Expert Telephone Engineers selected by the Committee whose recommendations have been included in the ordinance. The grant extends the franchise of the Chicago Telephone Company for a period of 20 years.

The Company's books are to be kept in the form and manner required by the City Comptroller and open to his inspection at all times.

The City is to be paid three per cent upon the gross receipts of the Company in Chicago from all sources.

The City is given rights upon the Company's poles throughout the city, free telephone service to all officers in the City Hall and a discount of twenty-five per cent from current rates at all other points.

The Company is obliged to maintain its plant and service at the highest practicable efficiency and without extra charge to promptly adopt all available improvements.

Maximum rates are fixed extending throughout the city limits and are as follows:

Single business lines, including 300 outgoing calls, $15 per quarter.

Next 600 outgoing calls, 3c each.

All additional calls, per quarter, 2c each.

Subscribers contracting for 1,800 calls per quarter shall be furnished with a second line and instrument without charge, and for each additional 1,500 calls per quarter contracted for an additional line and instrument will be furnished. All messages sent by a subscriber from his premises are included under his one contract. Additional lines to the same premises without contracting for any particular number of calls are furnished at $6 per quarter each. Subscribers having two or more single lines will be furnished with private branch switching apparatus without extra charge. Terminal telephones connected with private branch exchange and switchboards are 50 cents per month. Commutation trunk lines allowing an unlimited number of outgoing calls are furnished at the present rate of $1 per day. The rates to all private exchanges now established, embracing more than 28,000 telephones, are thus substantially reduced. There is no charge for switchboards and the charge for trunk lines is reduced from $36 to $24 per annum. Where messages are contracted for in advance there is no charge for trunk lines. Seventy-two hundred calls per year, or 24 per day for the 300 business days, will cost $204 and will include two lines and telephones or two trunk lines to a private exchange. The calls, including these privileges, will cost 2.8 cents each. The above rates will apply to present business flat rate telephones, of which there were 9,643 based upon the $125 flat rate on May 1st, and in connection with which 4,100 extension telephones were operated at the rate of $18 each. The new rate proposed for extension telephones of all classes is $6 per year.

The $143 now paid for a business line and an extension will, at the proposed rates, including an extension telephone, pay for 962 messages per quarter, or 3,848 messages per year, an average of about 13 calls per day, with additional calls at 2 cents each.

Records of traffic kept for several years show that the subscribers' use of more than 6,000 out of 9,643 flat rate telephones will, at the proposed rates, substantially reduce the present annual cost.

The proposed measured service is to be recorded by meters so designed as to make possible but one record of operation of the meter while a subscriber's line is connected with another, and until the installation of these meters the flat or unlimited rate of $125 is to be available throughout the entire city.

RESIDENCE RATES

Unlimited service at private residences is to be continued at the following rates:
Single lines $18 per quarter.
Two party lines $14 per quarter.
The present rates for this service are: Single lines $25 per quarter and two party lines $18.75 per quarter.
The four party flat residence unlimited service is to be discontinued and two party service made available at a reduced rate.

CHICAGO TELEP

203 WASHING

PHONE USERS!

Nickel prepayment service is provided with substantial reductions in rates and improvements in service.

One party line guarantee 20 cents per day; present guarantee 30 cents per day.

Two party lines guarantee 15 cents per day; present guarantee 20 cents per day.

Two party line for residences only guarantee 10 cents per day; present guarantee 20 cents per day.

Four party line residences only guarantee 5 cents per day; present guarantee 10 cents per day.

The ten party lines are to be abolished.

When any subscriber in making settlement for nickel service shall pay any amount to make up a deficiency between the amount in the coin box and the sum guaranteed the amount so paid will be received in payment for service in excess of the guaranteed amount during the next 60 days.

The charge for local service from any public telephone shall not exceed 5 cents.

Local or neighborhood exchanges as now established in Rogers Park, Irving Park, Washington Heights, Pullman, South Chicago and a number of other points are to continue at the rates now established within these districts providing unlimited service at the following rates:

	Business—Per month	Residence
One party line	$4.00	$3.00
Two party line	3.00	2.00
Four party line	2.00	1.50

The rate of toll from these neighborhood exchanges to the City is established at 5 cents per message, reduced from 10 cents.

There is no toll charged from any telephone in the general City exchange wherever located for a communication to any of these local or neighborhood exchanges.

A toll rate of 10 cents for a communication of two minutes (and not more than 5 cents for each additional minute) is established from any telephone within the City to any other telephone outside of the City, but within 15 miles of the present City Hall.

The rate for extension telephones of all classes is established at 50 cents per month.

The telephone directory shall be published at least three times each year and three listings will be included free for every subscriber excepting four party lines and neighborhood exchange telephones, of which one listing will be made. One additional free listing will be made for each extension telephone or terminal telephone in a private branch exchange if desired. Additional listings $3 per annum each.

The above schedule of rates has been based primarily with the object of making it possible to give a continued good and satisfactory telephone service, avoiding the present serious congestion of service brought about by overloaded flat rate lines and by ten party lines.

The reductions will affect and improve the service of every telephone in the city of Chicago, of which there were 140,784 on May first. A continued excessive use of about 3,600 flat rate business lines will, at the measured service proposed, increase their annual cost; the remainder, or more than 137,000 telephones, will be reduced and the service improved for all.

The conclusions of the Engineering Commission stated that a satisfactory service in Chicago requires that measured rates should be adopted for general service, making it possible to base the rates for each class of service upon its actual cost, thereby bringing the service within the means of the largest number of people and making it of maximum usefulness in the city.

The proposed ordinance further provides that the City reserves the right hereafter to regulate any of the rates of the Company at periods of five years, and reserves any further rights of rate regulation conferred upon it at any time by the legislature.

It is further provided that if during the term of the grant the Telephone Company should make any net profit beyond ten per cent upon the amount of money actually invested in its property, all such excess shall be paid to the City. This provides automatically for a reduction of rates if at any time such reduction is possible, and the Company during the grant is obliged to set aside a reserve fund to provide for depreciation and replacement of its plant and property amounting to not less than four nor more than eight per cent per year upon the amount invested. This depreciation fund shall be at all times subject to the control of the City Comptroller, and any amount in the fund unexpended at the termination of the grant shall be paid to the City.

The City reserves any rights it may have to license any telephone companies, and its grant to the Chicago Telephone Company is not exclusive. The Company agrees not to enter into any combination with any other company concerning rates or division of its territory within the City.

The underground district of the Company is made to cover a territory covering more than three times the present area, extending from the City limits on the north to 89th Street on the south, and throughout a large section to 40th Avenue on the west. In this territory no poles are to be erected in streets, and in any part of the city poles now or hereafter erected in the streets are to be removed in advance of permanent street improvements by direction of the Commissioner of Public Works. Pole lines for distribution of wires are to be erected in alleys only.

The City reserves the right to terminate the ordinance and purchase the plant of the Company if it so desires on the first day of January 1919, or 1924, or at the termination of the grant, paying therefor the then cost of duplication, less depreciation, with five per cent in addition as compensation for the compulsory sale, but there shall be no allowance for earning power or for the value of the rights and privileges granted or for any franchise value.

The Chicago Telephone Company has invested more than $16,000,000 in its telephone plant within the city. Its equipment is of the best and most modern standard. Its service has been congested and impaired by the over-use of flat rate lines and by ten party lines. It will require an expenditure of more than $3,000,000 to make the changes of service required by the proposed ordinance. The object of the Company is to give to the citizens of Chicago the best possible telephone service at the lowest possible cost. It is believed that this can be accomplished upon the plans proposed. A copy of the ordinance when printed will be furnished to anyone upon application.

HONE COMPANY

TON STREET

WHY TRIFLE with other boiler compounds when you can buy - -

DEARBORN?

It's cheapest in the end because it *does the work expected of it*

DEARBORN DRUG & CHEMICAL WORKS,

228-234 Postal Telegraph Building, CHICAGO, ILL. WM. H. EDGAR, Founder. Telephone: Harrison 3930 and 3931.

BUCKEYE ENGINE Co.

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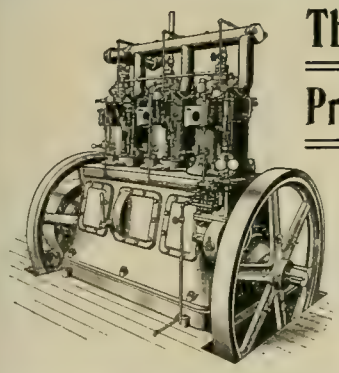

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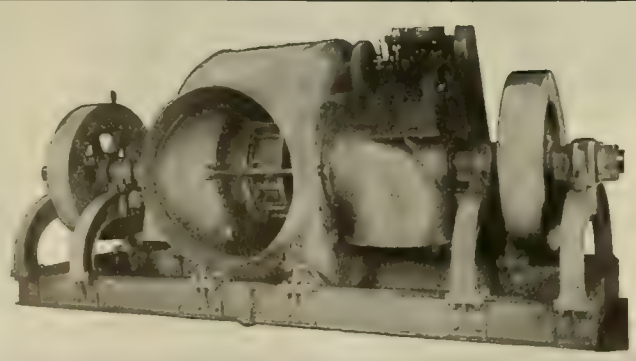

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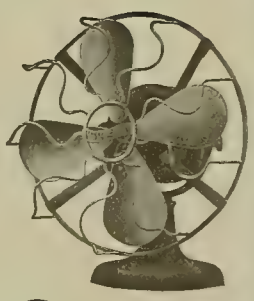

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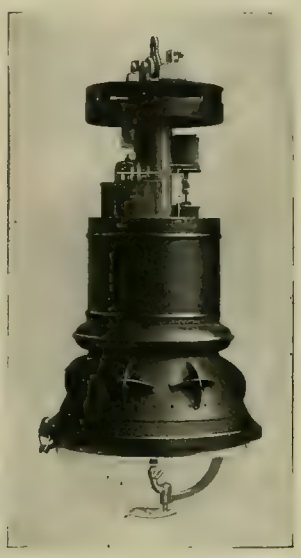

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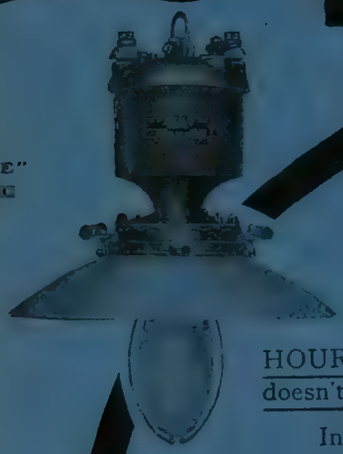

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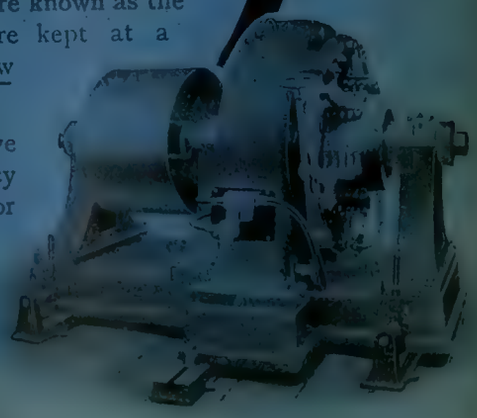

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Vol. XL. CHICAGO, JUNE 8, 1907 No. 23

German Single-phase Railway Operation.

By Dr. Alfred Gradenwitz.

Single-phase motors are being adopted on an increasing scale in Germany for the operation of urban, suburban and interurban railways, and in connection therewith large amounts of power are to be transmitted to considerable distances. These motors are regarded by their advocates as combining the advantages of rotary and continuous-current motors. The high-tension current as used in power transmission is supplied directly to the car and there converted to low-tension motor current in a transformer installed on the car, and which at the same time serves to control the pull and traveling speed. There is only one trolley line required, thus rendering the current supply to the car as simple as in the case of direct-current operation.

The illustrations herewith are reproduced from photographs of some late German railway equipments recently installed by the Siemens-Schuckert Works. Fig. 1 is a view on the Blankenese-Ohlsdorf Railway, showing multiple suspension from decorated poles. Fig. 2 shows a train of three cars and gives a good idea of the trolley suspension and current collectors.

The single-phase motors used in connection with these railways are of the series type for medium tensions, provided with auxiliary coils on the stator for eliminating the brush sparking. One is shown in Fig. 3. The motors are fitted with enclosed casings and are designed for artificial ventilation in the case of large outputs. The stator has uniformly distributed teeth and comprises only two coils, viz., an exciter and a compensating coil, part of the latter being used for generating an auxiliary field, serving to eliminate brush sparking. The armature is provided with pattern coils, placed in open slots, so as to be readily exchangeable.

Controlling and switching is done by means of controllers operated by the motorman, either directly or indirectly. The latter alternative is resorted to whenever several motor cars are combined in one train, while in many cases it is preferred even for individual motor cars. Each of the motor cars in a train has the same electrical arrangement, carrying only the traveling current required for its own propulsion. The arrangement used in this connection is represented in Fig. 4.

Current collectors are applied to the trolley line by means of compressed-air cylinders actuated in the head motor car by means of a hand-operated cock, and in the other motor cars by means of electrically operated valves. A special advantage of this arrangement is that no special compressed-air conduits or current generators are required. The high-tension single-phase current collected from the trolley wire is supplied to the primary coil of the transformer across the high-tension switch and fuses. The secondary coil is connected to the motors across a controller, comprising several individual jumping switches for electromagnetic operation, shown in Fig. 6. The arrangement used in this connection allows the strain on all these individual switches to be reduced by one-half by adding only one more switch of the same type. Moreover, either one of the two motors can be readily switched out and operation of the car continued with the use of the other motor alone.

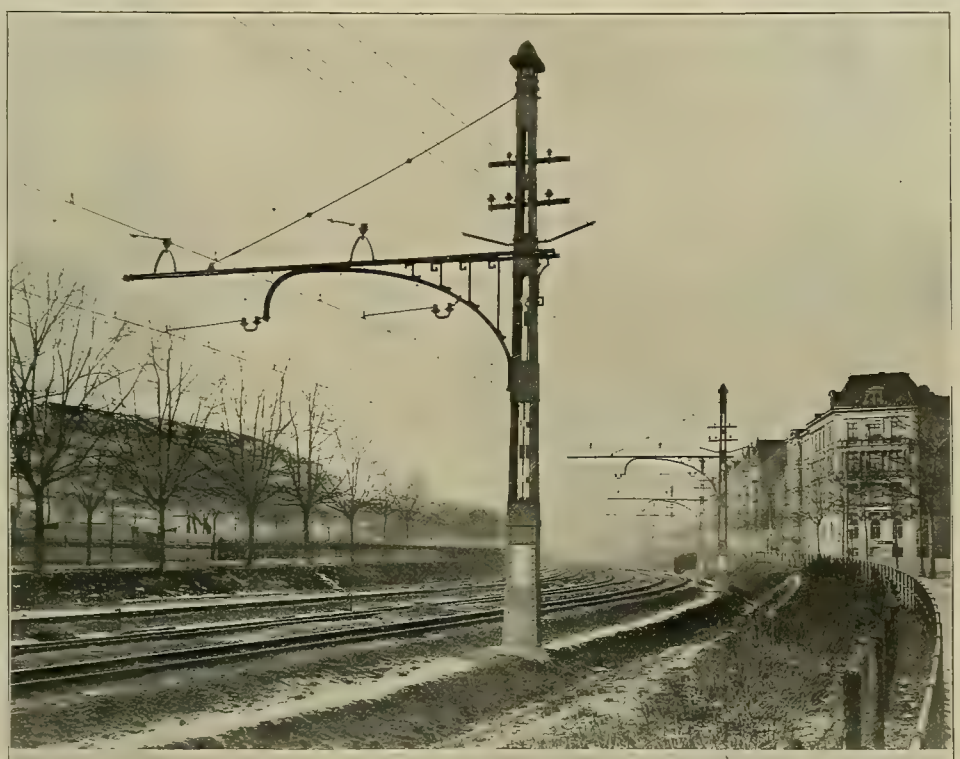


Fig. 1. View on Blankenese-Ohlsdorf Railway Showing Suspension from Decorated Poles.
Fig. 2. Train of three Cars, Showing Trolley Suspension and Current Collectors.

GERMAN SINGLE-PHASE RAILWAY OPERATION.

A special small transformer is provided to supply the current required for lighting purposes as well as for driving the pump motor and controlling the jumping switches. The high-tension switch (Fig. 7) and fuses are arranged in a special compartment, the lid of which can be opened only after lowering the current collector on the roof of the car, while in the event of the door being opened the current collector cannot be applied to the trolley wire.

A slightly curved aluminum bow with V-shaped cross-section, the groove of which is filled with thick grease, is used for collecting the current from the trolley wire. The arrangement is shown in Figs. 2 and 5. This bow is free to rotate by means of short arms around an axle transverse to the current. This axle is carried by two slanting frames resting on four movable levers. Owing to a convenient connection of the levers, the axle can be lifted or lowered only in a vertical direction. Two antagonistic spiral springs, mounted on the axle, are provided to keep the bow in a vertical position. According to the direction of travel the bow is deflected to either side through an angle of about 30 degrees from the vertical by the pressure exerted against the trolley wire and the resulting friction. The current collector is lifted by means of the compressed-air cylinder referred to, which is connected with and insulated from the lever, while being lowered under the action of its own weight. The current collector is used for both directions of traveling. The resilient arrangement of the axle and the small bulk of the contact bow rotating around the latter will enable the axle readily to follow any unevenness of the trolley wire, even in the case of high speeds.

The transformer is located in an enclosed casing, its iron core being made up of thin sheets, its high-tension winding of copper wire and the low-tension winding of flat copper wound on edge. Each of the two windings is distributed over a number of coils, which, in order to reduce the stray currents, are arranged on the iron core in such a way as to have alternately high-tension and low-tension coils. The branching points of the latter are connected to the jumping switches. Between the core and coils there are provided hollow spaces, insuring a free circulation of the cooling oil.

The high-tension switch is designed as oil switch for either electrical or compressed-air operation. It is provided with four contact springs placed on an axle, two of which are somewhat longer than the two remaining ones. The switching in and out of circuit accordingly occurs in two stages. In the first stage the circuit comprises a damping resistance, dealing with the current impulses produced on inserting the transformer, while in the second stage the resistance is short-circuited. The switch need not be kept in the first stage for any length of time, its action being quite instantaneous. The high-tension switch is kept in its closed position by an electromagnet working against an antagonistic spring, and which is free from any current, when the controller switch has reached its zero position or when the compressed-air cylinder actuating the collector bow is exhausted.

The controller comprises two rollers, viz., a switching and a traveling roller. The contact springs, sliding on the rollers, are connected to the windings of the jumping switches and to the low-tension windings of the auxiliary and main transformers. The traveling roller is switched in against the thrust exerted by a spiral spring and is kept in working position by a click, which, under the pressure of the driver's hand, will mesh with the teeth fitted to the casing. The traveling roller consists of two parts, the lower part being rigidly connected to the switching crank, while the upper

part is carried along by cams. In virtue of this relative mobility of the two parts, a switch inserted in the controller circuit is actuated. The high-tension switch is inserted only during the first stage.

The traveling and switching rollers are bolted against one another in the well-known manner. The following advantages are claimed for this arrangement: The motors will be switched out automatically, in case the driver should lose con-

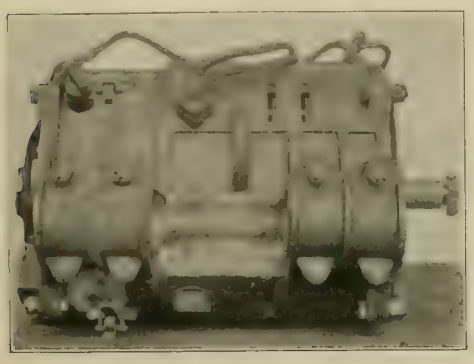


FIG. 3. MOTOR USED IN GERMAN SINGLE-PHASE RAILWAY OPERATION.

sciousness. The safety device will not be productive of any heavier strain on the driver. Sparks will be produced only on a few contacts. In the case of temporary breakdown of the working current, the driver should turn the traveling roller back to the first stage before again inserting the motors.

The jumping switches are electromagnetically steered switches, the magnet core of which consists of iron parts. The pole piece is partly surrounded by a short-circuit coil generating an auxiliary phase in order to avoid any humming noise in the magnets. The switch comprises several contacts arranged beside one another, one of which shows an advance, and is used as make-and-break contact. This contact is provided with magnetic spark damping. In order to keep the contact surfaces as clean as possible, the contacts have been designed for rubbing against one another on striking each other. As the switches are bolted together mechanically, the production of any disturbing electrical connections is prevented, while any jamming switches are disengaged violently under the action of the switch inserted afterward.

The trolley wire of these single-phase railways is suspended above the track in a specially careful manner, with a view to the high tension carried. The patented multiple suspension represented in Figs. 1 and 2 comprises a running wire of hard copper wire, 80 to 100 millimeters in cross-section, which at intervals of three millimeters is attached by means of clamps to the auxiliary supporting wire arranged immediately above. The clamps are free to move on the auxiliary wire both in a longitudinal and vertical direction. The auxiliary supporting wire is a steel wire six millimeters in diameter suspended from a supporting rope at intervals of six millimeters by means of the suspension wires and clamps. The suspension wires are of different length, depending on the curvature of the supporting ropes. Midway between the points of suspension of the latter they are replaced by clamps, as the supporting rope and auxiliary wire at this point are running immediately above each other.

The supporting rope comprises seven steel wires of an aggregate cross-section of 35 square millimeters. These wires are spun over and are carried by insulators fitted to outriggers of the poles. The traveling wire and auxiliary suporting wire are

FIG. 5. CURRENT COLLECTORS FOR SINGLE-PHASE OPERATION.

fixed by an insulated stay at each supporting point of the carrying rope, thus preventing any lateral oscillation.

All current-carrying parts are doubly insulated from the masts or outriggers, each of the insulators standing safely a working tension of 6,000-10,000 volts. By this arrangement of wires the number of suspension wires is reduced by one-half, and every facility is afforded for adjusting the tension of the trolley wire. In case of breakage the trolley wire will not interfere with the supporting rope or wire.

Spring Meeting of the Mechanical Engineers.

The American Society of Mechanical Engineers opened its spring meeting at the Claypool Hotel, Indianapolis, Ind., on May 28th, and held two sessions daily for three days. Over 200 members were present. The opening session on Tuesday night consisted of a welcoming address by Mayor Bookwalter and response by Frederick R. Hutton, professor of mechanical engineering in Columbia University, and president of the society.

The real work of the society began at 9:30 Wednesday morning. After reading the minutes of the previous meeting, which included a description of the dedication of the Engineering Societies Building in New York, and the disposing of some routine business, the reports of committees were discussed and disposed of. Abstracts of papers already printed were read on the following subjects: "Collapsing Pressures of Lap-welded Steel Tubes," by R. T. Stewart of Western University, Allegheny, Pa.; "The Balancing of Pumping Engines," by A. F. Nagle of Buffalo, N. Y., and "The Economy of the Long Kiln," by E. C. Soper of South Pittsburg, Tenn. The papers each brought out a spirited discussion and elicited a number of inquiries and answers.

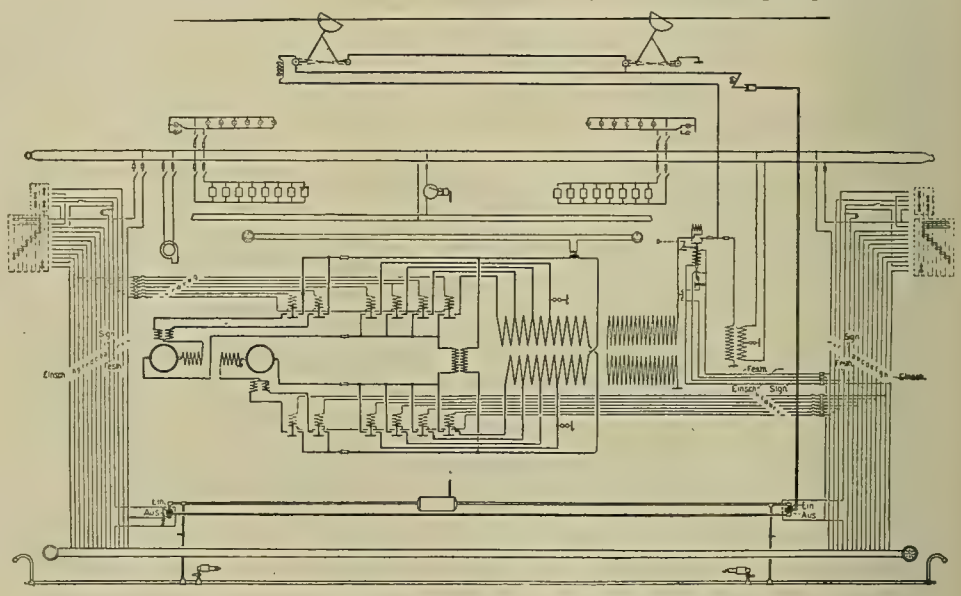


FIG. 4. DIAGRAM OF CONNECTIONS ON A MOTOR CAR.

The evening session was occupied by the reading of several papers on matters connected with the automobile manufacturing industry. The first paper, on "Ball Bearings," by Henry A. Hess of Philadelphia, was illustrated by a number of stereopticon views. "Materials for Automobiles" was the subject of an interesting paper presented by Elwood Haynes of Kokomo.

On Thursday morning the session was attended by 330 members and was said to be the largest attendance ever enjoyed by the society. The first paper read at this session was by B. D. Gray of the American Locomotive Company of Providence, R. I., on the "Railway Motor Car." This was followed by an interesting paper on "Materials for the Control of Superheated Steam," by M. W. Kellogg of New York. Mr. Kellogg said the economy of steam in the power houses of the great traction companies of Indiana and other states, in the electric-light plants, the transatlantic steamships and the locomotives of the country is of vastly great importance. The abstract of this paper was listened to with interest by a large number of power-plant superintendents, and the printed paper was much in demand.

The closing session of the meeting was held at Purdue University, Lafayette, whence the members had been taken on an excursion by the Northwestern Traction Company. After inspecting the university the meeting was called to order in Fowler Hall, and papers read and illustrated on the following subjects: "Performance of Cole Superheaters," by W. F. M. Goss of Purdue University; "Experiences with Superheated Steam," by G. H. Barrus of Boston; "Superheated Steam in an Injector," by S. L. Kneass of Philadelphia; "Use of Superheated Steam on Locomotives in America," by H. H. Vaughan of Montreal, and the "Analysis of Locomotive Tests," by S. A. Reeve of Worcester, Mass.

The social features of the meeting were not lacking. Several receptions, informal meetings, luncheons and dances were greatly enjoyed. The visiting and inspecting of the numerous large plants in Indianapolis were not only instructive but somewhat surprising to the members, who said they were not aware of so much manufacturing enterprise in the city.

Electrical Exports for April.

Electrical exports from the United States for the month of April, 1907, amounted to a total value of $1,332,398. This is less by $228,867 than the figures for April, 1906. Both classes of electrical goods—appliances and machinery—show a falling off as compared with a year ago. The figures in detail are: Electrical appliances—April, 1906, $750,579; April, 1907, $583,780. Electrical machinery—April, 1906, $810,686; April, 1907, $748,618.

Following is a list of the principal countries to which electrical goods were exported from the United States in the month of April, 1907:

Electrical appliances—British North America, $101,151; Brazil, $63,407; United Kingdom, $63,130; Mexico, $54,536; Japan, $46,728; British Africa, $22,703; Central American States and British Honduras, $21,816; Germany, $21,305; Belgium, $20,480; Cuba, $19,695; Argentina, $11,509; British Australasia, $7,910; France, $4,800; Philippine Islands, $1,046.

Electrical machinery—Japan, $144,748; British North America, $134,362; United Kingdom, $119,756; France, $74,657; British Australasia, $74,449; Mexico, $71,264; Brazil, $50,825; British East Indies, $26,820; Central American States and British Honduras, $11,110; Argentina, $5,262; Chinese Empire, $3,355; Cuba, $4,601; Germany, $2,809.

The United Kingdom, Mexico and Brazil show the largest falling off in the amount of electrical appliances imported in April compared with April, 1906, the figures being, for 1906 and 1907, respectively, United Kingdom, $199,835 and $63,130; Mexico, $106,543 and $54,536; Brazil, $138,849 and $63,407. Japan shows the largest increase in electrical machinery imported, from $54,305 in April, 1906, to $144,748 in April, 1907.

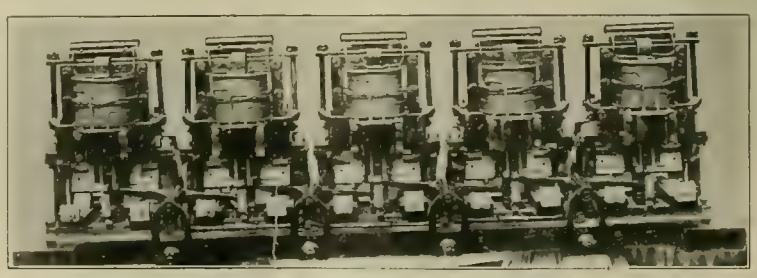


FIG. 6. JUMPING SWITCHES IN ELECTROMAGNETIC OPERATION.

Street Illumination and Signs in San Antonio, Texas.

By W. D. Hornaday.

No branch of the electrical business has had greater development during the last few years than that of advertising display. So important has this feature of the business become that in many cities it is a separate department of the electric-lighting companies.

San Antonio, Tex., now leads all cities of its size in this country in the matter of electrical decorations and display of its streets and buildings. The accompanying pictures give some idea of the effects, but are far from doing justice to the brilliance of the display. These decorations are not spasmodic efforts made in celebration of some holiday event, but are permanent institutions of the city. Of course on such occasions as the recent carnival there were special electrical displays, but so well is San Antonio equipped at all times in this respect that any special decorating, no matter how extensive, attracts comparatively little attention.

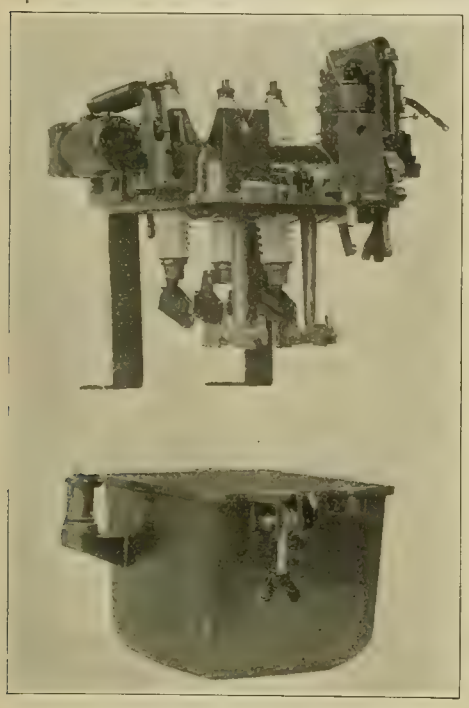


FIG. 7. HIGH-TENSION SWITCH ON GERMAN SINGLE-PHASE CAR.

The electrical attractiveness of San Antonio is so great that strangers arriving in the city at night are led to believe that a celebration of some kind is in progress. The two principal streets of the city are Commerce and Houston. It is upon these streets and the plazas that the leading business buildings are located. Each of these streets is spanned with electric arches. These arches are located one to each block. There are 10 of these arches on Commerce Street and eight on Houston Street. Each arch is equipped with 30 four-candlepower lamps.

These arches were erected about three years ago and are maintained at the expense of the business men on the two streets. That they have been a paying advertisement of the city cannot be doubted. This fact is attested by the willingness of the business men to keep the arches burning. The success of this experiment with arches has led to a large number of other electrical displays of various kinds being made. In the center of each arch are emblems which burn brightly. This emblem feature suggested to merchants a variety of electrical advertising which they have adopted.

The scheme of outlining the larger business buildings with incandescent lights is coming into general use. A number of buildings are brilliantly outlined. There are no skyscrapers in San Antonio, but some of the buildings are five and six stories high and the effect of the electrical outlines is very attractive. These illuminations can be seen for miles and arouse the interest and favorable comment of visitors coming in on trains at night. In addition to the building outlines a great many store fronts are similarly decorated; this is particularly true of entrances to places of business.

The electrical displays are not confined to downtown streets and buildings. Several of the larger manufacturing concerns in different parts of the city are brilliantly decorated with electric lights. It is stated by experts in this line of electrical advertising that there is no city in this country where the illumination is so equally distributed as in San Antonio. This adds materially to the pleasing effect of the general scheme.

There are now 20,000 lamps of four-candlepower in use for street and building decoration purposes, all coming under a flat rate. In addition to these there are many thousands of 16 and 8-candlepower lamps in use for the same purposes.

The fact that San Antonio is visited by thousands of tourists each year gives it the appearance at all times of being in a holiday mood. The beautiful electrical decorations by night accentuate the holiday appearance of the city and serves to stimulate a perpetual festive spirit upon the part of local citizens and visitors. The streets are narrow and afford unusually fine opportunities for effective decorations. The town is not laid out on any definite plan, and in installing the electric-lamp displays the monotony of sameness is avoided.

There are now more than 200 electric signs in the city. Roof signs are particularly numerous. The fact that most of the buildings are only three and four stories in height makes it possible to make these roof signs prominent, and some of them can be easily seen and read from the most remote parts of town. The designs are in many instances unique and show much study in planning and execution. At the rapid rate at which the new method of advertising is growing it will not be long until there will be several hundred electric signs scattered over the business and manufacturing districts of San Antonio.

The San Antonio merchants are also liberal in their use of electric lamps to decorate and illuminate their show windows. Some of these decorations are most artistically arranged and serve to attract much attention. This line of the business is also growing rapidly.

During the recent spring carnival special decorations were made. East Commerce Street from Alamo Plaza to the Southern Pacific Railroad depot was converted into a blaze of light by night. The historic Alamo Building was also beautifully outlined with electric lamps, more than 1,000 in number. Another decoration that had a patriotic and pleasing effect was a waving flag made of electric lamps. The City Hall and Court House were also outlined.

The introduction and wonderful growth of the electric display feature of the lighting business in San Antonio is due to D. N. Warwick, who has charge of this department of the San Antonio Gas and Electric Company. Mr. Warwick got his electric training in the practical fields of Chicago and Denver. When he started in with the San Antonio Lighting Company in 1894 there were only six electric-light signs in the city. Such a thing as permanent street decorations and building displays were unheard of almost among the business men. When he proposed to the company that a good business might be built up along these lines he was told that an effort had been made to interest business men in electric signs and it had failed. Mr. Warwick started in under the most discouraging circumstances. He was untiring, however, and one by one the business men of the town adopted his views as to electric advertising, with the result that the interest and rivalry between the different progressive business men of the city in this branch of acquainting the public with their trade is earnest and active. That electric signs have proved a profitable investment is admitted by all who operate them.

DAYLIGHT VIEW IN SAN ANTONIO, SHOWING ELECTRIC ARCHES.

It is asserted that the electric street displays and decorations have done more to advertise San Antonio throughout the country than any other method that could have been devised. Many thousands of

NIGHT VIEWS IN SAN ANTONIO, TEXAS, SHOWING ELECTRIC-LIGHT DECORATIONS AND SIGNS.

tourists and pleasure seekers visit the city each year and they are almost favorably impressed with the brilliant and beautiful street scenes by night. They tell others about it when they go home, and the result is an increase in visitors. Among the people of Texas San Antonio is known as the festival town of the state.

Mr. Warwick is opposed to the free-sign method which is followed in some cities. He conducts his department on strictly business principles. He is able to show the value of the electric signs, and they are installed because it has been proved that they are profitable as a means of advertising. When Mr. Warwick began this work in San Antonio he met with many obstacles. But when the fact was once demonstrated that the signs and electric displays were business getters, orders for them came to him rapidly. He took pains to interest the merchant and manufacturer in the new method of advertising. He had a large number of designs prepared, and when one design failed to please he submitted another until something was finally shown that gave satisfaction. Some of these advertising designs have a uniqueness that is probably unexcelled in any other city. Upon the roof of one of the business buildings is a large American eagle made true to life with electric lamps. The lamps are so arranged and operated that the eagle is given the effect of flying with its wings outspread.

D. N. WARWICK.

There is some talk of extending the street electric displays to some of the residence districts. It is believed that electric arches and other attractive illuminations on the residence streets would add greatly to the attraction of the city and would be the means of calling particular attention to the localities where they are given. If this movement is consummated the same method of paying for the extra lamps will be followed that is now in operation as to the business streets. The residents of each block will bear a proportionate amount of the expense of lighting just as the business men on each block now pay for the electric arch on that particular block.

It is not until a city has become well started upon electric advertising and displays that the possibilities of this branch of the illuminating business is fully realized. This has been the case with San Antonio and other cities where this character of illumination has become an art.

Coal Production in 1906.

According to statistics compiled for the United States Geological Survey by Edward W. Parker, coal-mining expert in charge, the total production of coal in the United States in 1906 was 414,039,581 short tons, valued at $512,610,744. These figures, compared with those of the preceding year, when the output amounted to 392,919,341 short tons, valued at $476,756,963, show an increase of 5.4 per cent. in quantity, and of 7.5 per cent. in value.

Of the total production in 1906, Pennsylvania contributed 48.4 per cent. in quantity, and 51.1 per cent. in value, the larger percentage in the value being due to the higher value of anthracite, which is produced almost exclusively in that state.

One of the interesting facts presented in the statistics of coal production last year is that West Virginia has supplanted Illinois as the second coal-producing state, West Virginia showing a total output of 43,276,485 short tons, while the production of Illinois was 41,407,435 short tons. This was due principally to the almost complete suspension of mining in Illinois (as in other states where labor union forces were strong) during all of April and a part of May, when the miners and operators were in conflict over the wage scale, whereas the majority of the operations in West Virginia were more actively worked, as a result of the suspension of work in the other districts.

Ohio ranks fourth as a coal-producing state, Alabama fifth, and Indiana, sixth.

It will cost, it is said, about $4,500,000 to harness the Loup River in Nebraska and transmit its energy to the streets and factories of Omaha. A series of about 40 miles of canals beginning at Columbus, will be turned into the Platte and other streams along the way. The natural fall of the country makes these canals feasible, the last drop being at Omaha, where the water will empty into Papillion Creek at Seymour Park. About 250,000 electrical horsepower will be generated.

High-tension Transmission Discussion.

Of the five interesting papers on high-tension transmission subjects read and discussed at the special meeting of the American Institute of Electrical Engineers in Chicago on May 24th, three were printed in the Western Electrician last week. The remaining two were entitled, "Potential Stresses as Affected by Overhead Grounded Conductors" and "Forced Oil and Forced Water Circulation for Cooling Oil-insulated Transformers," by R. P. Jackson and C. C. Chesney, respectively.

Following is an abstract of these papers, together with extracts from the discussion:

Potential Stresses as Affected by Overhead Grounded Conductors.

BY R. P. JACKSON.

This paper is a theoretical investigation of the potential gradients and the equipotential surfaces about grounded conductors suspended in the air, and also about metallic towers for supporting transmission lines. It is obvious that equipotential surfaces surround all conducting material subject to static strain, but the position of these surfaces and the gradient of change at different points are usually difficult to determine.

An example is furnished in the overhead grounded wire sometimes used as a protection for a transmission line against lightning. Such a wire placed above a transmission line serves two purposes: First, it interposes a grounded conductor between the sky and the transmission line, and tends to relieve the line from direct strokes (the effectiveness of the grounded wire for this purpose will probably depend largely on its size and the frequency with which it is grounded); second, a much more frequent condition, however, is the stress due to induced potential between the transmission wire and ground.

ATTRACTIVE ELECTRIC SIGN IN SAN ANTONIO.

The potential at a point near an indefinitely long cylinder remote from other conductors is proportional to the logarithm of its distance from the center of the cylinder. If the potential at the point also tends to be proportional to its distance above the ground its resultant potential will be the algebraic sum of the two. Obviously the surface of the ground is itself an equipotential surface; for if it were not, current would flow from the points of high to those of low potential, and it would immediately become an equipotential surface. This fact, that the earth is conducting, cannot be represented mathematically, so it is necessary to assume an image of a charged object the same distance below the earth's surface as the real object is above, and that its charge is always of opposite sign. The surface of the earth then becomes of uniform potential without assuming that it is conducting. The equation for potential of a point near a grounded wire then becomes

$$C\,H - K \log \frac{R}{r} = P \qquad (1)$$

where H is the distance of the point above the ground, C and K are constants, and R and r are distances of the point from the image and the wire, respectively. P is then the potential of the point taken. By taking the point on the surface of the grounded conductor, H, R, r and P become known. The constant, C, is determined by the assumed gradient, so the constant K may then be determined and if logarithms to the base 10 are used, will include the proper modulus.

In Fig. 1, a 0.5-inch wire 50 feet above the ground has been assumed. The gradient is taken at two per foot, so that if the wire were not there the potential at the point where it has been assumed would be 100. This is convenient, so that values deduced may also be used as per cent. ratios. The equation becomes approximately

$$2\,H - 30 \log \frac{R}{r} = P. \qquad (2)$$

All the curves of Fig. 1 are calculated from this equation.

It may be seen that at no point directly beneath the grounded conductor is the potential greater than 52. Curve (G) becomes the gradient instead of (N). The meaning of this is that a transmission wire placed, say five feet below the grounded wire, would, when there was a charged cloud overhead, have a potential of about 55 per cent. of that which would exist if there were no grounded wire tending to cause a charge to leak from ground to the transmission line. Again, after the cloud has discharged there would be only 55 per cent. as great a potential on the wire, and consequently only 55 per cent. as great a charge to escape suddenly to ground. In other words, the curves do not indicate that complete protection is obtainable from a single wire, but that under certain conditions a material reduction of static stress will occur. The amount of this reduction is dependent on the relative positions of the transmission line and the grounded conductor.

The equation given for a single conductor may easily be elaborated to cover any number of conductors of various sizes, distances apart and height above ground. By taking the point for which the potential is determined by equation (2) on the different wires in succession, as many equations will be obtained as there are constants, so all may be determined.

The equation for two wires 10 feet apart, 50 feet high and 0.5 inch in diameter becomes

$$2\,H - 23 \log \frac{RR}{rr} = P.$$

Fig. 2 shows the corresponding curves. It will, of course, be true that the protected area is considerably larger. Fig. 3 shows the assumed gradient, a straight line reaching a value of 100 at a height of 50 feet, and also shows the gradients on a medial plane, for 0.5-inch wire 50 feet high, two 0.5-inch wires 10 feet apart and 50 feet high, and the same, plus another wire between them and 5 feet higher. Curve 1 is for one wire, curve 2 for two wires, and curve 3 for the three wires, respectively. If a number of wires were arranged either in a horizontal plane or cylindrically with the concave side toward the earth there would be a large area of low potential covered which would probably be a comparatively safe location for a transmission line.

By the fundamental principle of the conservation of energy the potential stress which will cause a charge to appear on a wire will be reproduced in the opposite direction by that charge if the original stress be removed. This also holds good when a grounded wire is placed above a transmission line, so, although curves of Figs. 1, 2 and 3 are calculated on the basis of perfectly insulated line wires they hold equally good for an actual transmission line where charges could readily find their way to the parts of the line under stress by the paths previously mentioned. This can be proved mathematically, independently of the principle of conservation of energy referred to above.

If the line were so insulated that only a partial charge could leak to the transmission wires the primary stresses would be reduced somewhat, but the grounded wire would still have the same beneficial effect.

It is obvious that to get the full benefit of the grounded conductors they should be thoroughly and frequently connected to the ground, as their effectiveness consists in releasing their own charge at the moment of a lightning flash, and immediately receiving another of opposite sign from the ground. This latter charge is then of opposite sign to that which still remains on the transmission wires and serves to reduce the potential of these wires.

DAYLIGHT VIEW OF A LARGE ELECTRIC SIGN IN SAN ANTONIO.

It will be noted in Figs. 1 and 2 that the lines representing the equipotential surfaces are closely crowded together on the upper side of the grounded wire. This characteristic is much more marked in the case of a tower or spire projecting toward the sky. The potential of a point near such an object is much more difficult to calculate, so in Fig. 4 a one-inch conducting vertical cylinder 50 feet high was assumed and the equipotential surfaces calcu-

lated. Curve (C) shows approximately the proportional charge at different points along the cylinder. Curve (G) shows the potential gradient from the top of the cylinder. It is seen that the charge density becomes relatively very great at the top of the pole or cylinder, and that the change of potential is very rapid for the first two or three feet above the top of the cylinder. This is a condition tending to produce leakage into the atmosphere, or corona effect, such as the St. Elmo's light seen at times on mastheads of vessels.

Apparently if an insulator were placed on the top of this cylinder and a high-potential conductor were carried by this insulator there might develop a conducting state in the atmosphere about this insulator that would cause it to flash over, especially if there were any sudden rise of potential on the conductor carried by the insulator. Fig. 5 shows one view of a metal tower under this condition and Fig. 6 another view.

Fig. 7 shows the natural suggestion for relief. If the tower structure were carried higher and the insulators and transmission wires suspended downward the desired result would be obtained without the additional shielding device shown in Fig. 7.

All the discussion given in this paper is, of course, pure theory, and if there were never any insulators broken or other trouble from lightning strains it would have no practical value. Insulators are broken, however, especially those carried on metallic towers. So, while the information given in the curves does not indicate to any degree how much trouble can be eliminated by the devices discussed there seem to be suggestions as to the most effective arrangement of such devices. If line insulators are subjected to frequent stresses of a value five times that which they will stand, a reduction of 50 per cent. would not avail much. If, however, the average of normal stresses to which they are subject are only 150 per cent. of the breakdown value, a reduction of one-half in these stresses may eliminate a very large amount of trouble.

The general conclusions are as follows:

1. Properly placed and grounded conductors above a transmission line ought materially to reduce the electrostatic stresses to which the insulators will be subjected.

2. An insulator interposed between a high metallic structure and the sky without a grounded conductor above the insulator to act as a shield is exceptionally liable to breakdown.

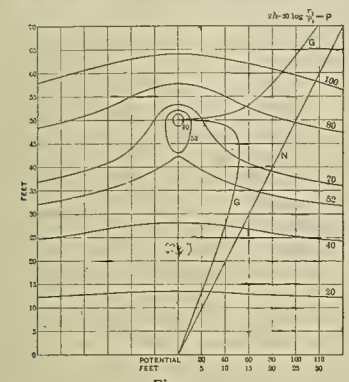


Fig. 1.

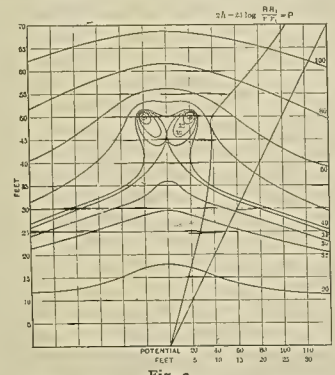


Fig. 2.

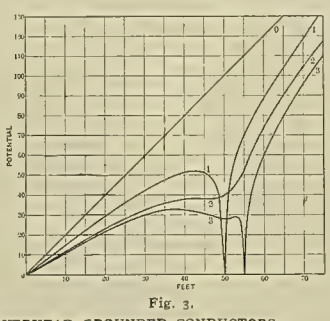


Fig. 3.

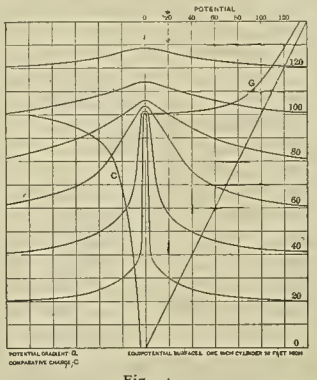


Fig. 4.

POTENTIAL STRESSES AS AFFECTED BY OVERHEAD GROUNDED CONDUCTORS.

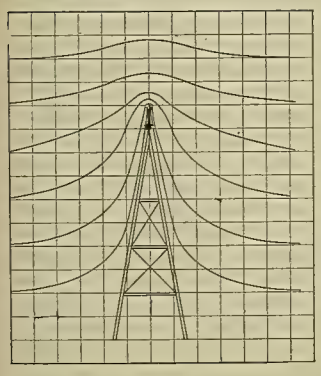


Fig. 5.

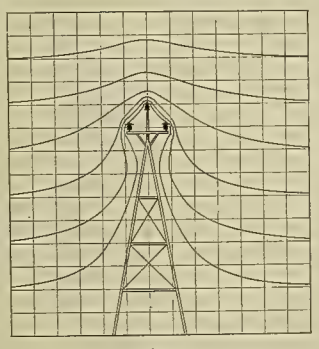


Fig. 6.

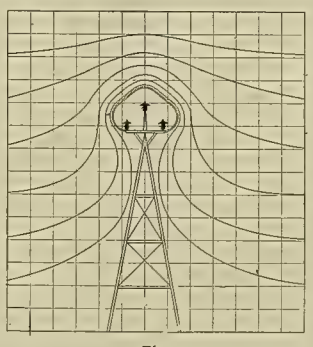


Fig. 7.

POTENTIAL STRESSES AS AFFECTED BY OVERHEAD GROUNDED CONDUCTORS.

Discussion (in Abstract).

Prof. D. C. Jackson: As we come to the situation where the wooden insulator is out of account, we have merely the strain on the insulator itself, and, as R. P. Jackson points out, a reduction of 50 per cent. perhaps of the strain on the insulator is well worth while. I doubt very much whether the reduction would be nearly so great as 50 per cent., but if the reduction is as great as 25 per cent., which I have been able to convince myself it might be, I think it might be well worth obtaining in the case of a line built upon iron towers. I am quite able to say that I am convinced that it might not and probably would not be worth obtaining, when the line is built on wooden poles, as little a reduction as 25 per cent.

Prof. Morgan Brooks: In regard to strains on pole lines, on lines for high-tension there is a great distinction above 50,000 volts. Up to that there is no brush discharge, or very slight, but over that it comes up very soon, and the step up to 100,000 is a greater one than up to 66,000. Of course 66,000, if taken as a standard, means, at the 100 curve, the breakdown of the insulator. Also, there is a surge that comes in on the line according to the time at which a switch is closed in switching in any apparatus such as a transformer, for instance, on the low-tension side, and while it has been known for a good while that by switching in a transformer surges come in varying amounts according to the time when the switch was closed. We tried at the University of Illinois to see if that followed any regular law, that is, any particular time of the cycle; so we rigged up a device for closing the switch at any particular point in the circuit and kept it closed, in the same sense that we have heretofore taken off points on an alternating-current curve at a particular point in the circle, the old-fashioned method, before we got the oscillograph of making points on the circle. The first test was at random, and we found that sometimes we would get a much greater discharge across the spark-gap than at others, and estimating, say, 60,000 volts as an average, it would go above and below that, and we have succeeded finally in getting an approximate result, at least, showing that it does make quite a difference as to the time the switch is closed. We also got other results which were somewhat unexpected, on which I would like very much to ask the privilege of the floor for J. W. Andree, one of the senior students. It seems to me that we ought to synchronize a transformer before connecting it to the line. It seems rather ridiculous to talk about synchronizing a transformer, but to get it magnetized to some extent before throwing it on the line, and thereby avoid the surges which would occur from the throwing.

J. W. Andree: To see if the varying amounts of surges followed any regular law it occurred to us that we should have an arrangement that would give us some positive way to know where we were closing the circuit. We plotted a curve for the addition of secondary voltages, closing the primary circuit on different points of this wave, and found that with a secondary voltage, that is, an effective voltage of 50,000 volts, or with an instrument that would close the circuit at the zero point of the wave, it gave on the secondary voltage 56,000 volts, and then by switching the contact so as to close at a different point we found that at 90 degrees, or anywhere near 90, it would give us a sudden rush of voltage up as high as 71,000 volts, that is, over 33 per cent. Then again, by plotting curves further on we found that near 180 degrees the voltage was practically the same as it was at zero, and again at 270 degrees the voltage was up to 71,000 volts. At 360 it came down to the same place again. To find out whether it was residual magnetism that had been causing this, we plotted curves, and found that three different curves were practically the same; therefore drew the conclusion that residual magnetism has no effect whatever. We have come to the conclusion that it is merely the point of the curve, the electromotive force, the beginning of closing the circuit, that makes this sudden rush of voltage, causing breakdowns on the line. We have tried putting in more or less induction on the primary circuit to see what effect that would have on this sudden rush of voltage, and find that it does make quite a difference, but perhaps the inductance we have was not quite large enough to cut it down entirely. But the curve I have here shows at zero we could get no higher voltage than 60,000 volts; at 90 we would run up to 65,000, where without it we would run up to 71,000. The currents are practically the same. We took some oscillograms of them showing that at zero there was almost no current at all; at 90 degrees there was a large rush of current, and again at 180 there was hardly any current at all.

D. R. Scholes: In some very long lines using steel towers no overhead grounded wire has been provided. That is true with regard to the wires of the Niagara, Lockport and Ontario Power Company. A certain amount of trouble has been reported with the top insulators in these lines, presumably due to the absence of the overhead grounded conductor. Then in a number of other cases one, two or three overhead grounded wires are provided, and in other cases there are guards placed over the insulators, lightning rods projecting considerably above the top of insulator and numerous arrangements of that general kind. In one installation now under construction in South Carolina three overhead grounded wires are installed, placed in a sort of umbrella arrangement over the power wire, and that seems to be the most extensive attempt at protection against lightning or static discharges by means of grounded wires that has been made. Almost without exception the towers that are being built to my knowledge are provided with ground-wire support in such way that if the ground wire is not strung at the outset it may be strung later if developments indicate that it is needed.

H. C. Hoagland: In Michigan, where we had trouble with lightning, and ran a grounded wire on the under side of the transmission, we noticed that the lightning discharged down to the pole and split the poles. After putting on the ground wire it practically eliminated that trouble. On the line from Jackson to Battle Creek two ground wires were used on the top arm, one on each end of the arm, and that practically relieved the trouble in that case. In Illinois a part of our line is equipped with the ground wire on top of the pole, and that has only been in service about a month, but we have had no trouble on that line. We are now arranging to put the grounded wire on top of the poles as fast as we can.

George A. Damon: I was in Toronto the other day and the line from Niagara Falls to Toronto has just recently been provided with this ground connection, but not as a ground wire. They have the triangle and the steel pole, and have inserted a ground connection of galvanized steel with two sharpened points, and that has been connected to ground, and they say it will overcome the difficulty they have been having with the lightning. It looked to me like a very sensible solution, because it is so easy to do. It is not the ground wire, however; it is simply a grounded connection at each of the poles. This connection at the towers seems to be installed for the purpose of protecting the insulators and not the line.

Chairman Lincoln: In connection with the scheme which Mr. Damon has just mentioned, it seems to me that that would be a protection against the lightning which occurred in the neighborhood of the supports. However, if the lightning tends to come on the wire half way between the supports, I do not see that the provision against it which he has mentioned is going to do any good.

R. P. Jackson: Any conductor carried up above the insulator which the lightning may strike if it comes that way and which will also relieve electrostatic stress will help matters, but it is not a complete relief.

George Hayley, general superintendent of the

Spring River Power Company: Mr. Jackson, while handling the problem simply from the theoretical standpoint, confirms absolutely actual experience with high-tension lines. We have been operating our power system for something over two years, and this will be the third season for electrical disturbances. Our original lines were built in the form of an equilateral triangle, with the apex of the triangle on top, with the ground wire running the entire length of the system, and located about three feet below the cross-arms. This form of construction, while exceedingly economical, is, in my opinion, the worst possible arrangement that could be devised. Practically all of the interruptions to our service, caused by atmospheric disturbances, have resulted from the failure of the top insulators, showing beyond a doubt that the greatest potential strain occurs at that point.

The result in every case has been the same, that is, the entire top of the pole has burned off, down to the ground wire. Last year we built five or six miles of line, using a new form of construction. The ground wire on one line was placed on top of the pole and the conductors arranged on two cross-arms below. In the other case, the ground wire was placed on one pin of the upper arm. We had numerous storms last season, and so far this year we have passed through four of more than usual severity. It may be only a fortunate coincidence, but the fact remains, that none of this line has ever caused us the slightest trouble, although we have ample evidence of severe lightning discharges along its route.

I am pretty thoroughly satisfied from my own experience that the grounded overhead conductor is the only practicable method of preventing insulator trouble due to severe atmospheric disturbances. I believe that the grounded conductor should be of a fairly large cross-section, not less than No. 4 gauge, and preferably stranded. It should be of the very best quality of annealed iron, thoroughly galvanized, and should be grounded at least on every other pole.

James Lyman: I was in Montana about a year ago, and looked over some of the transmission lines there with Mr. Heckman, the general superintendent of the Butte Electric Company. The Big Hole line is 15,000 volts, two three-phase transmission lines on one pole line, and this line is about 20 miles long, and goes over a divide in the mountains where particularly severe thunderstorms occur. To guard against trouble, for three or four miles of this divide, Mr. Heckman ran barbed wire along the tops of the trees that had been hit the worst; on each side of the pole line he carried these barbed wires. He also put three barbed lines on top of the pole line, one on each of the extreme ends of the upper cross-arm, which also carried one each of the two transmission lines, and one barbed wire on the top of the pole. As an experiment, to see what the effect of these overhead grounded wires was, he put a little hand switch into each of the wires that ran from the overhead lines down to the ground, so that he could open them all during a thunderstorm in case he wanted to. He had the lightning arresters in the usual way placed at each end of the transmission line. He said he could often see the discharges of lightning come down on the barbed wire on the tops of the trees, also the wire on the tops of his pole line. He said the lightning arresters were not particularly active; there was not very much going on, and for some six or eight months during the whole season he had experienced no trouble. He then, during one pretty severe storm, opened the switches on all the grounded wires the entire length, so that he had his grounded wires entirely disconnected from the ground, just during one storm. That satisfied him; the lightning arresters discharged almost continuously, and he was very much disturbed lest some of the apparatus should be injured. It was a practical demonstration of the value of those overhead grounded wires. From my own experience, the transmission lines which are protected by overhead grounded wires are much more free from troubles than those which are not. Of course, the lightning arresters add also very greatly to the protection of the system, and I would recommend them in all cases, and with the overhead grounded wire one really gets a very reliable service. Every precaution should be taken to give reliable service. The value of our long-distance power transmission largely depends, especially where there is heavy competition, on the reliability of service.

W. B. Jackson: The contribution which R. B. Jackson has made to the literature relating to overhead grounded conductors is both timely and valuable. Today it seems there is very little that is being undertaken in practice in the field of alternating-current transmission of power that cannot be greatly assisted by a careful consideration of the theory. In fact, it almost seems that the old time condition is being reversed in these matters and that theory must now "blaze the trail" and practice finish the clearing. The old complaint that grounded conductors are more trouble than good is now a thing of the past, for it is entirely practicable to install properly located and grounded steel wires so that they will give much less trouble than the line they protect. This is a splendid subject to be taken up with the assistance of the income of the Carnegie Institution of Washington, D. C., and one or more of the able scientists of that Institution might execute the work. I suggest that the American Institute of Electrical Engineers throw its influence toward such an end.

Forced-oil and Forced-water Circulation for Cooling Oil-insulated Transformers.

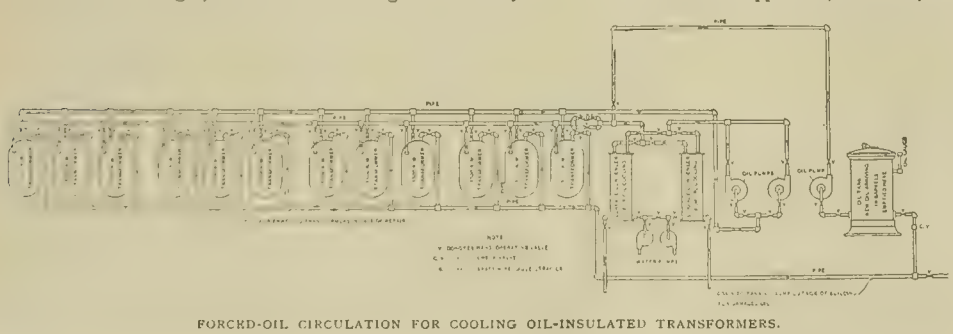
BY C. C. CHESNEY.

The more recent methods of cooling transformers by forced-oil circulation does away entirely with any internal cooling coils, but makes necessary external auxiliary cooling apparatus. The lower part of the windings of the transformer is enclosed in a metal box containing suitable directing plates, and this box is connected to the oil inlet by a vertical pipe raised to the top of the tank and passing through the cover. The outlet pipe has its opening somewhat above the top of the windings, thereby insuring a safe oil level. Oil under a slight pressure is introduced through the inlet pipe, and in passing through the transformer the oil is brought into intimate contact with the various windings and laminations by means of ducts and directing plates. After leaving the transformer, the oil flows through an external cooling system containing a surface condenser and strainer, and an oil pump, the latter providing the pressure needed to keep the oil moving at a proper rate through the entire system. An additional pump is provided to circulate water through the condenser. Sufficient water is usually circulated through the condenser to give a 10° C. rise to the water temperature, and the rate of oil flow is usually adjusted to approximately twice that of the water. The organization of the entire cooling system is shown in the accompanying drawing.

To offset the additional cost which this auxiliary cooling apparatus represents, there is a less first cost of the transformer proper, due to the markedly more efficient cooling which the positive circulation of the oil insures, and to the prevention of any local heating, in pockets, etc. The density in both copper and iron can be increased for the same temperature rise, which means less material used in the design of the transformer. In addition, since there is no cooling coil, the tank can be reduced in height, and less oil will be needed to fill it.

The total saving in the transformer proper will vary from 15 to 25 per cent., depending upon the size of the transformer. The reduced height of the transformer is, however, particularly welcomed on the score of shipment. With forced-water circulation the designer is handicapped, in the larger sizes, by being limited to a height of approximately 11 feet, this being the maximum height that can be safely shipped on any of the American railroads. By the use of forced-oil apparatus, however, the capacity of the transformer which can be shipped completely assembled is materially increased. On the other hand, as against the gain in head-room, the total floor space required will be greater, on account of the additional floor space required for the auxiliary cooling apparatus.

If a comparison of the total cost of the transformers installed is taken, the balance in favor of the forced-oil system appears for the large installations of 4,000 to 5,000 kilowatts when composed of individual transformer units of not less than 1,200 to 1,500 kilowatts. While forced-oil circulation is undoubtedly out of the question for smaller plants and smaller units, it merits for the large power plants the most careful consideration of any engineer.



FORCED-OIL CIRCULATION FOR COOLING OIL-INSULATED TRANSFORMERS.

Discussion (in Abstract).

J. W. Farley: There is no question about the saving which can be effected by directing the flow of oil through suitable ducts in a large oil-insulated transformer. The present system of water cooling can be employed, and is employed, in transformers of as large capacity as can be conveniently shipped as a unit. The addition of the feature of forced circulation will increase the capacity of the maximum transformer unit, in that it decreases the head room and maximum weight. One other point has to be considered, and that is maintenance and the complications of pumping; outside the cooling devices, the principal item, of course, being the up-keep of pumps and motors. The whole problem is quite feasible and has a good many advantages. In some cases these advantages largely outweigh the disadvantages of additional apparatus, and the closing sentences of the paper which has just been read are, in my opinion, quite apt.

C. W. Stone: It is true that if one considers the space taken by the condenser outfit for cooling the oil and the extra pumping apparatus necessary, you may require some more floor space, but that extra floor space can usually be found in most stations. The space necessary for the cooling apparatus, that is, the pump and condenser, is not as great as the space occupied by the transformer, and they can usually be put away in some corner in the station. Also, in several cases I have found it seemed advisable to install this cooling coil, not in a part of the station, but, say, the tailrace of the station, using the water from the turbine to do the cooling. Therefore you do not have the application of extra pumping facilities; you would only have one set of pumps with which you would ordinarily have to do the forcing of the water through the cooling coils. The oil is under moderate pressure; therefore very little trouble should be experienced from the pumping outfit with forced oil circulation and separate cooling.

A. H. Pikler: The advantage of this forced cooling is mostly due to the convection of the heat and very little advantage is due to conduction. As in all apparatus which has forced cooling, so with this one, the danger arises in the case of breakdown of the cooling arrangement. The density in the copper and the iron is higher than in the other method of cooling, and the amount of loss a good deal less, and if the cooling arrangement gets out of order this kind of transformer can be operated without forced cooling for less hours than other transformers. This is the disadvantage of the system.

W. B. Jackson: In this system the trouble from possible leaking water pipes is entirely obviated; in other words, instead of there being pressure on the water pipes, it is entirely possible to have the opposite, have the water drawn through the condenser in such a way that the old danger—and there used to be more or less danger—of the water getting into the oil and in that way short-circuiting the transformers, is overcome.

W. S. Moody: As soon as the idea of making transformers this way occurred to us the possibility of water getting into the oil occurred. We guard against it by simply having the pressure in the cooler, the oil toward the water, a little greater than the water toward the oil, so that if there is a little leak the oil gets into the water, and not the water into the oil.

Chairman Lincoln: Oil is the hardest stuff to keep where it belongs, and the more piping, etc., there is to convey this oil around the more danger there is of getting leaks and a condition which might be best designated by the term sloppy. That is, I think, one very real objection to the scheme of having forced oil circulation rather than the present. It is undoubtedly cheaper. That is to say, there are bound to be less materials used with a properly designed oil circulation than if the oil is allowed to circulate itself, and efficiency can be improved for the reason that, with a more efficient means of carrying off the heat evolved, there is bound to be an improvement in efficiency.

BOOK TABLE.

The 20th Century Toolsmith and Steelworker. By H. Holford. Chicago: Frederick J. Drake & Co., Publishers. 1907. Pp. (5 by 7½ inches), 240, with 117 illustrations. Price, $1.50.

The book is written in the interests of blacksmiths, toolsmiths, toolmakers and all mechanics connected directly or indirectly with the use, repair and manufacture of steel into tools. It gives the secrets and obstacles to be overcome toward making steelwork or toolmaking a success. Full instructions are given on how to forge, weld, anneal, harden and temper every tool that the toolsmith or toolmaker is called upon to make or repair. The author is an expert mechanic, who has spent the best part of his life over the anvil with the hammer and tongs. The information contained in the book is of a simple, practical and scientific nature, which should be easily understood by a mechanic of average intelligence. It should be of especial value to the young mechanic.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

The annual convention of the International Independent Telephone Association was called to order in the convention hall of the Auditorium Hotel, Chicago, at 2:30 p. m., June 4th. On the day previous the executive committee and advisory board held a joint meeting, at which the following committees were appointed:

On Amendments to the Constitution—Charles E. Sumner, chairman, Oregon; F. H. Woods, Nebraska; Theodore Gary, Missouri; M. B. Overly, Kentucky; Judge Smith, New York.

On Credentials—A. C. Lindemuth, chairman, Indiana; Alpheus Hoover, Canada; G. S. Shanklin, Kentucky; W. H. Nelson, Kansas; W. H. Bassett, Illinois; T. H. Ferris, New York; G. W. Thompson, Ohio; E. H. Pollock, Nebraska; F. D. Houck, Pennsylvania; J. B. Ware, Michigan; J. W. Barnes, West Virginia; E. H. Moulton, Minnesota; W. T. Wynne, North Carolina; F. H. Stowe, California; Houck McHenry, Missouri.

On Resolutions—James S. Brailey, Jr., chairman, Ohio; C. W. Kline, Pennsylvania; S. S. Lichty, Iowa; W. J. Uhl, Indiana; W. B. Woodbury, Michigan; Manford Savage, Illinois; H. D. Critchfield, Wisconsin.

On Nominations—D. E. Sapp, chairman, Ohio; O. C. Snider, Missouri; Charles West, Pennsylvania; R. Valentine, Wisconsin; H. S. Baker, Iowa; E. L. Barber, Kentucky; M. L. Clawson, Indiana.

On Auditing—Charles West, chairman, Pennsylvania; C. C. Deering, Iowa; C. S. Norton, Indiana.

When the convention was called to order six hundred delegates and representatives of operating and manufacturing companies had registered, which indicated a total attendance of at least one thousand.

Dr. Evans, health commissioner of Chicago, represented Mayor Busse and welcomed the convention to Chicago in a few well-chosen words.

John M. Glenn, secretary of the Illinois Manufacturers' Association, welcomed the convention in behalf of the business interests of Chicago. He spoke about the efforts made by the Manufacturers' Telephone Company to secure a franchise in Chicago, and alluded to the opposition which the Manufacturers' franchise had encountered. He said that he desired to impress upon his hearers that the City Council committee on gas, oil and electric light, which had recently made a report favoring the perpetuation of the Chicago Telephone Company's franchise, did not represent the sentiment of the business men of Chicago.

H. D. Critchfield, president of the Milwaukee Independent Telephone Company, responded to both addresses of welcome. He said that within a radius of 500 miles of Chicago there are 1,200,000 Independent telephones, as against 625,000 Bell telephones. He said that certain interests in Chicago consented to shut out the business which would naturally come to them from the 1,200,000 users of Independent telephones in a region which might practically be called "at home."

President Hoge's Address.

President James B. Hoge then delivered his annual address. He said among other things:

"From the best information that I can obtain it appears that there has been an increase in the Independent telephone system of more than 500,000 telephones during the last year. Franchises have been granted in the following large cities: Boston, San Francisco, Milwaukee, Denver, Omaha, Springfield, Mass., Nashville, Tenn., and in a number of smaller cities, thus leaving but few centers of population where the Independents do not have adequate terminals arranged for.

"The year has been one of increased prosperity among the Independent companies. I find that today a very large majority of them are in a much better financial condition. Most of them have placed their properties on a dividend-paying basis, having decided to stop putting all their earnings into extensions and betterment, as was the custom during the early days of Independent development. Most of them, however, are content to pay reasonable dividends and then put a substantial surplus back into the properties for extensions and improvements. In almost all cases investigated, I find this amount to be equivalent to from 3 to 10 per cent on the capital stock of the company."

Speaking on the subject of competition and duplication, Mr. Hoge said: "Twelve cities with competition, representing a population of over 2,000,000, show a development of one telephone for each 7.4 of population, while the same number of cities without competition, with a population of 650,000, show one telephone to each 23.8 of population, with very much higher rates and unsatisfactory service."

Dealing with the question of future policies of the various Independent companies in the United States, President Hoge urged the Independent telephone men to show no partiality to any particular class of subscribers, but treat them all alike. "If your competitor," he said, "does not follow this policy to the letter it is only a matter of time when he will have to account for his delinquencies to either state or federal authorities." He expressed the opinion that sooner or later the federal government or state legislatures would make a thorough investigation of telephone companies, and he thought that for that reason the entire business should be brought on a strictly legitimate commercial basis.

Speaking of telephone development Mr. Hoge said: "There are in the United States today approximately 7,000,000 telephones, or about one to every 13 of the population. If we had one telephone to every 7.4 of the population we would have at least 12,000,000 telephones, or approximately 75 per cent. greater development than we have today. Mr. James J. Hill estimates that there will be 200,000,000 population in this country in 1950, which will require at a conservative estimate 35,000,000 telephones, or five times the present number."

Speaking of compulsory interconnection, President

THEODORE GARY, NEW PRESIDENT OF THE INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

Hoge urged the various companies to point out to the public the operating disadvantages incident to compulsory connection, which he considers an interference with private property rights and which he thinks would have a tendency to stop all further development of long-distance lines.

Mr. Hoge closed his address, which was received with enthusiasm, with the following peroration:

"In conclusion I may be pardoned for referring to matters personal. After three years of service I cannot retire from the executive chair without thanking my fellow officers and committees for their co-operation and assistance. Through their substantial efforts the success of the association has been made possible. I also desire to thank the officers of the various state associations, the delegates to our conventions, the honorary members and all others who have given their support to the association.

"On three different occasions this association has honored me by election to the highest office within its gift and has shown its faith in my judgment by adopting the 'Ohio plan' of organization, which I originally worked out in that state, as well as by many other tokens of confidence. Friendships have grown out of these relations which are growing dearer from day to day, but the gratitude which I now express for the many honors conferred on me extends far beyond personal friends and acquaintances and embraces every man interested in the cause for the advancement of which we are all working together.

"Much has been accomplished. More remains to be done. Therefore I would ask you to give to my successor the same loyal support which has enabled me to make the work of the association of practical value. This association is your association, and not until every Independent telephone operator in the United States and Canada has become one of our members and all are filled with the spirit of devotion to the movement must the work of propaganda cease. We must stand solidly together, shoulder to shoulder, loyal to the cause, to our officers and to our associates, thus winning the approbation of our own conscience and the good will of the people."

Growth of the Association.

The auditing committee, through its chairman, Charles West of Pennsylvania, reported that the total receipts from June 26, 1906, up to and including May 25, 1907, amounted to $17,444.11; that there was a cash balance on hand June 16th of $1,113.73, making a total of $18,557.84. The total disbursements amounted to $18,241.60, leaving a balance in the treasury of $316.24. The total assets of the association amount to $4,254.39, and the total liabilities to $5,845.51, leaving a deficit of $1,691.12, which has since been provided for.

John A. Harney, assistant secretary of the association, made the interesting report that during the last year 2,642 new companies had been added to the records of the association, making a total of 10,042 Independent companies operating in over 10,000 cities and towns. This report showed the association to be in splendid condition and that the various branches of its work have been of material help to the movement in the United States and Canada.

Wednesday's proceedings of the convention were opened with a paper by C. E. Tarte, general manager of the Citizens' Telephone Company of Grand Rapids, Mich., on "Independent Improvements and Possibilities," especially along the line of long-distance service. He referred to the vast growth of Independent toll-line development during the last decade and laid especial stress on the statement that the public everywhere is satisfied with the Independent service. The construction of standard Independent toll lines he considered to be fine and constantly increasing in efficiency. To the service itself, he thought, there would be no limit.

A. L. Tetu of Indianapolis, who is about to remove to the Pacific Coast as general manager of the Independent system in Washington and Oregon, thought Independent long-distance prospects most promising, and urged the operators of the Central West not to surrender to the opposition at this or any other time. "The eyes of the entire country," he said, "are upon you to see what you will do with the Bell overtures."

Senator C. W. Kline of Hazleton, Pa., remarked that the sooner Independent operators realized that long-distance business must be divorced from local business the better, because "not until then can you expect to give really good service." All the interests in a state, he thought, should get together and form an overlying long-distance company, which should build standard lines to connect with standard local lines.

A. B. Hulit of Chicago spoke about the advisability of consolidating telephone and telegraph lines and said that Chicago alone had many business houses owning private wires worth many millions. These wires, he thought, could be made more efficient and productive if the Independent telephone companies would make use of them. "The time is coming," he concluded, "when all of us will rally to a movement whose possibilities cannot be grasped without a little consideration, but which is bound to produce great results."

Senator C. W. Kline then presented a resolution which extended in eloquent terms the hearty appreciation and thanks of the association to President Hoge for his untiring and fruitful efforts in behalf of Independent telephony during the last three years. The resolution was unanimously adopted and a copy ordered engrossed and presented to Mr. Hoge.

Exchange of Business.

The much discussed proposition by which the Independent companies are said to have been offered the local business in certain localities provided they turn over the long-distance business to the Bell lines was disposed of by the adoption of the following resolution presented by Mr. Kline.

Whereas, the Bell Telephone Company is insidiously proposing long-distance connection to local Independent telephone companies in various parts of the United States and offering in consideration of entering into such connection to abandon the local field; and

Whereas, it is the sense of this convention that any such connection is bound to injure the Independent telephone cause as a whole.

Therefore, be it Resolved, that this association frowns upon and denounces any affiliation or connection of Independent telephone companies with the Bell company anywhere on the American continent as being injurious to the people as a whole.

A resolution was also adopted concerning the infringement of one Independent telephone company on the territory of another company, and it was the sense of the convention that "the company on the ground and satisfactorily serving the public shall be entitled to recognition by this association, and any company or individual infringing on the rights of such Independent company shall be repudiated and shall not be admitted to membership in this association."

Reports of the California, Canada and other state associations were read and placed on file, whereupon the convention adjourned until 2 p. m.

Election of Officers.

On Thursday the following-named officers were elected: President, Theodore Gary, Macon, Mo.; first vice-president, Frank L. Beam, Columbus, Ohio; second vice-president, Charles E. Sumner, Portland, Ore.; third vice-president, E. B. Fischer, Grand Rapids, Mich.; fourth vice-president, Alpheus Hoover, Toronto, Ont.; secretary, Charles West, Allentown, Pa.; treasurer, Manford Savage, Champaign, Ill.

[Continued on page 511.]

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DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.
National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.
Illuminating Engineering Society (first annual convention), Boston, July 30 and 31, 1907.
International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7 to 9, 1907.
Illuminating Engineering Society (first annual convention), Boston, week of July 28-August 3, 1907.
Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.
Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.
American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

THAT HIGH-TENSION power transmission is a subject which is attracting the close attention of electrical engineers was shown by the interest manifested in the special high-tension transmission meeting of the Institute in Chicago last week. Two hundred gentlemen were present at the opening session. The printed "introductions to discussions" were not long, but to the point, and served well to bring out spirited discussion. It was apparent from the large number of written contributions to the discussion that the subject of high-tension transmission has been receiving careful study. There was a healthy difference of opinion on some of the points brought out, which leaves plenty of room for further consideration of the various branches of the subject at a meeting to be held under the auspices of the high-tension transmission committee on the occasion of the annual convention of the Institute at Niagara Falls.

Both the three-phase and the single-phase transformers had their advocates, and likewise it was shown that enclosed station wiring—the surrounding of conductors by continuous fireproof barriers—is good practice in some instances, while in others such precautions constitute a useless expenditure of money. So that the transformer and wiring questions will probably reach their solution on the basis of a dividing line between the fields of practical and economical usefulness of the two types and methods.

Overhead grounded conductors on transmission lines are being used to good advantage in many localities, and this formed the basis of a good discussion on the protection of transmission lines against lightning and other disturbances. The paper of R. P. Jackson on potential stresses as affected by overhead grounded conductors offered some good suggestions in the matter of effective arrangement of insulators and other protecting devices.

The local committee is to be congratulated on its enterprise in arranging a high-tension transmission inspection trip following the meeting, which not only proved a beneficial outing but also afforded an opportunity of seeing the practical side of the high-tension transmission problem as exemplified in the plants of the Grand Rapids and Muskegon Power Company, one of which is now transmitting energy at 66,000 volts and the other being prepared for 100,000 volts.

TELEPHONE COMMUNICATION has made hitherto but slow progress in Great Britain, compared with other countries. This apathy to the use of one of the greatest conveniences of modern civilization appears to be wearing away, however. The postmaster-general in a recent report shows a sharp falling off in the receipts from letter postage and telegrams, and this fact is attributed to a greater use of the telephone. No doubt the message-rate system, which is only of comparatively recent introduction, is a factor to be reckoned with. Then, too, no less than 78,000 miles of new telephone wire was erected during the year last reported—a mileage which would have been easily eclipsed but for difficulty in securing rights-of-way or "way-leaves." This difficulty is also experienced in connection with power-transmission projects, and is to be expected in a conservative and thickly settled country, where the erection of additional pole lines is regarded with disfavor. It is interesting to note that the underground telephone and telegraph cable system connecting cities is being constantly extended in Great Britain; the amount expended on plants of this description now reaching a total of $6,250,000.

IN IRELAND the effect of the new metallic-filament lamps on the central-station industry is being carefully considered, as indeed it is everywhere. Mr. W. Tatlow, an electrical engineer of Dublin, recently read a paper on the subject before the local branch of the Institution of Electrical Engineers. He came to the conclusion that these improvements will ultimately reduce the consumption of many large customers, although no doubt the full economy will not show itself in the reduction of kilowatt-hours used, as more powerful lamps will probably come into use than the 16-candlepower lamps now universally employed. The reduction in current consumed will, however, undoubtedly be more than counterbalanced by a great extension in the number of consumers; the change will involve dealing with a larger number of consumers and collecting a larger number of accounts for a given sale of units. On the other hand, the load factor will probably improve slightly. Whether the change may postpone the necessity for increase of plant in stations already nearly fully loaded is therefore a matter of some doubt. Mr. Tatlow, on the whole, takes the optimistic view of the matter, to which we are accustomed in this country. He believes that with the improved lamps consumers will be well satisfied to pay the rates now in general use, for they will have electric light cheaper than gas—a situation which will be reached without any reduction in the existing rates for current.

WHAT is the real cost of producing power by the various methods in use in electric generating stations? The question is so complicated, involving so many variations in engineering conditions and practice in methods of bookkeeping that fair comparisons on a common basis are almost impossible. Prof. Charles E. Lucke of Columbia University has made a study of the subject, and he says that "The determination of power costs is not only a question of geographical location, a question of the generating system, a question of the size of the apparatus, a question of the perfection of its design, a question of the load condition, but it is also a question of accounting, and the engineer engaged upon a question of this sort must not only be an engineer but something of a financier and an accountant."

However, to stimulate discussion, Professor Lucke made some figures of comparative values under certain assumed conditions and published the results in a recent paper read before the American Electrochemical Society. He compared waterpower development, oil engines, gas engines and producers and steam engines, assuming a 24-hour continuous load in each case. In the case of the oil engines 250-horsepower units coupled to 160-kilowatt generators were taken for example, and the station was supposed to contain six such units. As typical of steam engines, a plant of six 5,000-kilowatt units was selected, while for gas engines a station containing six 1,000-horsepower units driving 600-kilowatt generators was chosen Steam turbines were not considered in the steam plant, the author saying that the net result would not be very different from that of the reciprocating engines. Under these assumed conditions the comparison of power costs was figured as follows:

Waterpower—First cost per kilowatt rating, $75 to $200; total power cost per kilowatt-year, $8.50 to $25.

Oil Engines—First cost, similarly, $217; cost of power per kilowatt-year, $78.64.

Gas Engines and Producers—First cost, $270; annual cost of power per kilowatt-year, $65.54.

Steam Engines—First cost, $110 to $150; power cost per kilowatt-year, $85.50 to $97.50.

These estimates, while very conservative and based on 100 per cent. power factor, are nevertheless very interesting. The hydro-electric plant shows up very favorably, although it is to be noted that the cost of transmission is not included. The author thinks it likely that gas power will be cheaper than steam when the load factor is high and that the difference will be greater as the cost of coal is greater.

In the discussion Mr. W. L. R. Emmet said that it is probable that further improvements will be made in the economies of large steam-turbine units. He declared his belief, however, that these improvements will not be of very radical importance, since the limits are being approached. "There seems to be a large scope for improvement in the design of boilers for such wholesale steam production," said Mr. Emmet, "and I look for considerable advance in this direction."

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Washington, June 4.—Already sure of the distinction of possessing the most ambitious programme yet attempted, there is little doubt that the thirtieth convention of the National Electric Light Association, begun at the New Willard Hotel in this city today, will likewise prove to be the most largely attended in the history of the organization. At the present writing, 4 p. m., the registration has reached 1,400, and the total will undoubtedly be several hundred higher before the convention comes to an end on Friday. Many of the men prominent in the central-station industry of the country are in attendance, including W. H. Blood, Jr., of Boston, E. H. Davis of Williamsport, L. A. Ferguson of Chicago, H. L. Doherty of New York and James I. Ayer of Boston, former presidents of the association. Arthur Williams of New York, the president now in office, is in the chair during the sessions of the present convention. He is ably assisted by Dudley Farrand of Newark, N. J., the first vice-president, who will succeed Mr. Williams if the precedent of the last few years is followed, and by W. C. L. Eglin of Philadelphia, the efficient secretary and treasurer.

The arrangements for holding the convention are excellent. There is a meeting room, with seating capacity for 350 on the tenth floor of the hotel. Adjoining it is a larger room, beautifully decorated both by day and at night, used for the exhibition of electrical apparatus made by associate company members of the association. In tastefulness of arrangement this exhibit exceeds anything heretofore attempted by the association. Signs, railings and posts are uniform and of white and gold. Festoons of lamps and greens depend from the lofty ceiling, with various lamp designs and other decorations, and the whole is a delight to the eye. This exhibition, with floods of light, music, attractive exhibits and a throng of ladies and gentlemen in evening dress, formed a brilliant picture at the opening of the display last evening. Following this opening there was a formal reception at nine o'clock, a large number of ladies and gentlemen standing in the receiving line, and the occasion was later turned into an enjoyable dancing party—a transformation particularly easy, as the meeting and exhibition quarters are in ordinary use ballrooms of the hotel.

The arrangements for registration are particularly effective. Advance registration was solicited, and badges bearing the names of recipients were prepared. These were presented to all entitled to them on arrival. The registration room is supplied with railings and windows like a bank, the badges and other material being handled alphabetically by delegates' names at the three windows, one being A to H, and so on.

Tuesday's Proceedings.

President Williams made an apology for calling the association to order a quarter of an hour after the announced hour (owing to the starting of an automobile party) and gave warning that future sessions would be begun promptly on time. He introduced Gen. George H. Harries, vice-president of the Washington Railway and Electric Company, who has had much to do with the success of the convention. General Harries spoke briefly and said that the District of Columbia had a form of government which many other cities might envy. The municipal administration is thoroughly clean; every dollar appropriated goes directly to the one item for which that dollar is appropriated; there is no "rake-off." The speaker concluded by introducing Hon. H. B. F. Macfarland, president of the Board of Commissioners of the District of Columbia, who delivered the address of welcome.

Mr. Macfarland made an exceptionally bright, clever speech, beginning by quoting the addition to the litany proposed by the witty bishop of Missouri—"from our traducers and our introducers good Lord deliver us." He said that when a public officer of the District had to have a certificate of character from the manager of a public-utility corporation, it was time to elect Governor Hughes to the presidency. He remarked that Washington should be particularly interesting to men engaged in electrical development, as it has been the temporary or permanent home of a number of famous men, like Henry, Morse and Bell, who have contributed to the advancement of the art. In eloquent phrase Mr. Macfarland pointed out that all citizens of this country have a right to feel at home in Washington. "All Americans are free citizens of the national capital by right of birth. Renew here at the very altar of your country the fires of your patriotism."

President Arthur Williams of New York then delivered the annual presidential address, which follows in full.

President Williams' Address.

It gives me pleasure to welcome the delegates and those with them to our thirtieth convention. This is the second meeting of the association in this beautiful city. The former was held here early in 1894, slightly more than 13 years ago.

Then the active, Class A, membership included 107 companies; now it includes 709 companies; then there were 112 associate, Class D, members; now there are 151; then we had 27 honorary members, now 31. In these three classes there were then 246 members; now there are 884 members.

Since that convention two membership classes have been added—the B now including 317 members and the E including 85 members—a total of 402 members, making at present an aggregate in all classes of 1,286 members.

In addressing that convention President Armstrong stated there were "upward of 2,300 central stations in this country, representing at least $200,000,000 of capital." According to our honorary member, Mr. T. C. Martin, in his United States Census Report on the North American Continent, there are now more than 5,000 central stations; the investment in the United States alone has reached $850,000,000; the gross annual revenue $165,000,000, the gross return yearly thus approximating the investment of the industry in 1894.

Then the dominating thought was technical, mechanical and electrical. The American in whatever he does moves rapidly. In operating limitations, development toward the practical, if not the ideal, has about been reached, and now the predominating thought in a convention such as this, while giving due regard to engineering problems, tends more especially to the commercial development and to broad questions of management which, in the highest sense, affect our relations with the general public.

Notwithstanding this change the technique of our industry has not been neglected in the programme of this convention. Much that is new in protective devices will be presented; we shall hear of recent developments in the steam turbine; the gas engine will receive the attention it appears increasingly to deserve, and in connection with the report of the committee on street-lighting specifications we may expect to hear of the latest developments in incandescent and arc lamps and in other forms of artificial illumination. Upon these and other technical matters we shall hear from some of the country's highest authorities.

Examples of the new tungsten lamp consuming slightly more than one watt per candle will be on exhibition; metallized filaments may now be obtained in quantities with an efficiency of 2½ watts, and we are given to understand that this lamp will soon be available with an efficiency of two watts per candle. In this room will be shown mercury, magnetite and other luminous arc lamps, and we hope the meeting will result in much available information concerning their illuminating power, adaptability and practical usefulness in commercial service.

These higher efficiencies in incandescent lamps will introduce new problems in the management of central stations. Thus far the consumption of the lamp as a unit has been changed but little, the improvement being an increased illuminating power. More light may thus be obtained by the consumer without increase in the cost or material reduction in the load on the station.

The increase in the use of incandescent lamps during the last five years may be of interest. In 1900 the number used was 21,191,131; in 1905, 88,333,285 lamps of 16 candles.

During the year the association's committees have rendered splendid service. To attend meetings some of the members have traveled great distances. Their reports should be received with close attention. Perhaps passed over, sometimes without much apparent notice, undoubtedly the reports of our committees have done much to mold the opinions and methods of our membership.

Though not the time to consider in detail our committee work, I cannot but refer to the success attending the efforts of a sub-committee of the public policy committee, consisting of Messrs. Charles L. Edgar, chairman, Samuel Insull and J. W. Lieb, Jr., in securing a satisfactory adjustment of the differences between member companies at Lockport, N. Y.; nor should I fail to refer to the manner—thoroughly public-spirited and in the interest of our industry—in which the executives of these companies and their respective boards of directors have co-operated in every practicable way in making possible the satisfactory solution that has been reached.

The public policy committee has accomplished another notable feature in securing closer relationship for suggesting proper ways of maintaining more cordial relations with the public between the other public-service interests and our own. Representatives of the several associations met at the invitation of the chairman, Mr. Everett W. Burdett, and, at the suggestion of that gathering, each of the represented associations has appointed, or will appoint, two members to form a joint working committee for the purpose of securing closer intercourse and more frequent exchange of views. So important has been the work of this committee that an entire evening has been assigned to the reception and consideration of its report.

Questions have arisen recently concerning the rating of the so-called 2,000-candlepower municipal arc lamps. Those of our members who have occasion to refer to this matter would do well to consult the "Report of the Special Committee on the Rating of Arc Lamps," appearing in the Proceedings of the 1894 convention, which will be referred to more fully in the report of the committee on street-lighting specifications. Recent improvements in arc lamps and the possibility of their adoption for street illumination has made it seem desirable to consider the practicability of returning in some form to a candlepower rating. It was for this purpose that the committee was appointed, of which our first vice-president, Mr. Dudley Farrand, is chairman. Several meetings were held during the year, each attended by every member, and the report should be awaited with a great deal of interest.

Corporation accounting is receiving widespread attention. That which is desirable for one company would seem so for another—allowing for local differences. Your committee on this subject, of which Mr. H. M. Edwards is chairman, consists of eminent accountants; its report is most complete and the efforts of our association should be toward its general adoption, at least basicly, throughout the accounting methods of our industry.

A report will be submitted by the committee on dues, of which Mr. W. H. Gardiner is chairman, looking to an increase in the revenue of the association. With the occupancy of the larger offices go increased expenses, and the work of the association as a whole is so broadening out that increased expenditure will be required. The object of the committee has been to provide additional revenue, placing the increase fairly upon those who are best able to bear it.

It seems fitting to mention that but a portion of our expenditures is made through the association's treasury. The contributions of some member companies—direct and indirect—amount to large sums each year. Take as an illustration the member who travels hundreds of miles and gives several days of his time; as another, the subscriptions toward our convention expenses. In many other ways these expenditures may be large, but not the slightest complaint has been made, and each member seems to feel that more than an equivalent is returned through its connection with the association.

The committee on constitution and by-laws, of which Mr. Samuel Scovil is chairman, will make a report at one of the executive sessions. This report, while containing few if any radical changes, makes the constitution and by-laws more convenient and clear upon some points concerning which in the past doubt may have arisen.

Co-operation promises to be one of the keynotes of the century's progress. As elsewhere, it extends into the field of advertising. The committee appointed to consider the subject, of which Mr. W. W. Freeman is chairman, has worked in conjunction with the Co-operative Electrical Development Association, and a report of its conclusions will be made at a later session.

In the movement toward the municipal socialism, which for a time threatened to sweep the country, there seems to have been a pause. As opposed to it Chicago and London have won notable victories during the year. This appears to have been done entirely through an educational appeal to public reason. The facts for and against the movement have been fully and clearly stated and the public was not slow in deciding between right and wrong, nor long in making known its decision.

Fair play may be expected from the American public. But it must have facts, not personal opinions with nothing behind them other than "mere assertion." For many years the public has heard only one side of the question and therefore could not do otherwise than form a one-sided—and as subsequent events have proved—a wrong opinion. This pause should not be considered as a victory. Rather, simply an indication that the public is willing to hear both sides and to render its opinion in favor of those who, in their treatment of the public, are in turn entitled to public support.

The power of public opinion and the resistless force it exerts when centered upon a given subject has been one of the object lessons of the year. It promises to become increasingly a predominant feature in the conduct of the affairs—political, corporate and individual—of our American municipalities. It should be carefully studied, shaped where wrong and always reckoned with.

Our own is one of the industries through which public opinion may be greatly affected. The men who are in attendance at this convention are in a position personally, and through their subordinates, to make an impression for good or for ill upon a

large percentage of our 80,000,000 of population. Whether our rates are fair and made without discrimination; whether our representatives are competent and courteous; whether our service is of high standard, all are elements which go to make public opinion favorable or unfavorable, and in this there is no detail too small or seemingly too unimportant to receive attention. We shall surely reap what we sow.

It would be desirable could our association agree upon some approximately common method, or methods, of charging for electric current. If one method cannot be considered best, several eventually might be recommended, each possessing recognized elements of fairness to the public as well as to the supplying companies.

The "sliding scale," fixing a maximum price and a minimum dividend, is receiving increased attention. It seems to offer advantages in uniting the interests of the public with those of the supplying companies. Its application and range of usefulness may be considered in the report of the public policy committee.

At the last convention in this city the question of pending legislation in the various states of the Union was given consideration. It is today a live question. To obtain and send this information to our members seemed almost impossible until one of the reports of the public policy committee became available, which showed not only the practicability of the plan, but how well it could be carried out. Central-station managers are usually much engaged with their work, and without notice hostile and unfair legislation may at any time be passed. Were there a method through which every member in a given state could be advised of such measures, combined and united action would go far toward preventing results harmful to the industry and, reactively, to the general public.

The relations with the insurance interests of the country continue pleasant. In expressing his regrets that he could not attend the convention, Mr. G. M. Goddard, secretary of the Underwriters' National Electric Association, says he would enjoy the privilege of meeting many of the representatives of the N. E. L. A. and the representatives of our members, because he believes the relations between the underwriters, who are particularly concerned in the matter of the National Electrical Code, have become in the past few years more and more cordial.

During the year the offices of the association have been moved from 136 Liberty Street to West Thirty-ninth Street, near the Grand Central Station and but a block from the new public library. The new offices are in the Engineering Building—made possible through the generosity of Mr. Andrew Carnegie.

In closing it is but fair to say that during the year the secretary's office has been conducted admirably. One not directly connected with the affairs of the association cannot realize the amount of work done and the responsibility resting upon these offices. Warmest praise is due our secretary and treasurer, Mr. W. C. L. Eglin, and our assistant secretary and treasurer, Miss Harriet Billings.

The secretary will report in detail at a later meeting upon the various matters considered by the executive committee during the year.

Miscellaneous Business.

Secretary Eglin announced that the Consolidated Gas, Electric Light and Power Company of Baltimore extended an invitation to visit its new Westport power house and also offered other courtesies to visitors to Baltimore. The McCalls Ferry Power Company also invited the convention people to visit its hydro-electric plant at McCalls Ferry, Pa., on the Susquehanna River.

President Clayton H. Sharp of the Illuminating Engineering Society sent a letter saying that the annual meeting of that society would be held in Boston on July 30th and 31st.

Asbury Park and Atlantic City, N. J., and Boston, Mass., extended invitations for next year's convention.

T. Commerford Martin presented an abstract of the report of the committee on progress. The development of the year was reviewed, with electrical statistics from foreign and American sources. Mr. Martin remarked that part of the electrical development of this country was due to the remarkable growth and progress of the country in general. It was a process of evolution as well as an exhibition of acumen and enterprise by electrical men. He asked whether it might not be possible to force evolutionary processes too fast by, say, campaigns for new business and thus obtain development at too great an expense.

Lüpke on Accidents.

The clever paper of Paul Lüpke of Trenton, N. J., was read by T. Commerford Martin. It was entitled "Accidents" and abounded in epigrams. A few may be quoted:

"Be wary of prevailing tendencies. There is no 'deadbeat' instrument to measure their true value, so do not get caught taking a wild swing for a true reading."

"Provide everything that will help to keep the place clean, but keep out, as much as possible, things that must be kept clean. There is no more unsightly thing than tarnished brass; there is no more unprofitable labor than polishing brass; then why the brass? Bric-a-brac and business don't mix."

"And now, as to men. I say get them green whenever that is feasible. Have a standard of your own and educate them up to it. Starting with nothing is easier than starting heavily in debt. The right time to look out for your head fireman is when you hire a coal-passer; for your chief engineer, when you hire an oiler; for your chief electrician, when you hire a machine-wiper. This plan avoids much shifting. Floating help is a most serious hindrance to economy and good service. Any bully can discharge a man, but it takes a sage to hire a better one in his place."

"Nevertheless, in spite of all that may be done to prevent them, accidents happen, for there are many conditions that come to you as unsolicited as original sin; but every accident that does happen must be considered as an opportunity for improvement."

"Do not stick your head in the sand and call a thing queer. Things are queer only to the lazy, the ignorant, and the man that is afraid to know."

"Remember, the utter absence of the need for hurry is immeasurably preferable to the most brilliant exhibition of it. The man that skips over an accident with the remark, 'Oh, that's nothing! Little things like that happen every day; we can't help it!' is a dangerous man to have around. He has arrived at the same mental state reached by the copious liar when he begins to believe himself."

"Complaining about the stupidity of your help but proclaims your own. Patience and persistence must be your watchwords. Repetition may be tiresome, but the truth has nerves of iron and can stand it."

"Put your house in good repair before you invite people into it. Do not hang out a gilded sign on a ramshackle shanty. Advertising a plant that has outlived its usefulness is on a par with feeding medicine to a corpse."

Mr. Lüpke's paper was received with very hearty applause.

Other Papers of Tuesday Morning.

F. D. Newbury of Pittsburg presented a summary of his paper on "Power-factor Correction by Synchronous Motors." He pointed out how, in some cases, the bad effects of low-power factor may be overcome by the proper application of over-excited synchronous motors. The motors are run without load simply to raise the power factor—as synchronous condensers, in fact. There are three cases in which this practice may be desirable—where the trouble can be remedied only by the employment of synchronous condensers; where, in proposed systems, there will be a large inductive load, with large cost for feeders and transforming apparatus, and, finally, in proposed systems with large inductive load in which slow-speed generating units, as gas-driven units, will be used. There was no discussion of this important technical paper.

The Question Box, prepared by Mr. Lüpke, was presented. Paul Spencer of Philadelphia read the introduction, in which Mr. Lüpke suggested the establishment of a Bureau of Information to suggest answers to questions when submitted and later to present to the association the questions and answers of general interest. This plan was advocated also by H. T. Hartman of Philadelphia, Douglass Burnett of Baltimore, Alex Dow of Detroit and W. H. Gardiner of New York. On motion the subject was referred to the incoming administration, with the recommendation that the idea be adopted, with such modification of detail as might prove practicable.

Insurance and Standard of Construction.

W. H. Blood, Jr., of Boston, the insurance expert of the association, presented a valuable report. Somewhat abridged, it is as follows:

"The association has, for several years, felt that it was handicapped at the annual meetings with the Underwriters' National Electric Association in the consideration of the changes in Code rules; that no one took enough personal interest in the proposed changes to discuss them intelligently with the representatives of the underwriters, who made it an important part of their regular business.

"This year, your representative spent over a week in preparation for the meeting and practically a second week in attendance at all of the sessions in New York. Of approximately 1,000 proposed changes only about 100 were passed, and many of them were of minor importance or simply improvements in phraseology. It is gratifying to state that your representative was instrumental in preventing the passage of several radical changes which would have worked hardships upon the lighting companies. One rule, in particular, in regard to wiring in show windows, which the electrical committee of the underwriters approved for passage, was resisted by your representative and finally defeated. The passage of this one rule would have meant a loss of hundreds of thousands of dollars to the lighting interests of the country and would have affected most seriously the small and medium-sized companies, which need every dollar of income they can obtain.

"As a result of the interest shown in these meetings, your representative has been appointed on several committees of the Underwriters to report on further modifications of the rules. One of these committees is to consider the complete recodification and reclassification of the National Electrical Code.

"There is a strong tendency on the part of some inspectors and more contractors to insist upon the most expensive forms of construction and to enact rules making such construction obligatory. This tendency is to be regretted and should be combatted. So long as the wiring is safe and conforms to city and code requirements, the matter of kind should not interest inspectors. Contractors should see that to increase the cost of installations tends to decrease the use of electricity and, consequently, the number of wiring jobs and their attendant profits. On the other hand, the electric-light companies should insist on nothing but safe wiring and should resist the passage of rules requiring unnecessarily expensive construction, tending to depopularize the use of electricity without increasing the safety.

"Your representative has given advice to numerous small companies belonging to the association, in regard to the best forms of insurance policies to cover their plants and properties, together with recommendations as to the wording of insurance riders, improvements in rates, etc.

"As an expert witness in several important suits brought by insurance companies against one of our member companies, your representative has been able to render some service. This matter alone has required nine special trips to New York and approximately 20 days of time.

"Your representative holds himself in readiness to act upon any suggestions from members of the association and to give his services in negotiations with the underwriters, in the presentation of new or the revocation of old rules, in court cases when expert services are required, and, in fact, in all matters pertaining to insurance business."

President Williams said the services of Mr. Blood were of the utmost value. The report was discussed briefly, A. A. Dion of Ottawa, Ont., and others taking part.

Fire Hazard of Electricity.

C. E. Skinner of Pittsburg presented the report of the committee on the fire hazard of electricity. He said that the appointment of the committee to bring in a report at the annual meeting of the association last year was due to complaints which had been made by members of the association that publications put out by the underwriting interests, giving figures for the number of and losses by electrical fires without comparative figures for other hazards, was working a hardship to the electric-lighting interests. As one result of its work the committee reached these conclusions:

First—We recommend that the association take action looking to systematic and uniform inspection throughout the country, this inspection to be based on the National Electrical Code.

Second—We recommend that each member company appoint some individual, a part of whose duties it shall be to follow up all fires in the company's district that may be attributed to electrical causes; to see that, if possible, the exact facts are ascertained and published, and that no statement be allowed to stand that fire was supposed to have been caused by electricity unless this is proven to be the case.

Third—We recommend that it shall be the duty of the secretary's office to collect and distribute information relative to the fire-hazard situation. This should include the collection and editing of information furnished by the member companies which will be of value to the members of the association in general; the collection and distribution of information relative to the installation and inspection of apparatus in accordance with recognized standard methods; the collection of statistics covering the general insurance situation; and, through the proper committee or officer appointed by the association,

to bring before the Underwriters' National Electric Association such suggestions for changes and modifications of the Code as may be found necessary or advisable through the work carried on as above.

An executive session of the association was held after the presentation of Mr. Skinner's report, and adjournment was then taken.

RECEPTION BY PRESIDENT ROOSEVELT.

The feature of Tuesday afternoon was the special reception of the association at the White House by the president of the United States. Only members and guests wearing badges were admitted to the executive mansion. The ladies and gentlemen present walked in procession to the White House and formed a long line, which passed by the president, standing in the East Room. Mr. Roosevelt shook hands with every man and woman in the line and had a pleasant word or smile for each. There must have been a thousand or more in line, and the task could not have been other than fatiguing. The visitors to Washington were greatly pleased with the president's gracious kindliness at undoubted discomfort to himself.

ELECTRIC LIGHT ACCOUNTING.

The evening session of Tuesday was largely devoted to a discussion of the report of the committee on electric-light accounting, presented by H. M. Edwards of New York. Mr. Edwards not only presented an abstract of the report as chairman of the committee but also presided at the session while this subject was under consideration. This innovation was due to Mr. Williams, who said he thought that the man who had conducted the work of the committee might very well preside while the report of that committee was discussed, owing to his familiarity with the subject and with the men best fitted to shed light upon it.

The report of the committee was an elaborate one and was devoted to the discussion of general construction, operating and income accounts. These subjects were treated with various subdivisions and details to which only reference can be made in a telegraph outline such as this. It was evident that the report represented painstaking work, and at the end of it a number of bookkeeping forms were given. In discussing it Isaac B. Smith made the point that uniform accounting is of special importance to all companies operating electric railways which come under the scope of the Interstate Commerce Commission.

Some companies in the association operate both light and railway plants. F. L. Dame suggested that a conference committee take the subject up with the Street Railway Accountants' Association. The two systems of accounting might be kept on nearly the same basis. W. H. Gardiner of New York suggested the adoption of the kilowatt of capacity as the unit rather than the kilowatt-hour of output. Costs vary by maximum momentary demand; output costs are much less in amount. This is with load factor of 25 or 30 per cent.

John H. Gulick of Chicago pointed out that the adoption of uniform accounts by the association would very likely influence state governments and the national government in adopting that system. The speaker favored uniform accounts for illuminating companies. Stanley Baker thought the system suggested in the report too complicated. W. H. Coughlin of Worcester, Mass., said that the first thing was for the various state commissions to standardize their own ideas of accounting. Mr. Edwards remarked that probably if the association adopted a standard system of accounting the various state commissions would follow it.

Alex Dow of Detroit said it was of importance that the small plant and the large plant keep their accounts on the same general system. The small towns can simplify the system by consolidating details under the various headings. T. F. Wickham thought the report a little too elaborate; it is apt to frighten the smaller companies. Everett W. Burdett of Boston declared that no company is honest with itself which does not recognize the existence of depreciation represented by no other account. It is hard for new struggling companies to recognize this, perhaps, but they should. The time will come or has come when the public will pay the public-utility companies only a reasonable return on a reasonable investment.

A uniform system of correct accounts will prevent inquisitorial methods of ascertaining this. The standardization of accounts will go very far toward establishing the stability of the business in its relation to the public. H. T. Hartman of Philadelphia found one error in the report—the apportionment of expenses on kilowatt-hours sold. The system of service charges and output charges should more accurately represent the facts.

President Tingley of the Street Railway Accountants' Association said that the system of accounts devised by his society had been adopted by practically every state in the Union except Massachusetts. Mr. Tingley complimented the exhaustive and painstaking work put into the report, but nevertheless he took issue with it; it differs radically from the state railway system, which is built on lines of maintenance, operation and transportation, whereas the electric-light report is based on generation and distribution. The street railway system of accounts cannot very well be changed; therefore he thought that the electric-light people should conform to it, else there will be much confusion where lighting and railway plants are operated by one company.

Finally, on motion of J. B. McCall of Philadelphia the committee was continued for another year and the report was referred back to it.

RATES AND CHARGING SYSTEMS.

G. W. Betts, Jr., of New York read a paper on "Legal Justification for Differential Rates." He said that a differential based on a reasonable difference in the cost of producing service is not contrary to law. At common law rates should be fair and reasonable but not necessarily uniform. Statutory enactments may modify this, of course. In relation to differentials based on quantity of current consumed there is a little doubt, but the speaker thought they were justified. Competition also might modify the question of making differentials.

W. W. Freeman of Brooklyn said an important question was the right of the customer in changing from one schedule to another. It has been claimed that the company discriminates if it does not point out to the customer the lowest schedule for his business. But if the company accepts the business on the higher schedule unintentionally it would seem that the customer could not recover. Of course the schedules are open to all customers to do their own figuring.

J. F. Geisler of Waynesboro, Pa., said that in his plant a "service unit" system of charging is used. This is based on a certain number of hours' use and a certain number of kilowatt-hours. There are rates for the first, second and third service-unit hours, and so on.

Frank Conrad of Pittsburg abstracted his paper, "Commercial Development of the Mercury Rectifier." As the hour was late there was no discussion on this paper or on that of D. B. Rushmore of Schenectady, entitled "Recent Developments in Protective Apparatus." This latter paper was abstracted by Mr. Dubois. It described several new lightning arresters, among them the graded-resistance multi-gap arrester, the aluminum cell arrester and the liquid electrode arrester. It was nearly 11 o'clock when adjournment for the day was taken.

Wednesday Morning's Session.

NEW METHOD OF DETERMINING STREET ILLUMINATION ADOPTED.

Washington, June 5.—Important action was taken at this morning's convention session, which was one of the most interesting held in years. Dudley Farrand of Newark, N. J., chairman of the committee "to consider specifications for street lighting," presented the committee's report. This strong committee has done effective work and has had many meetings. Besides Mr. Farrand it is composed of Dr. A. E. Kennelly of Harvard University, Dr. C. P. Steinmetz of Schenectady, L. A. Ferguson of Chicago, and Paul Spencer of Philadelphia. All the members were present at the convention and took part in the debate.

In effect the committee recommended that under ordinary conditions of street arc lighting, with lamps spaced 200 to 600 feet apart, specifications should define the mean illumination given by each lamp at some point in the street not less than 200 nor more than 300 feet from the lamp, as measured at the height of the observer's eyes and perpendicular to the rays. The illumination at this point shall not be less than that given by a stationary standard incandescent lamp of 16 candlepower placed at a certain proportion of the distance between the observer and the arc lamp. This proportion is to be fixed in advance by agreement. For instance, it might be one-tenth of the distance separating the observer from the arc lamp.

After a most interesting debate this report was unanimously adopted. On motion of Mr. Ferguson the committee was continued and authorized to fill out the report with some data now lacking which are supplementary to the report. If the executive committee then approves the report, as is of course to be expected after the decisive action of the association, the report is to be officially promulgated with the approval of the association.

By a further resolution, offered by Samuel Scovil of Cleveland and adopted by the association, it was declared that the 450-watt test adopted at the Washington convention of 1894 is still a proper one for the old open-arc carbon lamps and the usual types of enclosed arcs, but is not a proper test for flame or luminous arcs, magnetite arc lamps or mercury-vapor lamps.

Besides the members of the committee, W. D'A. Ryan of Lynn, Mass., F. W. Willcox of Harrison, N. J., Dr. E. P. Hyde of the Bureau of Standards, Washington, D. C., Alex Dow of Detroit, Dr. Edward Weston of Newark, N. J., A. J. Decamp of Philadelphia, Philip Torchio of New York, J. J. Burleigh of Camden, N. J., P. S. Millar of New York, John F. Gilchrist of Chicago, H. L. Wills of Savannah, Ga., and others took part.

Further and more extended reference to this important action will be made next week, when the conclusion of the report of the session of today, tomorrow and Friday will be given. W. E. K.

The Chicago "Special."

Over sixty ladies and gentlemen traveled from Chicago to Washington on the special convention train which left the former city on the Pennsylvania Railroad shortly after three o'clock on Sunday afternoon. The trip was a pleasant one, the train being personally conducted by representatives of the railroad company, with the co-operation of Mr. F. L. Perry, assistant master of transportation for the National Electric Light Association. Every lady in the party was presented an American Beauty rose, with the compliments of the Western Electrician. Another special feature was the hand-painted souvenir menu cards, arranged by Mr. Perry, which were not only attractive in an artistic sense, but also caused amusement by plays on words. The coffee, for instance, was spoken of as "grounded circuits." Following is a list (alphabetically arranged) of the names of the persons composing the party:

Fritz Bernstein, Grand Island Electric Company, Grand Island, Neb.; E. M. Bischoff, Westinghouse Electric and Manufacturing Company, Chicago; W. E. Blachley, Pennsylvania Railroad Company, Chicago, Ill.; R. E. Brown, Mankato Gas and Electric Light Company, Mankato, Minn.; Joseph W. Busch, Westinghouse Electric and Manufacturing Company, Chicago; W. H. Colman, General Electric Company, Chicago; H. Y. Darnell, Pennsylvania Railroad Company, Philadelphia; J. R. Cravath, Electrical World, Chicago; S. F. Dibble, General Electric Company, Chicago; C. L. Drain, Marshall Field & Co., Chicago; C. N. Duffy, Milwaukee Electric Railway and Light Company, Milwaukee, Wis.; Mrs. C. N. Duffy, Milwaukee, Wis.; W. H. Fellows, Leavenworth Light and Heating Company, Leavenworth, Kan.; L. A. Ferguson, Chicago Edison Company, Chicago; Master Louis Ferguson, Evanston, Ill.; G. B. Foster, Power Improvement Company, De Laval Steam Turbine Company, Chicago; Mrs. G. B. Foster, Chicago; Edwin J. Fowler, Chicago Edison Company, Chicago; H. M. Frantz, H. W. Johns-Manville Company, Chicago; J. W. Gardner, Allis-Chalmers Company, Chicago; J. F. Gilchrist, Chicago Edison Company, Chicago; Mrs. J. F. Gilchrist, Chicago; H. J. Gille, Minneapolis General Electric Company, Minneapolis, Minn.; C. G. Guild, Fort Wayne and Wabash Valley Traction Company, Fort Wayne, Ind.; J. H. Gulick, Chicago Edison Company, Chicago; W. E. Hicks, C. W. Lee Company, Newark, N. J.; R. C. P. Holmes, Chicago Edison Company, Chicago; Mrs. R. C. P. Holmes, Chicago; H. H. Jones, Springfield Consolidated Railway Company, Springfield, Ill.; Peter Junkersfeld, Chicago Edison Company, Chicago; W. E. Keily, Western Electrician, Chicago; J. D. Kenyon, The Sheldon School, Chicago; Mrs. J. D. Kenyon, Chicago; P. H. Korst, Janesville Electric Company, Janesville, Wis.; Mrs. P. H. Korst, Janesville, Wis.; R. E. Lee, Lee Electric Light Company, Clarinda, Iowa; A. W. Leonard, Minneapolis General Electric Company, Minneapolis, Minn.; Mrs. A. W. Leonard, Minneapolis, Minn.; E. W. Lloyd, Chicago Edison Company, Chicago; Mrs. E. W. Lloyd, Chicago; G. H. Lukes, North Shore Electric Company, Evanston, Ill.; W. B. MacDonald, Evansville Gas and Electric Light Company, Evansville, Ind.; W. D. McJunkin, advertising expert, Chicago; Mrs. W. D. McJunkin, Chicago; Charles A. Monroe, Economy Light and Power Company, Joliet, Ill.; Frederick Pearson, Marshall Field & Co., Chicago; F. L. Perry, Western Electrician, Chicago; Edward Peterson, Crookston Water Works, Power and Light Company, Crookston, Minn.; W. R. Pinckard, Westinghouse Electric and Manufacturing Company, Chicago; Mrs. W. R. Pinckard, Chicago; W. R. Putnam, Red Wing Gas, Light and Power Company, Red Wing, Minn.; Francis Raymond, The Sheldon School, Chicago; G. A. Roth, Roth Bros. & Co., Chicago; Mrs. G. A. Roth, Chicago; Thomas Roycraft, Grand Forks Gas and Electric Company, Grand Forks, N. D.; P. B. Sawyer, Des Moines Edison Light Company, Des Moines, Iowa; Mrs. P. B. Sawyer, Des Moines, Iowa; S. E. Schweitzer, Omaha Electric Light and Power Company, Omaha, Neb.; J. Scribner, General Electric Company, Chicago; C. N. Thorpe, The Franklin Electric Manufacturing Company, Chicago; R. S. Wallace, Peoria Gas and Electric Company, Peoria, Ill.; Mrs. R. S. Wallace, Peoria, Ill.; H. E. Watson, Benjamin Electric Manufacturing Company, Chicago; J. B. Wilkinson, Westinghouse Machine Company, Chicago.

James C. Drake of Tacoma, Wash., who is said to be backed by a large machinery manufacturing company, has presented plans to the City Council of Tacoma, under which the city may soon install a power plant. The scheme includes the installation of a steam turbine plant of 6,000-horsepower capacity, in four units, which may generate current at less than one cent a kilowatt-hour, it is said. The cost of the proposed plant is estimated to be in the neighborhood of $500,000.

Electric Heating Without Special Concessions From the Central Station [1]

By C. D. Wood, Jr.

I shall try to describe some recent applications of heating devices where the devices were made to fit the rates and not the rates to fit the devices. The installations that we shall investigate are supplied with current generated by steam power; heating propositions that are not possible in the case of a steam station are possible where water is the source of power. In January, 1907, not over 15 per cent of the central stations in cities of over 50,000 inhabitants in this country and Canada were giving a special rate of six cents or under for heating and cooking. I am not going to enter into a discussion of the merits of the ribbon unit versus the wire resistance, or the advantages of the quartz-enamel insulation over the mica; but I do assert that when electricity is the source of heat specially designed utensils and machinery must be used if cost comparisons are to be made.

Domestic Devices.

No city in the United States is governed by economic conditions so particularly localized as is the city of New York. The flatiron, our best ambassador of electric heat, will be used nine times out of ten in homes where the laundry work is in the hands of servants; the best way to install an iron in a city residence under such conditions is to interest the laundress and cook first, and then carry your campaign "higher up." We have one case on record where the domestic threatened to leave if the electric iron were not purchased after it had been used on a 10 days' trial. An average family of five persons, where the collars and cuffs are sent out to be ironed, consumes about 13.2 kilowatt-hours of energy per month, which represents, at a 10-cent lighting rate, an income to your station of $15.84 per year. The automatic handle attachment, which cuts off the current when the iron is not in use, has proved a failure, as the operator invariably ties down the handle. A satisfactory automatic cut-off has yet to be developed. For summer use there have been installed in several high-grade dwelling houses electric clothes-dryers, the heating units varying in capacity from five to ten kilowatts, depending on the size of the dryer. A cabinet eight feet high, eight feet wide and eight feet deep may be built in sections, each section equipped with a unit of two kilowatts; this division makes possible a saving of current when a small amount of work is to be done. During the months of July and August, 1906, a dryer of this capacity consumed about 100 kilowatt-hours per month, which was billed to the consumer at a 10-cent rate. The dryer was satisfactory in every respect. Plate warmers of 800-watt capacity are included in the specifications of the architects in many houses. The New York Edison Company has connected as many as 25 plate warmers in as many different houses in one month. The average consumption of these devices is 24 kilowatt-hours per month. Of the small home devices the water cup has been the most pleasing, with the possible exception of the heating pad. We have approached the medical fraternity with electric sterilizers and found them waiting for just such a device. No doctor likes to use gas; his sterilizer consumes about 800 watts, and the average office use of this device is in the neighborhood of 20 kilowatt-hours monthly.

Bookbinding.

The bookbinding industry affords an excellent opportunity for electric heat. It is possible to supplant the gas-heated embossing press with electric-heating units and make a very fair comparison with gas, when electricity is sold for five cents per kilowatt-hour. We have several good installations of this class of apparatus; one I have in mind has been operating steadily for two years. There are three embossing presses in this equipment. The head of the largest is 19 by 12 inches; the machine has a small panel-board placed within easy reach of the operator on which are placed two double-throw switches. There are four resistance units in the press-head placed at equal distance from the center; and by means of a change of connection from series to parallel we get eight different degrees of heat. The large press is rated at 220 volts and 16 amperes. The resistance units may be placed in the holes left vacant by the extraction of the old steam pipes. Some manufacturers supply a hot steel plate which may be placed next to the die; these plates take about five amperes and are connected to the lighting circuit. The machine, 19 by 12 inches, referred to above, reached a temperature of 354° F. with an expenditure of 4.07 kilowatt-hours, starting with a room temperature of 75 degrees. The "running" current or low heat was 0.6 kilowatts, which kept the head at the proper temperature while making 480 impressions of the die per hour. The monthly cost of current for the past year for this work at a seven-cent rate was $8.05 per machine. Twenty-five inversion coil glue pots, two-quart capacity, are installed in a bookbinding house on the Edison system. These pots were installed February 1, 1906, and thus far only one has been replaced. The current consumption has been 812.5 kilowatt-hours monthly, or an average of 1.3 kilowatt-hours per pot per working day.

Welding.

Electric welding has been considered impractical in sections where ordinary power rates of 10 to 6 cents per kilowatt-hour have been available. The New York Edison Company is supplying current for the purpose of welding iron bands used in the trunk industry. Welding machines are used where alternating current is received at, say, 110 volts, a transformer mounted on the frame reducing the current to the necessary pressure. The consumption of a machine while making 480 welds per hour is about 1.16 kilowatt-hours, costing 0.02 cent per weld at a 10-cent rate. A motor-generator set has been used to generate the alternating current, materially lessening the efficiency of the whole plant. This work should be particularly interesting to managers of alternating-current systems.

Steel Cutting.

Electricity was used in the recent construction of the Hoffman House in New York city for cutting steel piling. Alternating current at 50 volts pressure was utilized by connecting one cable to the steel piling itself and the other to a carbon electrode that was fastened by a copper plate to a wooden guiding pole. Six hundred and fifty amperes were developed at the arc, which represents 32.5 kilowatts of current. In an eight-hour day 10 feet of piling could be cut at an expenditure of 260 kilowatt-hours. At 10 cents per kilowatt-hour the work cost $26 plus the wages of the attendant, which made the total cost exactly $3 per foot of piling. It required two men at $4.50 per day and two electric drills consuming 44 kilowatt-hours to drill one foot of piling per day, costing $13.40 per foot. The heating method shows a saving, regardless of time, of $10.40 per foot.

Laboratory Use.

The milk supply of New York city is governed by tests made in the city laboratory by means of electric stoves. Twenty-five 3.5-inch disk stoves of 60-watt capacity are used to boil the ether used in the test. Fourteen times per hour these little stoves cause the ether to vaporize and rise from the containing flask to a condensing chamber that holds the milk to be tested. The ether after condensation is released by a siphon and conducted into the original flask. An open gas flame could not be used for this work. The medical officer in charge was so well pleased with the operation of these stoves that he wished to heat and regulate his incubator, or germ cabinet, with electricity. The germ producer is 22 by 22 by 22 inches, and the temperatures to be maintained are 100, 110, 120 and 130 degrees C. The cabinet is made of sheet copper with three jacketed walls, having a maximum current consumption of 16 amperes. The heavier current is used only 15 minutes of the hour, as three amperes are sufficient to keep up the desired temperature. A thermostat with four contact points furnishes the automatic heat regulation. The regulation has been perfectly satisfactory.

Coffee and Cocoa Dryers.

The cocoa and coffee trade has applied electric heat to its small desiccating or drying cabinets. A dryer 3½ feet by two feet by five feet, requiring a temperature of 150 degrees, will need about 74 watts per cubic foot when properly jacketed. One heater of this kind has returned a revenue of $11 per month. The cocoa and coffee beans are particularly susceptible to the odors arising from combustion, hence the advantage of electric heat. For drying kilns we advise about 40 watts per cubic foot.

Candy Manufacture.

Warming tables and chocolate dipping pots have proved successful in the candy trade. Fifty watts, or the energy of a 16-candlepower carbon-filament lamp, would produce enough heat to keep the chocolate in working condition. Wherever these chocolate heaters have been installed they are at work today. The energy consumed in the device itself is not large, but it will surely lead to more business along this line. We are figuring with one manufacturing concern today to heat a 30-gallon batch of caramel paste to a temperature of 285° F. The operation will consume 10 kilowatt-hours of energy, and each melting will cost about 65 cents. The service is intermittent, hence the adaptability of electric heat. Where high-grade candy is made there is always a chance for electric heat.

Soldering Irons.

The manufacturers of switchboards and telephone supplies find a useful, economical tool in the electric soldering iron; a soldering iron equal to a 1.5-pound soldering copper will consume 70 watts of energy. The operator will accomplish more work with this tool, thereby saving time. Two manufacturers using these devices have stated that soldering irons using current at five cents per kilowatt-hour cost less than soldering furnaces operated by dollar gas. This condition is possible because of the actual time saved in doing the work. Heaters of 110-watt capacity are now made, into which a soldering iron may be thrust, thereby doing away with the connecting handle cord. One thousand hogs per hour are stamped "inspected" by the government meat inspectors in Chicago by means of a 400-watt branding tool that is nothing more than an electric soldering iron with a die inserted in place of the copper tip.

An Instantaneous Water Heater.

You have been told heretofore that electricity must be sold at 2.5 cents per kilowatt-hour to be on an equal-cost footing with gas at $1 per 1,000 cubic feet, also that two kilowatt-hours of energy are necessary to raise 20 gallons of water through 40° F. in one hour; these figures are accepted today. We are now told of an instantaneous water heater that is ready for the market that will deliver 60 gallons of water per hour at 30° F. above the hydrant temperature (62° F. yearly average) with an expenditure of four kilowatt-hours of energy; the water reaches the maximum temperature a few seconds after the switch is closed. The device may be connected to the water service pipe. The water circulates around the heating element (a cartridge unit) without coming in contact with the current, and an automatic device cuts off the current should the water supply fail. A place is predicted for this device in restaurants and cafes. Electric heat economies are not fully appreciated. A certain manufacturer in New York city has been paying $30 per month for a steam supply that is used in a secret woodworking process. He was persuaded to try electric heat and found that he could do the same amount of work as before with a monthly consumption of 50 kilowatt-hours. He was buying current at 10 cents per kilowatt-hour and his yearly saving was $300.

WATER HEATER OF FOUR KILOWATTS CAPACITY.

Thawing of Water Pipes.

For those interested in the thawing of water pipes I give a few figures showing the details of operation of a 44-cell storage-battery outfit, mounted on an automobile truck, in comparison with those obtained by the use of a rheostat in series with a direct-current three-wire Edison system with the neutral wire grounded. The figures represent the average amounts in each case:

	Amperes.	Kilowatt Hours.	Time Min.	Pipe Inch.	Voltage.	Cost Per Case.	Revenue Per Case.
Storage battery	513	1.39	5.44	⅝	31.5	$10.85	$16.40
Edison	275	10.4	19.0	⅝	120.0	14.43	16.93

The Edison system is used until the season has so far advanced that the number of cases will warrant the exclusive service of an automobile truck.

1. Abstract of a paper read at the convention of the National Electric Light Association, Washington, D. C., June 5, 1907.

Commercial Development of the Mercury Rectifier.[1]

By Frank Conrad.

Within the last few years considerable attention has been paid to the development of the mercury rectifier for converting alternating into direct current. As it is apparent that this device is to play an important part in the betterment of central-station economies, a description of some of the latest developments in this line may be of interest at the present time. The rectifier in its usual form consists of a glass bulb containing two positive electrodes, or anodes, and one negative electrode, or cathode. The bulb is exhausted to a high degree of vacuum and sealed. The anodes are connected to the terminals of the transformer supplying the alternating current, the connections for the direct-current supply being made between the cathode of the bulb and the middle of the transformer winding. During one-half of the alternating-current cycle current flows from one of the anodes through the bulb to the cathode through the direct-current load to the middle point of the transformer. During the next half of the cycle the polarity of the transformer terminals is reversed and current flows out of the other anode through the cathode to the load. The positives, due to their surface electrode resistance acting as valves, allow the current to flow out, but not in a reverse direction, the resistance of the negative terminal being broken down by the starting operation so that current can flow

1. Abstract of a paper read at the convention of the National Electric Light Association, Washington, D. C., June 4, 1907.

into that terminal only. Should the current be interrupted for an instant the negative resistance will reassert itself and the rectifier will require restarting. Therefore to bridge over the neutral point of the alternating-voltage wave it is necessary to give the direct-current circuit a certain reactance which will store up sufficient energy to maintain the current flow over the zero of the alternating-current voltage.

The negative electrode resistance or valve action of the electrodes is not an absolutely rigid condition, but is influenced in a number of ways, chiefly in the shape of the containing bulb and the temperature at which it is operated.

To obtain a minimum loss in the bulb, the path between the electrodes should be as short and direct as possible. With a short, direct path, especially at high temperatures, there is a tendency for the electrode resistance on the positives to break down—or, in other words, for the bulb to short-circuit. This may, in a measure, be overcome by operating the bulb at low temperatures, and to obtain this condition it is necessary either to give the bulb considerable radiating surface or resort to artificial cooling. The preferable way, especially for high voltage, is to cool the bulb by immersing it in oil contained in a tank having a comparatively large radiating surface. By this means it is possible to use a construction that will give a minimum of loss and still be free from any tendency to short-circuit. The general design of the bulb and auxiliary apparatus is determined usually by the requirements of the direct-current circuit that is to be supplied, which can in most cases be classed under two heads, namely, the supply of low-voltage approximately constant potential for charging of isolated storage-battery plants and a high-voltage constant-current circuit for supply of series arc lamps. Outfits classed under the first head are usually operated from a low-voltage supply and an auto transformer is used to transform this voltage to that required by the bulb. The voltage to be applied across the positive terminals is determined by the direct-current voltage required and the losses in bulb and auxiliary apparatus. As current is drawn from one-half of the transformer winding only, the direct-current voltage will be one-half the total alternating-current voltage. In addition to this, as the direct-current voltage is the average of the rectified alternating-current waves, while the value of the alternating-current voltage is expressed as effective, it will be reduced by the ratio of the average to the effective, which in a sine wave is 0.9.

The voltage of each half of the auto-transformer in an outfit delivering 110 volts direct current would be 100 plus the loss in the bulb (approximately 15) plus the loss in the choke coil (approximately 4) divided by 0.9, a total of 143, or approximately 286 volts across the anode terminals of the bulb. A reactance is placed in the direct-current circuit to give the necessary bridging over the zero point. This coil should have sufficient capacity to maintain the direct-current flow during the period in which the alternating voltage wave is less than that across the terminals of the storage battery. To maintain the current flow at a constant value would require a reactance of infinite proportion. Therefore to obtain a minimum size the current supplied is allowed to pulsate a certain amount. For the ordinary battery installation the smoothing out need only be sufficient to prevent the bulb going out. For some special purposes, however, such as batteries used in telephone exchanges, where they will be charged while supplying current to talking circuits, it is necessary to use a reactance of considerable proportions in order that no noise be produced in the telephone circuits.

To put the outfit in operation it is necessary to break down the electrode resistance of the cathode. This is accomplished by a small arc produced between the mercury forming the cathode and that in a small auxiliary electrode. The bulb is tilted so that the mercury in the two electrodes makes contact, thus closing a local circuit which at the break produces the small arc necessary for starting. The efficiency of an outfit of this character is high compared to that of a small motor-generator set. It is determined mostly by the voltage of the direct-current circuit, as the voltage loss in the bulb is practically constant irrespective of the total voltage of the circuit or the current delivered. As stated before, the loss in the bulb amounts to about 15 volts; therefore, to obtain 110 volts direct current the voltage of the transformer should correspond to a direct-current voltage of 125; the efficiency of the bulb thus would be $\frac{110}{125}$ or 88 per cent. With an efficiency of the transforming apparatus of 90, the net efficiency of conversion from alternating to direct current would be over 79 per cent. The efficiency of a small motor-generator set would probably be 60 to 65 per cent. The power factor of the outfit, when used without adjusting the reactance in the alternating-current circuit, would be about 90 per cent. When used with this reactance it will, of course, be lower. It should be possible, however, to operate with a power factor of 80 per cent. From the standpoint of the central-station man the most important development of the rectifier is that for the operation of constant-current direct-current arc lamps. Within the last few years there has been a very great increase in the use of series alternating-current arc lamps for street lighting. This has in a large measure been due to the fact that they can be operated from the existing alternating-current lighting generators with simple and efficient transforming apparatus. With the advent of the new high-efficiency, direct-current, series arc lamp it would seem like a step backward to revert to the old constant-current generator.

A description of an outfit designed primarily for the operation of the new high-efficiency arc lamps will illustrate the general features of this class. The regulating transformer is in general similar to that used for alternating-current lamps. The secondary, however, is wound for the higher voltage required on the rectifier terminals, a middle tap being furnished for the negative terminal of the direct-current circuit, and in addition to this some extra taps are provided near the ends of the secondary winding to provide for operation on loads below the rated capacity and at a power factor corresponding to that obtained on a full load. An auxiliary secondary winding consisting of a few turns wound directly in the transformer core is used for operating the starting device of the bulb. The terminals of the transformer secondary are connected direct to the positive terminals of the bulb. From the negative terminal of the bulb connection is made to the reactance, the remaining terminal of this reactance forming the positive supply terminal for the load. For starting two methods have been employed. In one of these methods two additional electrodes are used in the bulbs. These auxiliary electrodes are connected to a small transformer which is fed from the auxiliary secondary on the main regulating transformer. A connection is made from the negative electrode of the bulb to the middle point of this small transformer, the whole thus constituting a complete rectifying outfit on a smaller scale. The auxiliary electrodes are so placed that by tilting the bulb the mercury forming the cathode will bridge over and short-circuit them, the spark that follows the breaking of this short circuit serving to start the operation of the rectifier. Should the lamps break their arcs, due to a momentary drop of the supply voltage, they would immediately restart as the auxiliary local circuit would keep the cathode of the bulb broken down or alive. As to the general operation and efficiency of the rectifier outfit, the results obtained are far superior to that of a constant-current generator. The percentage of loss in the bulb is practically zero, amounting to less than one per cent. in an outfit supplying 50 arc lamps. The losses in the regulating transformer and reactance will total about eight per cent. more, which will give a total efficiency of conversion from alternating to direct current of above 90 per cent.

Aims of the National Electric Lamp Association.

The engineering department of the National Electric Lamp Association, Cleveland, Ohio, is sending out a number of bulletins concerning the organization of the association and the manufacture of incandescent lamps. Separate bulletins are devoted to descriptions of the Gem metallized 50-watt lamp, the Gem metallized high-candlepower and Prismo lamps and units, the tantalum and the tungsten lamps.

In bulletin No. 1 the company calls attention to the fact that "the National Electric Lamp Association does not in any way control the prices or the terms of sale of incandescent lamps; it does not attempt to control the actions of its individual members, and it is optional with each member to take up any position he may see fit on any subject that may come up for discussion."

"For a period of years," says the bulletin, "there existed in this country a condition that was most serious to the manufacturers of incandescent electric lamps. There were about 30 companies engaged in this industry, all competing with each other in both price and quality, although practically all of these manufacturers, as individuals, realized that the only safe foundation upon which a lamp business could be established was upon the basis of quality. The competition in price had reduced lamp profits to such an extent that no manufacturer could see his way clear to spend the necessary money for quality improvement. Such action would have raised his cost until it was impossible for him to compete in price. The number of discriminating lamp buyers became greater and greater until practically all large users of incandescent lamps were purchasing lamps that they considered the best, regardless of any difference in the price. This was not to be wondered at when it is considered that the difference of a cent in the price of a 20-cent lamp would be entirely neutralized if the lamp lived five per cent. longer than the lamp which cost the smaller amount. It is apparent that the quality of a lamp is of tremendous importance as compared with the price at which it must be sold on the retail market."

In order to overcome the troubles enumerated the association was organized, says the bulletin. It now has 15 members, starting originally with five. In conclusion, it is stated that "the best evidence of the value of this association is the improvement that has occurred in the quality of incandescent lamps during the last few years, and every advantage to the manufacturer is an advantage in which the purchaser has shared. No independent company, with a capacity of less than 20,000,000 lamps a year, could possibly afford to maintain an engineering organization that could in any way be compared with the engineering department of the National Electric Lamp Association, and it is only by reason of this association that such an organization can be maintained."

Bulletin No. 2 is devoted specially to the engineering department of the association, the work of which is said to be along the following lines: "Improvement of lamp quality; experimental and development work; advisory technical supervision of the factories; advisory technical supervision of new lamp literature, specifications, etc.; giving out of technical data having a commercial value."

Convention of Illuminating Engineering Society.

The first annual convention of the Illuminating Engineering Society will be held in Boston during July 30th and 31st. The programme as to hours and number of sessions will be announced later, but from the material already in the hands of the various committees and the promise of many additional valuable papers and exhibits, there can be no question of the assured success of the convention and its educational value to each and every member.

The business headquarters will be located at Room 728, Old South Building, Boston, where delegates may secure any information or have mail or other matter sent them.

The committee on hotels will make such reservation as is requested, and full details concerning hotel accommodations may be had by application to J. H. Griffin, Jr., 728 Old South Building, Boston. The members can either take the matter of transportation up individually or with their local secretary, bearing in mind, however, that they will be entitled to reduced rate of fare, announced for Boston's Old Home Week.

The committee on papers is arranging a strong programme of papers from leading representatives of the various interests which the membership of the society includes. The committee on exhibits is arranging for an interesting exhibition of illumination appliances and measuring apparatus. The notable examples of decorative illumination which will be seen in the streets of Boston will, by themselves, be worthy of study. Mayor Fitzgerald will address the opening session of the convention.

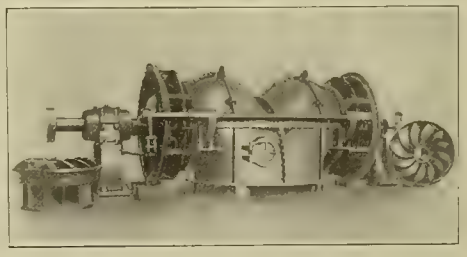
While it is planned to have a business convention, the matter of entertainment for members, their ladies and guests will be specially provided for, quite apart from the opportunities for amusement afforded by Old Home Week festivities. The latter include military, civic and trade parades, illuminations, electrical pageants and general opportunities for enjoyment that Boston offers.

John Campbell is chairman of the convention committee, and may be addressed at the business headquarters referred to above.

Great Falls Plant of the Southern Power Company.

The hydraulic turbines of the Southern Power Company's Great Falls (S. C.) station were placed in operation for the first time on March 13th, when water was turned through the gates. Six of the turbines are now in service. The equipment includes six horizontal hydraulic turbines like the one illustrated, direct-connected to 3,000-kilowatt three-phase 2,200-volt generators. The turbines operate at 225 revolutions per minute under a 72-foot head, and the normal development is 32,000 electrical horsepower.

Actual building operations at this plant were begun in August, 1905. The building of the dam at Mountain Island occupied eight months and the concrete wall at the power house was completed in one year. The dam is 10 feet wide at the top and 80 feet wide at the base. It is 105 feet high and 650 feet long from hill to hill. There are 100,000 cubic yards of masonry in both of the walls. The hydraulic turbines were supplied by the Allis-Chalmers Company.



TWIN TURBINE IN THE SOUTHERN POWER COMPANY'S GREAT FALLS PLANT.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XIX.—Central-station Auxiliary Apparatus.

Service Transformers.

In all of the early lighting stations which supplied alternating current the practice was formerly to distribute current at high tension up to each house where electricity was used, and to use a small transformer on each house of sufficient capacity for the number of lights installed. This practice will be found in effect at present in a good many lighting stations, although it is a very inefficient and extravagant method of distribution. It is far more economical to group the loads in a number of buildings upon one large transformer, and run a secondary low-tension system of distribution from the transformer to the buildings which it serves. There are probably a number of central stations which could reduce their operating expenses to a very marked extent by throwing away their old-style small transformers and substituting modern transformers of large capacity, with short secondary distributing systems.

Service transformers are usually placed in rather inaccessible positions, as on the tops of poles or the sides of houses, and from this fact is probably due the prevalent lack of testing, although systematic testing of the transformers would go far to explain why some central stations are not paying dividends.

In the first place, transformers manufactured a number of years ago are decidedly inferior to those manufactured at present, on account of the quality of the iron employed. In old transformers the iron aging was frequently very marked. While the iron losses were reasonable in amount when the transformers were new, the aging frequently took place very rapidly, so that in the course of a year the iron losses would be 25 or 30 per cent. greater than when the transformer was new. In modern transformers the losses due to iron aging are not so serious, as a quality of iron is now obtainable by means of special treatment, in which the aging is very slight, even after long usage.

In the second place, the iron losses on the whole system will be greatly reduced by changing from a very large number of small-capacity transformers to a small number of large transformers. Where the small transformers are installed, it is necessary that each house have a transformer of sufficient size to take care of all the lamps installed; and as a comparatively small number of the lamps wired up in a house are in use simultaneously, the transformer operates for the most part on very light load, at which its efficiency is comparatively low.

By using large transformers it has been found that the total transformer capacity need not be over 50 per cent. of the total number of lamps wired on the secondary circuit. This has been found to be a safe estimate from the results of experience at a large number of stations, as there is but little opportunity of all of the lamps in a number of houses connected to the circuit of one transformer being in use at one time. Moreover, should such a case occur, modern transformers are built with a very large overload capacity, which would be sufficient to tide them over in case of any unusual demands for current.

With the large transformer and secondary distribution system, therefore, the transformer will operate at or near its full-load capacity during the time of day when the lighting is required, and this means considerable increase in efficiency, and a very large decrease in the iron losses, as only half of the total capacity of the small transformers is installed and the core losses are therefore cut in half.

In general, the most economical transformer would be the one in which the iron losses and the copper losses are about equal. Iron losses occur during the whole 24 hours of the day, as transformers are usually energized all the time, whether they are carrying load or not. It is therefore important to select transformers having low iron losses, as these losses occur continuously without regard to the load on the system. The copper losses are greatest at full load or overload, and in case of excessive copper loss, the effect is to reduce the ultimate capacity of the plant at the time of full load, when a large capacity is needed most.

In the average lighting plant the heavy load only exists for four or five hours a day, and for the other 19 or 20 hours, the transformers are practically without load. The number of watts comprising the iron loss during the 19 or 20 hours the transformers are unloaded may be figured at the rate of the cost of production of the current at the central station, while the copper losses, which occur at the time of heavy load, and which limit the ultimate capacity of a station, should be figured at the rate at which the current is sold. As previously stated, however, the most economical transformer for general purposes is the one in which the iron and copper losses are about equal.

Circuit-breakers and Switches.

During recent years there has been a remarkable increase in the voltage of long-distance transmission lines, and the use of these high-voltage circuits has necessitated the development of various switches and circuit-breakers capable of breaking heavy currents at high potential. While it would be almost impossible to break a heavy current at 25,000 or 35,000 volts or higher by means of any ordinary form of knife switch, without burning up the switch, due to destructive arcing, or injuring the operator, it has been found that such high-potential currents can be safely and easily broken without the production of an arc, by immersing the switch in oil. The use of oil, therefore, becomes a very important factor in high-tension distribution, as switches and circuit-breakers used on high-potential lines are invariably immersed in oil.

There is only a slight distinction between oil switches and oil circuit-breakers. Switches are those instruments which tend to remain fixed in whatever position they are placed by the operation of the handle, while circuit-breakers generally close against a spring and are held closed by a latch or other device, but tend to fly open whenever such latch is released.

Oil circuit-breakers are made to be operated both by hand and by electric motors, and both the hand-operated and the electrically operated circuit-breakers may be made to operate automatically or non-automatically. The non-automatic types are opened by the station operator, while the automatic types are controlled by means of relays of various kinds, which cause the circuit-breaker to open without attendance when certain predetermined conditions are exceeded.

Switches and circuit-breakers of comparatively small capacity and moderately low potentials are made either single-pole, double-pole, three-pole or four-pole, as the service may demand, and are generally designed to be mounted upon the rear of the switchboard, with the operating handle passing through the panel to the front of the board. In some cases, a separate tank is used for each pole of the switch, while in other cases all of the poles are immersed in a single tank of oil. Such switches should preferably be constructed so the oil tanks can be lowered or removed from the switchboard easily, so that the contacts may be easily examined and the oil renewed without difficulty. The tanks should also fit close to their support, so that there is no possibility of oil being thrown about when the switches are operated.

In case of very high potentials, it is desirable to remove all high-tension wiring from the switchboard, on account of the danger to switchboard operators, and in such stations the oil switches are usually mounted some distance from the switchboard, and are operated, either manually by some system of rods and levers, or by means of small electric motors, which are controlled from the switchboard. These large-size circuit-breakers are almost always made single-pole, and in case of two-phase or three-phase circuits, two or three separate circuit-breakers are used. These should be mounted in fireproof compartments of brick or concrete, each pole being provided with a separate compartment, so that any injury to the contacts in one compartment will not affect the other parts of the switch. When circuit-breakers are arranged for automatic operation by means of relays, various kinds of relays may be used to protect the apparatus from various causes of trouble. The relays may be designed to open the circuit either on overload or underload, and also in case of low-voltage or reverse current. These relays are small, compact devices, which can be easily mounted on the back of the switchboard.

[*To be continued.*]

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Economy of Electric Light.

Central stations may well emphasize the fact that it is convenient to save electric light. A turn of the switch, and the expense of that lamp ceases at once. The same is true of a gas-jet, of course, but there is a temptation in the case of gas to allow the light to burn unnecessarily, as there is a slight effort in relighting it. With the incandescent lamp, another turn of the switch does the trick. The point is made clear in the following "ad" on the back cover of the house organ of the Edison Company of Boston:

Don't Waste Light

Electricity Is Convenient for Use; It is Just As Convenient to Save

A large Department Store has found it desirable to employ a man whose only duty is to Turn Out individual electric lights when not needed.

So large a saving resulted that two electric elevators were installed the second year, but the bills for the electricity were less than before the Store Management stopped the waste.

Edison Electric Illuminating Co.,
33-39 Boylston Street, Boston.

QUESTIONS AND ANSWERS.

Constant-current Transformers.

O. L., Maroa, Ill.: In your next issue of the Western Electrician please describe one or two common forms of constant-current transformers.

Answer.

The questioner probably means constant-current transformers for series load, the primaries being connected to a constant-potential system. Why not write to the manufacturers of transformers of this type for literature on the subject? Illustrated bulletins giving full information can doubtless be procured. A list of the names of transformer makers can be obtained from several sources. One is the Classified Index of Advertisements in the Western Electrician.

Cost of Producing Current.

K. W. M., Knoxville, Tenn.: With soft coal at $1.50 a ton at the boiler, $2.50 a day wages for the engineer and $1.25 a day for common labor, and with well-equipped boiler plant and up-to-date compound, condensing engines, what will our current cost us per kilowatt?

Answer.

It is impossible to give the cost without knowing all of the conditions in the station, such as boiler efficiency, generator efficiency, load factor, etc.

Power-transmission Problems.

D. A. S., Bern, Kan.: We intend to run a high-tension transmission line to a town about nine miles distant, and as our alternator generates 1,100 volts, we would step up to 6,600 volts and use No. 8 bare copper wire. Would not this carry 250 16-candlepower lamps with a drop of three per cent.? How would barbed wire strung on the poles (between the copper wires) and grounded thoroughly, do for lightning protection? We intend also to use some good arrester at various places on the line. I have found in telephone practice that a grounded line run parallel with a metallic line takes nearly all the discharge. Would barbed wire grounded do better on account of the barbs? Please state whether the plan would be practical.

Answers.

More information is needed. Is the system single-phase or polyphase? What is the frequency? How are the conductors arranged on the pole?

The addition of a ground wire strung on the poles over the copper wires has been found an efficient aid in lightning protection. The relative merit of a solid wire and a barb wire is still an open question, each side having its advocates.

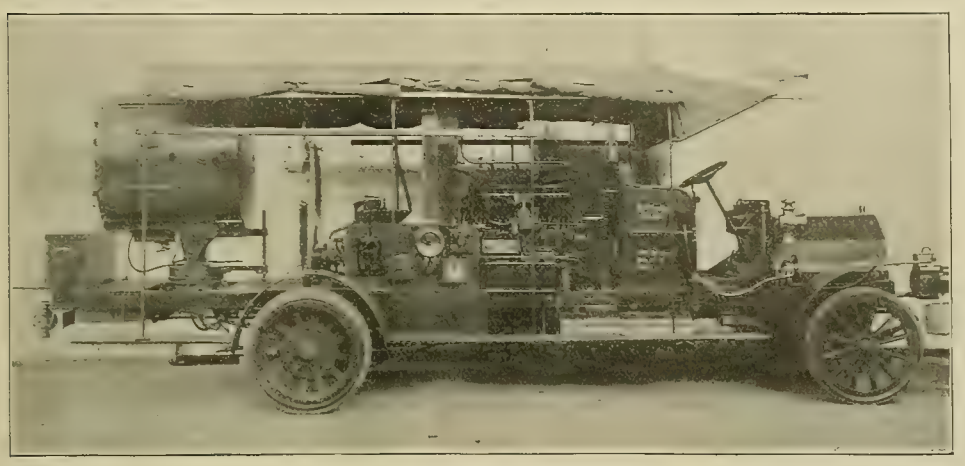
A Novel Electric Searchlight Car.

One of the most interesting automobile equipments of English design recently brought out is that of a high-power electric searchlight and power-generating car shown in the accompanying illustration.

This electric searchlight automobile was constructed at Lowestoft, England, the power being supplied by a Brooke four-cylinder gasoline motor of 18-horsepower capacity designed to drive the car at a speed of 20 miles an hour.

This electric searchlight car is adapted for military service for fire department use and is of unusual construction.

The electric projector or searchlight is mounted at the rear of the car, back of the rear axle, and is 36 inches in diameter, equipped with an automatic focusing arc light of high power with gearing provided for raising and lowering the beam of light and turning the same to the right or left as desired.



ENGLISH ELECTRIC SEARCHLIGHT AUTO.

The dynamo supplying current for the lamp is mounted in the center of the car and is driven independently by direct connection by means of a gas engine of the four-cylinder Brooke type. The switchboard is shown in the illustration just forward of the rear wheel and is equipped with the usual switches, rheostat and electrical measuring instruments, including voltmeter and ammeter.

This unique portable searchlight car was built for the No. 1 Tyne division of the Volunteer Royal Engineers. It has a total weight of 7,840 pounds, of which the front axle carries 2,800 pounds and the rear axle 5,040 pounds. The entire car is covered by a canopy with rolling curtains at the side, as shown in the illustration. Very heavy iron and wooden wheels are utilized with solid rubber tires. This electric-generating plant is not only capable of supplying power for the great electric searchlight mounted on the rear of the car, but if desired can be utilized for operating a number of ordinary arc lights or several hundred incandescent lamps of 16 candlepower. P.

Fenders and Wheel-guards Criticized.

The Massachusetts Railroad Commissioners after a series of tests have issued a circular to street-railway companies on the subject of fenders and wheel-guards. In it the Pfingst fender is given credit for having saved many persons from injury, though the commissioners find that the fender has frequently failed to do its work.

It is stated that upon a large percentage of the surface cars in Boston the fender is useless from the fact that projecting parts of the car so reduce the available area of the platform as to leave no room for catching or holding a person who falls or is thrown upon it. The commissioners say that "notwithstanding the multiplication of patents and the ingenuity of experts we know of no device in use or exhibited through sketch or model that, attached to a street car moving at varying speed, can be relied upon always to trip a standing person or pick up a prostrate body without injury."

The commissioners believe that it would be hazardous to attach to the front ends of high-speed interurban cars operated under the conditions commonly met, automatic fenders which might upon occasion so fall or be thrown in the way of the car as to cause a derailment. On the other hand it is stated there would be no such hazard in the use of an automatic wheelguard upon cars as ordinarily operated in city streets. Criticism is also given to a fender or wheelguard that must be dropped by the motorman in case of threatened accident, for it complicates his duties at a time when he ought to give paramount attention to the stopping of the car.

Big Growth of Electrical Manufactures in Five Years.

During the five years since 1900 the capital invested in the manufacture in the United States of electrical machinery, apparatus and supplies has more than doubled, the value of the products has increased by more than one-half and the number of establishments has grown by one-third. This statement is contained in bulletin 73, issued in May by the Bureau of the Census under the directorship of S. N. D. North, and containing a report according to the census of manufactures of 1905. The bulletin was prepared under the supervision of William M. Steuart, chief statistician for manufactures, by Thomas Commerford Martin, expert special agent.

In spite of the general tendency toward the consolidation of manufacturing establishments there was a gain in number of 34.9 per cent. between 1900 and 1905, while the capital invested increased 108.1 per cent. Throughout the last five years, the bulletin says, labor has been actively and remuneratively employed in all the electrical industries and no single strike of any serious magnitude has been recorded.

The increase in the total value of electrical products, 1900 to 1905, was 52.3 per cent., which is a good indication of the capacity of the field at large for consumption, although various factors have come in to establish wide differences in the increase in the respective departments of the electrical business. In many instances, moreover, while the general trend of prices has been upward the cost of electrical apparatus to the consumer has been less, owing to large production and greater refinements in the processes. This, the report states, has been affected, however, by the higher cost of such raw material as copper, the price of which has risen steadily throughout the entire term.

In 1905 there were 784 establishments engaged primarily in the manufacture of electrical machinery, apparatus and supplies, with a capital of $174,066,026. This shows a gain over 581 establishments in 1900 of 34.9 per cent. The capital invested in 1900 was $83,659,924, and in 1905, $174,066,026, an increase of 108.1 per cent. The value of products (including amount received for custom work and repairing) in 1900 was $92,434,435, and in 1905, $140,809,369, an increase of 52.3 per cent. Both these sums do not include the value of electrical machinery, etc., made by establishments engaged primarily in the manufacture of other products, which in 1905 amounted to $18,742,033 and in 1900 to $13,397,430.

New York, Illinois, Ohio, Pennsylvania, Massachusetts, Connecticut, Indiana and New Jersey reported 631 of the 784 establishments making electrical apparatus. The increase in total capital was greatest in Pennsylvania, equaling 178.5 per cent., the capital in 1905 being $58,393,011, although the value of the products advanced only $7,144,904, or 37.4 per cent. The capital and value of products of the other leading states for 1905 follow:

	Capital.	Products.
New York	$30,643,167	$35,348,276
Illinois	21,644,783	16,700,027
Massachusetts	12,735,427	15,882,216
New Jersey	18,457,821	13,803,476
Ohio	10,408,184	11,019,235

Complete statistics are given in the bulletin of the comparative outputs and values for 1900 and 1905 of such products as dynamos, motors, transformers, switchboards, storage and primary batteries, carbons, arc and incandescent lamps, searchlights, electric-light fixtures, telephone and telegraph apparatus, insulated wires and cables, conduits, annunciators, electric clocks, rheostats, electric meters, fuses and lightning arresters, electric heating, cooking and welding apparatus, etc.

Much valuable information is given on modern practice in the manufacture, installation and operation of electrical machinery and apparatus, several fine illustrations appearing throughout the book.

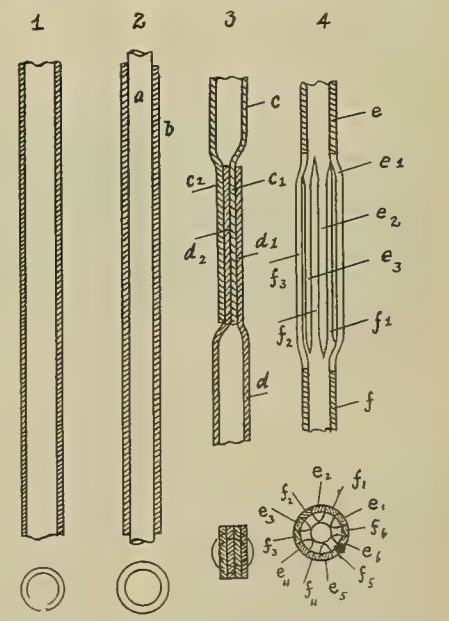
The lighting plant of the Harrison Light and Water Company at Harrison, Ohio, has been sold to Charles A. Hinsch for about $22,000.

Method of Making Hollow Metallic Conductors.

A new process for manufacturing hollow metallic conductors has been brought out in Paris by E. Lherminier, who lately secured a French patent for his invention. The essential features of the new process are illustrated in the sectional and plan views shown. The conductor is obtained by using a continuous metallic strip which is sufficiently flexible, this being of copper or any other suitable metal. The strip is rolled in a special machine so as to produce the hollow conductor. Three rollers are used, one of which is movable. Next to these is placed a rod which gives the form of the conductor, having the diameter wished for the inside. Following the rollers is a reel for winding up the finished conductor.

The hollow form is given by pressing the strip around the form by means of the rollers so as to give a nearly closed tube (1), shown in the drawing, and this can be closed up entirely by soldering or, preferably, by electric welding, which gives a good joint. This process also enables the inventor to form a combination conductor in which the above-mentioned copper strip is formed around a central core (2). This core can be of flexible steel cable or any other suitable composition. When it is desired to make a junction between such wire or cable the method shown by (3) is employed. At the point of junction the wire is cut in the direction of its length and the two semi-circular portions thus formed, in the case of the hollow conductor, are opened out and flattened, leaving a space between them which is equal to the thickness of the metal. The conductor (c) thus forms the flat part (c_1) (c_2) and conductor (d) the portion (d_1) (d_2). By placing the two pairs of jaws together and soldering them, a good joint is formed between the conductors.

Another method which can be used to advantage is shown in diagram (4), where (e) and (f) are the two conductors used. Each of them is slit at the end in a number of places and the resulting parts are separated so as to form a series of tongues disposed around the circle (e_1), (e_2), etc., and (f_1), (f_2), etc. By interlocking the tongues an expanded cylindrical part is produced which forms the joint, and the tongues are then soldered or electrically welded.



METHOD OF MAKING HOLLOW METALLIC CONDUCTORS

Chicago Council Authorizes Canal Power Contract.

The Chicago City Council at its last meeting unanimously authorized the mayor and the controller to make a contract with the Sanitary District of Chicago for the use of electric power to the amount of 7,000 horsepower a day. In the contract the city is allowed to say whether it wants the power delivered for 24 hours a day or for an average time of 11 hours a day, varying according to the time of the year.

The price the city is to pay is $1.25 a horsepower per month on the 11-hour schedule, and $2.20 on the 24-hour schedule. In case of excess use in an emergency, the price is to be proportionate. The city obligates itself to use the power thus acquired only for municipal purposes and not to sublease or transfer its contract.

The city may make changes in the schedule upon 30 days' notice or when necessary on account of fire or other emergency. It has the right of supervision over the measuring instruments, which are at the distributing station, Western Avenue and the Drainage Canal.

The Curtis Primary Battery Again.

The new chemical primary battery which attracted attention in Fond du Lac, Wis., some time ago, where the inventor, Frank G. Curtis of Meriden, Conn., conducted some tests, is again being heard from, this time from St. Paul and Minneapolis. According to the Minneapolis Tribune, the battery, which is said to generate current in sufficient quantities to run large vehicles or light stores and houses by the decomposition of chemical solutions without attacking the metals immersed, has attracted the attention of prominent Twin City men, and among those mentioned as being impressed with the possibilities of the invention are J. H. Gugler of the Gugler Electric Company and several other railroad officials and electrical men.

It is said that Mr. Gugler, who is an electrician of considerable experience, may give up his present supply business to become manager of a company which will promote and manufacture the new battery. In an interview Mr. Gugler said that the company had still considerable development work to do on the battery and that the chemicals used contained some organic compounds. He was unwilling to submit a cell to his questioner for test, but said that the Northwestern Railroad was making a test and that he had tested the battery himself and was confident of its value. In answer to a question concerning the inventor's statement that the new battery could produce electrical energy at a cost of eight cents a kilowatt-hour, Mr. Gugler said that it could be done at 15 cents a kilowatt-hour, which was low enough.

Quoting from the Tribune: "The battery gives a voltage of 2.1 on open circuit and a voltage of 1.75 on a 30-ampere discharge. A battery of 18 cells of the power battery will operate an electric runabout or stanhope 200 miles on one charge of the solution, claims its inventor. With the battery a vehicle can be recharged anywhere along the road in 15 minutes, where water can be obtained from a well or brook. It takes at most 25 pounds of the chemical compound to recharge for an additional 200 miles, and the 25 pounds can be stored into very little space. The battery as now arranged on the car weighs one-fifth as much as the battery now in use and occupies one-fourth the space. From external appearance it resembles a salammoniac battery and differs in that its elements are composed of new compounds."

As in Fond du Lac, many of the electrical men of the Twin Cities will await a demonstration of what the battery can actually do before giving it much attention.

A Record of Reliability.

Electrical generators have become such a standard product that attention is seldom called to that thoroughness of design and construction which results in such a record of reliability as that shown in the following statement concerning a 150-kilowatt three-phase belt-driven alternator, built by the General Electric Company. This generator ran more than four years, 24 hours a day, with a single stop of 15 minutes, due to a defective pulley. The details of this performance are given by Assistant Manager Rhodes of the United States Smelting Company, West Jordan, Utah, as follows:

"The generator was received about June 1, 1902. It was put in service October 15 for 11 hours per day until November 9th, when 24 hours per day service was required. On January 25, 1904, shortly after noon, the paper pulley on the exciter went to pieces. A cast iron pulley being on hand, a shut-down of 15 minutes was recorded. From June 13 to 18, 1904, the switchboard was moved and all feeder circuits were connected directly on the machine without switches or fuses by means of jumpers without a single mishap to cause a shut-down. Last fall [1906] one of the screws worked out of one of the split oil rings on the pulley end. Not being able to shut down, we ran along with the remaining one till March 28, 1907, when the machine was shut down for three days, thoroughly cleaned out, new oil put in bearings, collector rings turned true, the broken oil ring fixed, and service commenced as usual, vaculine oil being used during this run. The alternator is belt-driven, and an engine is located at either side with belt attached in case of emergency. Bearing in mind that this machine carries a continuous overload of 25 to 60 per cent., its record is truly wonderful."

An Appreciation of Berthelot.

France has lost within a year three of her greatest masters of physical science—first, the physicist Curie, the discoverer of radium; next the chemist Moissan, the wonder worker with the electric furnace, and then Berthelot, the founder of modern synthetic chemistry. Although he was the last of the three to go, Berthelot's eminence dates back much farther than that of the others.

Pierre Eugène Marcellin Berthelot, as one may learn from an appreciation in Science (abstracted in the Literary Digest) by Prof. Charles A. Doremus, was born in Paris, October 25, 1827, the son of a physician, from whom he inherited a taste for a scientific career and who schooled him effectually for it. His education was obtained at the Lycée Henri IV. Berthelot was a man of cyclopedic learning, a master of Greek, a frequent writer on education, morals and philosophy, an expert in all sciences, with an extraordinary grasp of their meaning and relationships. The series of researches that began with his doctoral thesis in 1854, on the synthesis of fats from glycerin and the fatty acids, led nine years later to the founding of a special chair at the Collège de France, that he might have opportunity for carrying on this new kind of chemical work, which sought the formation of compounds instead of their separation into their elements. Says Dr. Doremus:

"He thus entered on a field of work which made him famous. Analysis had until this period been the chemist's aim. Synthesis now claimed his attention, and before the end of the nineteenth century wonders were indeed wrought, revolutionizing both philosophy and the arts.

"By causing an electric arc to play between carbon electrodes in an atmosphere of hydrogen, Berthelot secured the direct union of carbon and hydrogen with the production of acetylene. He then converted this by the action of heat into benzine, and from these passed to other syntheses. He also experimented with the silent discharge turning oxygen to ozone. With the induction current he combined acetylene and nitrogen to hydrocyanic acid. He obtained formic acid, starting from carbon monoxide. By the use of sealed tubes in which chemicals were subjected to high temperature and pressure through considerable time he influenced them to combine, and also gave us a new general method in chemical manipulation. Six important works, in all nine volumes, attest his genius as applied to this department of his labors. His soul was in his work. When one contemplates how his experiments steadily progressed, effecting the grouping of the elements to form hydrocarbons, alcohols, acids, ethers, sugars, fats, thus simulating natural processes and building up compounds which up to his day were conceived as being solely the result of vital force, we little wonder that he became permeated with the idea that ultimately man would manufacture his own sustenance. In his address to the second International Congress of Applied Chemistry he says: 'No one can deny that the day is perhaps near when the progress of chemistry will realize the manufacture of foods; in that day the cultivation of wheat and the raising of cattle will be exposed to the same destiny which has overtaken the culture of madder in our day.'"

In an attempt to measure the energy developed by chemical reactions in definite terms, Berthelot founded what is now known as thermochemistry, at which he worked for 35 years. His work on "The Force of Explosives" (1883) was intimately connected with these researches and led to the discovery by others of smokeless powder. During the war of 1870 Berthelot was president of the scientific committee on defense. His later work in the chemistry of animal and vegetable life was connected with his belief in the identity of chemical phenomena in living and non-living matter. Of his beautiful experiment at Meudon the writer says:

"Here the master undertook his experiments on the influence of electricity on the growth of plants—generating this force or deriving it from the atmosphere. Here it was that the fixation of nitrogen was studied, a problem that has engaged the sturdiest minds, and here it was that he found that microbic life was the means of transferring atmospheric nitrogen to the living plant cell. The import of this phenomenon he tersely stated in saying. 'The soil is something alive!'"

Berthelot was greatly loved and honored in his native land. He was made a life senator in 1881, and twice served as a cabinet minister, holding the portfolio of public instruction in 1886 and that of foreign affairs in 1895. There was an international celebration of his scientific "jubilee" in 1901, during which President Loubet gave him a gold medal, specially struck for the occasion, testifying to the love and gratitude of the nation. His end was dramatic—almost sensational. His wife, with whom he had lived most happily for 45 years, died suddenly, and the shock brought about his own end a few minutes later. He was laid to rest in the Panthéon amid such military and civic ceremonies as are accorded to a man of science in France alone.

"Union" Combination Switch Boxes.

The Chicago Fuse Wire and Manufacturing Company has recently been granted patents on a new line of sheet-steel switch and receptacle boxes, which it has been developing and perfecting the last few years. These boxes, which are designed for use in connection with concealed wiring of either knob and tube or conduit work, embody several features which commend themselves to the electrical trade for use in old and new installations. The accompanying cuts show a few of the different types manufactured, and illustrate in a general way features of their construction.

Fig. 1 represents type AA single box, and is identical in design with type BB except that the latter is intended for conduit and armored cable and is consequently made somewhat deeper, while the box shown by Fig. 1 is provided with five-eighths-inch openings suitable for entrance of flexible tubing. The body of this box, forming the back and two end walls, carries the supporting ears, switch lugs, knockout plugs and two side walls, which are attached by means of flanges, formed up so as to come on the inside of the box, thus presenting smooth edges at all corners, and permitting the device to fit snugly into a recess in the wall or plaster. It is just large enough to admit the base without cutting away additional material on account of protruding screw heads or flanges.

The supporting ears of these boxes are swung on a slotted-screw pivot, which allows considerable adjustment, as well as permitting the turning of the same at any angle to secure lodging for supporting screws. In new installations the ears may be inverted, so as to bring the outer face of the box flush with the plastered surface. Types AA and BB unit boxes are made large enough to accommodate all standard receptacles, push buttons or rotary switches having rectangular bases, and at the same time leaving sufficient room for the entrance of conduit or tubing and wires, a feature often overlooked in switch-box manufacture.

Fig. 2 illustrates type BB two-gang box, which is the unit of all sectional gang boxes intended for conduit work. It consists of two boxes, very similar to the one shown by Fig. 1, assembled together, in which the two adjacent side walls are omitted, the flanges being secured by screws in place of rivets. This two-gang box is also made in type AA for knob and tube work when it is desired to install two controlling switches together. If a gang of switches are to be located in one place, the size of the boxes can be increased indefinitely by removing the screws holding the two portions together and inserting any number of the spacers shown by Fig. 3. In this manner it is possible to meet a demand for any size of gang box, from a stock of two gang boxes and a few spacers, the only tool required in the operation being a screwdriver. All parts are accurately formed and punched by dies, insuring perfect fitting and ease in assembling, and forming a close-fitting and reliable box when completed.

In Fig. 4 is shown type C, of different construction, in which the four walls are formed of one piece with a dovetailed joint, thus insuring a perfectly smooth outer surface and rounded corners similar to a drawn steel box. The ears of this device are designed particularly to fit recesses in cover plates of Perkins and H. H. switches, and are carried in stock from two to six gangs.

Fig. 5 illustrates a four-gang box of this construction. Types C and D are designed only for installations in old buildings, the latter being constructed identical with type C, but accommodating any standard make of switch or receptacle. The ears of types C and D are well united for installation flush with the plastered surface, and insure substantial support of the device in position. In addition to the makes referred to above, a type R C is furnished, which in design is similar to types AA and BB, but is much shallower and somewhat wider, being particularly designed for rotary switches with round bases.

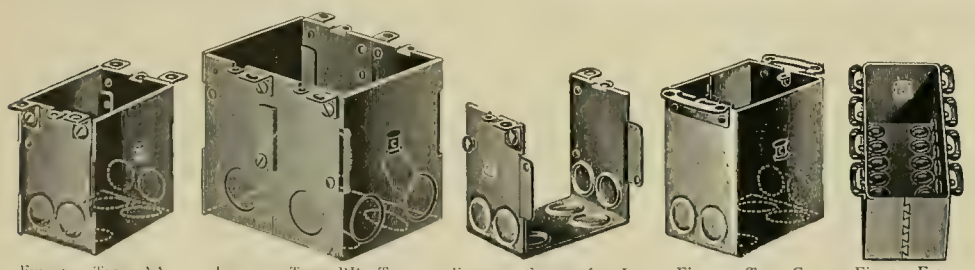


Fig. 1. Type AA, Single Box. Fig. 2. Type BB, Two-gang Box. Fig. 3. Spacer for Increasing Size of Boxes. Fig. 4. Type C, One Piece. Fig. 5. Four-gang Box.

"UNION" COMBINATION SWITCH BOXES.

The annual meeting of the New York Electrical Society for the election of officers will be held in the Engineering Societies Building, New York city, on June 10th. Following are the nominations by the nominating committee: President, Albert F. Ganz; vice-presidents, Augustus Post, Theodore Bevan and W. L. Conwell; secretary, George H. Guy; treasurer, H. A. Sinclair. After the election Dr. William H. Tolman, director of the American Museum of Safety Devices and Industrial Hygiene, will lecture on "Safety and Security for American Life and Labor."

International Independent Telephone Association.

[*Continued from page 501.*]

A report of the closing sessions of the convention will be given in the Western Electrician next week. There are a large number of exhibitors at the convention, affording an opportunity for the delegates to inspect the latest telephones and telephone appliances.

STANDARDIZATION OF TELEPHONE EQUIPMENT.

One of the most important subjects up for consideration at the convention of the International Independent Telephone Association is the question of the advisability of standardizing Independent telephone equipment in all the systems throughout the country.

Following is the report of the committee of physical standards, which report, however, had not yet been acted upon by the association when the forms of the Western Electrician were closed:

Your committee on physical standards, after mature deliberation, indorses the report of the committee on standardization of equipment, submitted at the annual convention, June 26, 1906, which is as follows:

1. We indorse the resolution presented at the convention of 1905 by the proceeding committee on standardization, recommending that a permanent equipment committee should exist and that a national association bureau of standards and engineering should be maintained.

2. In our opinion the official selection of one unvarying type of telephone equipment as a standard for all companies in the association is not feasible at present, and if it were effected it would probably discourage improvement and impede progress; but we believe that there can and should now be standards officially determined to which various kinds of material and equipment can be referred.

3. In connection with the fixing of standards it is highly desirable that many details affecting maintenance costs should be determined upon, specified and recommended for adoption by all operators and manufacturers as soon as possible. Examples of such details which have been fixed in other lines of business are: Standard incandescent lamp base, standard threads on iron pipe, the standard system of machine screws and the standard fitting for railroad practice.

4. A unit of carrying value for telephone circuits should be determined as soon as possible, and the knowledge of it properly disseminated throughout the association. The adoption and use of this standard unit will enable subscribers' lines, trunk circuits and long-distance lines to be designed and treated in a uniform and definite way that will render possible mutual understanding and co-operation in transactions involving such lines and line values which has hitherto been impossible.

5. We recommend that the association carry the foregoing suggestions into effect, and to that end that a permanent committee be authorized, to be known as the committee on physical standards; that this committee be appointed immediately after the present convention to take the place of the present committee on standardization of equipment, with power to carry on the required work under the direction of the proper officers of the association. All physical determinations made by or under the direction of this committee should be recorded in the form of specifications, to be kept on file as a part of the permanent records of the association, and standard materials as they are determined should immediately be given code names and numbers for the convenience of maker, seller, purchaser and user.

6. In addition to the foregoing we further recommend that the officers of the association be authorized and empowered to receive and act upon the recommendations of the committee on physical standards, and to make necessary business arrangements for carrying on the work of said committee, including provision for meeting expenses of the work, which if possible should be done without making a charge upon the revenues of the association.

All of which the committee respectfully submits.

SAMUEL G. MCMEEN, Chairman.
R. A. WALKER, Secretary.
EDWARD E. CLEMENT, Acting Chairman.

Our deliberation on this matter brings us to the conclusion that the recommendations tersely made in that report if carried out would be productive of substantial benefit to the Independent telephone business at large as well as to the individual members of this association.

There has been some opposition to any attempt at standardization in the Independent telephone business, but it is thought that such opposition arises in the main from a misconception of what this committee is to do. In order to remove this misconception your committee will herein consider somewhat more in detail some of the matters treated in the former report.

Emphasizing the last year's statement: This committee again recommends that no step be taken which will tend to restrict telephone companies in their decision as to types of system or of apparatus. On the other hand, one of its functions should be to assist in the intelligent selection of certain component parts the requirements for which are alike in all systems and in which the results to be obtained are clearly subject to standardization. We may mention as an example that a standard thread might be adopted for the mouthpiece of transmitters to the benefit of all and to the injury of none. The same would apply with respect to the diameter and gauge of thread of receiver caps. Standardization of such things would be beneficial in cheapening maintenance costs and in other various ways.

Many other things which are furnished by the telephone manufacturers and which might with benefit to them as well as to the operating companies be made the subject of reasonable standardization will be obvious to all.

It is the opinion of this committee that the standardization of the products of the telephone manufacturers should not constitute the principal work of the committee on physical standards, but that its main work should consist in standardizing and codifying many of the materials used in construction and of specifying the methods of employing such materials.

As an illustration of the good that can be made to result from the standardization of an article of construction material it may be pointed out that if all purchasers are given a set of specifications covering the proper galvanizing of wire and hardware and are strongly recommended to use material purchased under these specifications, not only will the purchasers thus influenced be benefited but an indirect benefit will result to all operating companies with whom they connect.

It is undoubtedly true that much money is wasted and much time lost by purchasers in writing lengthy and impossible specifications. Such specifications frequently result in paying a higher price than is warranted without any corresponding improvement in quality.

It should be the function of the permanent committee on physical standards from time to time to supply specifications for material, in suitable form for preservation and reference, which should set forth the real requirements of the different types of things to be purchased. Your committee recommends that the most practical way to start this work is to employ a competent engineer as secretary of the committee, whose duty it shall be to compile and distribute among the members of the association the matters determined upon. This engineer should work under the general direction of the members of the committee, who should act in a consulting capacity in order to assure the soundness of the information disseminated.

He should be selected by the permanent committee as soon as possible after its appointment, and thereupon receive his appointment from the proper officers of the association.

Your committee feels that this work cannot be seriously undertaken unless a fund of at least $5,000 is assured in advance. This figure is determined upon the assumption that the members of the permanent committee will be able and willing to give the necessary time and attention to the consulting work of the bureau without charge. Should it be considered necessary to hold meetings of the committee or to prosecute special work this amount would be increased.

The committee making the above report consists of Edward E. Clement (chairman), Washington, D. C.; O. F. French, Winnipeg, Man.; Edmund Land, Grand Rapids, Mich.; Kempster B. Miller, Chicago; A. C. Morse, Cleveland; W. C. Polk, Birmingham, Ala.; H. Linton Reber, St. Louis; Charles Zahm, Portland, Ore.

Indiana Telephone Items.

The Northern Indiana Telephone Company, with principal office at Union Mills, has been incorporated with a capital of $10,000. It will operate a telephone system throughout Laporte, Starke, Porter and St. Joseph counties. Roy Dye, J. F. Underwood and John R. Bailey are directors.

The Zenas Independent Telephone Company proposes to build an exchange in Zenas and extend its lines through portions of Jennings and Decatur counties.

The City Council of Petersburg has notified the Cumberland Telephone Company that unless it pays into the city treasury $500 cash and two per cent. annually on gross earnings in the corporate limits of the city, the franchise, which expires on the 15th of June, will not be renewed.

The Indiana Independent telephone men are greatly elated over the action of the executive committee of the Bondholders' Protective Association of the United States Independent Telephone Company at Rochester, N. Y., in favoring the sale of the properties to the syndicate of Independent capitalists which recently offered $6,000,000 for them. The executive committee of the Bondholders' Protective Association of the United States Independent Telephone Company is made up of men associated with the Independent companies, who banded themselves into a protective association to safeguard the syndicate's best interests. They own a quarter interest in the Indianapolis Telephone Company and have one representative on the board of directors. S.

GENERAL TELEPHONE NEWS.

The Hooker (Okla.) Telephone Company has been incorporated for $20,000 by N. O. Stevenson and others.

The Texoma (Okla.) Telephone Company has been incorporated with a capital stock of $5,000 by J. F. Osborne and others.

An extension to September 1st has been granted telephone and electric companies to comply with the ordinance against aerial wires in the downtown district of Minneapolis, Minn.

The Automatic Telephone and Telegraph Company has been organized at Portland, Me., with a capital of $100,000. The company proposes to manufacture telephone and telegraph apparatus.

The government of the province of Alberta, Canada, will construct a long-distance telephone system from Wetaskiwih to Daysland and will either construct a local system in Camrose or give the town every assistance to construct its own system.

In accordance with the arrangements made at the annual meeting of the Des Moines (Iowa) Mutual Telephone Company in January to consolidate the Independent lines near Des Moines, the capital stock of the company has been increased from $450,000 to $1,600,000. The merger has not, however, yet been fully effected.

The Winnipeg (Man.) Tribune publishes a report to the effect that the Manitoba government is negotiating with the Bell Telephone Company for the purchase of the company's systems in Winnipeg, Brandon and several of the larger towns in the province. Some weeks ago the province agreed to build a system in both Winnipeg and Brandon, and it is thought, rather than have a competing system, the company has decided to sell out to the government, retaining its long-distance lines.

The following telephone companies have recently been incorporated: White Bread Telephone Company of Binger, Okla.; Reeding (Okla.) Telephone Company; Sheldahl (Iowa) Telephone Company; Thayer County Telephone Company of Hebron, Neb., capital stock, $100,000; Buffalo (Neb.) Mutual Telephone Company; Clay Center (Kan.) Telephone Company; Valley Green Telephone Company of Aline, Okla. J. A. Ward will construct a telephone system at Dale, Texas.

The committee on gas, oil and electric light of the Chicago council last week agreed on a tentative ordinance embodying the terms of a telephone franchise for the Chicago Telephone Company. It is a combination of the measure drafted by the committee's attorney and another ordinance drafted by the attorney of the Chicago Telephone Company. Practically all the business telephones would be put on a meter basis. Residence flat rates would be considerably reduced. Final approval of the proposed ordinance by the committee was halted, however, at the committee meeting this week, when several amendments were proposed, one of them suggesting the placing of the company under a board of control and limiting the stockholders' profits to five per cent. on actual investment instead of 10 per cent.

The merger of the York (Pa.) Telephone Company with the York Telegraph and Telephone Company was recently approved at a meeting of stockholders of the former company. The purpose of the merger is to give the company a broader charter, which will enable it to build its long-distance lines. The York Telegraph and Telephone Company will construct its lines into Philadelphia and Pittsburg and eventually extend them throughout the state. The intention of promoters of the new company is to connect at Pittsburg with the west, at Hagerstown and Baltimore with the south, and at Philadelphia with the east. An extension may later enter New York, where it will connect with the Great Eastern Company. A line to the northward reaching Elmira and Buffalo, N. Y., will, it is said, be extended into Canada.

At a meeting of the student body of the Polytechnic Institute of Brooklyn, held recently, President Atkinson announced that there would be several changes in the faculty. Constantine Herzberg, professor of drawing since 1860; Brainerd Kellogg, professor of English language and literature since 1868, and Ami Lador, professor of the French language and literature, have tendered their resignations. William J. Berry, instructor in mathematics, has been given a two years' leave of absence to study at Harvard. C. P. Steinmetz of the General Electric Company will become consulting professor of electrical engineering; William B. Ennis, M. E. (Stevens), will occupy the chair of professor of mechanical engineering; Frank W. Chandler becomes professor of English and the head of the arts department, and Charles A. Green becomes professor of history and economics. The evening and extension work will be continued on broader lines. In civil engineering there will be a series of lectures on concrete and concrete construction. At the annual commencement, which will be held in Shubert's Theater, Brooklyn, on the evening of June 12th, an address will be delivered by Walter C. Kerr of Westinghouse, Church, Kerr & Co.

CORRESPONDENCE.

Continental Europe.

Paris, May 20.—The new Loetschberg railroad and tunnel are now in course of construction in the Berne Canton of Switzerland. The tunnel will be one of the two which pass through the Alps and is the next one to be built after the Simplon. The present work is carried out by one of the large French contracting firms. As to the railroad, which will be operated by electricity, it commences at the station of Frutigen, the latter being the terminal point of a railroad line already built, and follows along the Kander Valley. At Kandersteg the road enters the tunnel, which is about 8½ miles in length. After leaving the tunnel the road passes along the Rhone Valley and finally reaches Brigue, where it connects with the Simplon railroad. It is expected to carry a heavy and through traffic on the new line at high speed, and this will be facilitated by the electric system. Rock drills are now at work in the tunnel on either side, and there is a large electric motor and air-compressor plant erected for the purpose. The whole line is expected to be finished within five years, and it is to cost $15,000,000. In this way the distance from Calais to Milan will be 120 miles shorter than by the Mont Cenis or the St. Gotthard route.

At Paris there is a new section of underground conduit road in construction which runs along the Rue de Rennes and is the extension of the conduit line which was commenced some time ago, but which had to be stopped, owing to the work on the subway tunnel lying underneath. At present the new section will bring the conduit line to the terminal point at St. Germain des Près. This, as well as the old conduit line, which intersects it at right angles, is built on the Thomson-Houston system.

One of the largest electrical syndicates in the south of Europe was formed not long ago in Italy. It is capitalized at $5,000,000, and expects to utilize 30,000 horsepower from one or more hydraulic plants located in the Camonica Valley, in the Brescia district. Later on, this may be increased to 100,000 horsepower. Forming part of the syndicate are the two large Edison companies of Milan and the Conti Company, which is now increasing its capital from $1,400,000 to $2,600,000. These companies have a network of lines in the Milan, Como and Bergamo provinces, and the lines from the new system will be joined to this. In the syndicate are also the South Italian Railway Company, the Commercial Italian Bank, the Paris and Holland Bank and some of the leading banking and other houses of Brussels.

From the latest reports about the new Korn telephotographic apparatus, it appears that it has just been making very successful experiments in Germany, between Berlin and Munich, a distance of about 230 miles. Photographs could be easily transmitted over that distance. It will be remembered that the Carpentier firm is building several of these apparatus at Paris, and they are to be used for the first time in commercial work by one of the Paris illustrated journals, which will receive pictures sent from London.

Steam engines in some of the largest mines in Corea will soon be replaced by electric motors, and to secure the current which is needed for operating them one of the large companies expects to erect a hydraulic plant of some size upon a neighboring river, and by using a 105-foot fall it will be able to secure about 500 kilowatts for the commencement of the plant, after which other groups will no doubt be added. The system will be operated on 13,000 volts. A. DE C.

Great Britain.

London, May 24.—A good many reports have been reaching London lately as to the difficulties which are being encountered in connection with the large gas-driven generating station in Johannesburg. Our interest here with this plant is very close, for the whole of the apparatus has been, or is being, manufactured here, and the headquarters of the consulting engineers who designed the plant are in London. Each succeeding account from Johannesburg tends to leave a worse impression of the difficulties attending the operation of the plant than before. One gathers that the chief trouble has been with the gas engines.

As a result of the opening of the electric railway extension from Islington to Euston—which, as I have already pointed out, gives intercommunication with three more suburban steam termini—the City and South London Railway shows an increase of nearly $2,500 in its receipts for last week. On the Central London Railway the receipts for the past week fell off $4,000, due to the fact that for the whole length of its line this company is subject to the keenest possible competition from motor omnibuses in the matter of price as well as speed. After serious consideration it has been decided not to depart from the uniform fare of four cents for the whole journey, though there was a strong inclination to have a graduated system.

Apropos of the committee appointed by the Tramways and Light Railways Association, in collaboration with the Board of Trade, to consider the whole question of tramway brakes, comes the announcement of a new brake invented by the manager of the municipal tramway system at Preston, in Lancashire. This is of the electromagnetic type, energized in the usual way by current from the motors acting as generators when the controller is on the brake notches. The pair of electromagnets are suspended by springs attached to the frame of the car. Attached to the upper surface of the brake are double-inclined planes. Fixed rigidly to the frame of the car are a pair of rollers, so arranged that any longitudinal movement of the electromagnet will bring one of the rollers into contact with one or other of the inclined planes. Thus, when the car is in motion and the magnets are in contact with the rail, as usual, the further movement of the car has the effect of transferring a portion of the weight of the car onto the magnets through the rollers pressing down on the inclined planes. It is claimed that with a coefficient of friction of 25 per cent. and an inclination of the plane of 3 to 1, an initial magnetic pull of one ton will give a total pressure of 3.9 tons per magnet, or 7.8 tons for a single truck fitted with two magnets. The inventor of the brake believes in the abolition of the hand-brake, which is believed to have been the cause of several accidents, in that by it the driver has locked the wheels of the car and so rendered the ordinary magnetic brake useless.

Every day, almost, brings a fresh development in connection with the electric power bills relating to London. It is very clear that the proposals of the London County Council by no means meet with the approval of the borough councils which own electricity undertakings, for they see in the present policy of the County Council a splendid opportunity for competition with them by a company of some sort. In order, therefore, to guard against this, in addition to maintaining an uncompromising opposition to the bill, a conference is being called together of borough councils owning electricity undertakings, with the object of urging the Board of Trade to once more introduce the supply of electricity bill. As the whole spirit of the bill, however, would conflict with the proposals now being put forward, the Board of Trade would only be complicating matters to an unpleasant degree if it were to accede to any such request in the present state of affairs.

A telescopic lowering gear for arc lamps used in connection with traveling cranes has been put upon the market here. Instead of always having the lamps at one level above the crane, as is so common in generating stations and such places, the lamp can be lowered to a working position and drawn up to admit of the passage of the crane.

Prof. S. P. Thompson, F. R. S., is president of the electrical engineering section of the British Association this year at the Leicester meeting, which opens on July 31st and closes a week later.

Lord Kelvin is now president of the Institution of Electrical Engineers for the coming session. This makes the third time that he has occupied the presidential chair.

The most profitable field in Great Britain at present for the application of electrical machinery is in collieries, there being equipments in course of installation in all parts of the country, particularly in the Newcastle and South Wales districts. There is a curious contrast between these two districts, for whereas in the former there exists the most flourishing of all our electric power companies, in South Wales the electric power company is at a standstill. One of the latest schemes in the Newcastle district is on the property of the Harton Coal Company, where four collieries are being equipped. The supply is at 2,600 volts, 40 periodicity, and the motors will work direct at this pressure. G.

New York.

New York City, June 1.—In its dying moments the Board of Rapid Transit Commissioners decided to give Brooklynites the Fourth Avenue subway, with branches to Coney Island and Fort Hamilton. About 150 men, representing South Brooklyn's civic organizations, attended the meeting to urge definite action before the board went out of existence. This was not necessary, however, as a motion was made by President Orr to call for bids for the above routes, which was unanimously carried.

Eleven months have now been added to the time for completion of the Brooklyn subway, which the Interborough company is constructing, and it will be next May, if there is no further extension of time, before trains can be run to the Flatbush Avenue tunnel. This extension was recommended by Chief Engineer George S. Rice and Counsel George L. Rives, who stated that the extension was necessary because of delays in getting consents when the original plans were changed from two to four-track construction. Failure to get steel is also a cause of the delay. The problem of building a subway beneath busy Fulton Street, with an elevated railway to support it, has proven to be much more difficult than was originally anticipated, and their report intimates "that complications may arise which may tend to even further delay the completion of the work."

Attorneys for the New York Central and the O'Rourke Engineering and Construction Company have agreed to execute an agreement in which, by the payment of a lump sum by the railroad to the construction company, the $8,000,000 contract between them for the excavation of the site for the Central's new terminal will be canceled and the New York Central will complete this work itself. The canceling of the contract was sought by the O'Rourke company because it was not satisfied with the condition under which the work had to be pursued. Changes in the Central's plans and the matter of congested traffic are some of the reasons given why the contract should be canceled.

A committee has been formed of those living near the Third Avenue station of the Brooklyn Rapid Transit Company to make a house-to-house canvass for signatures to a petition to compel the Brooklyn Rapid Transit Company to stop the soft coal and cinder nuisance. Dr. Maxwell of the Health Department, who was interviewed recently, says that nothing can be done for about six months, or until the Brooklyn Rapid Transit Company installs additional boilers and thus decreases the amount of cinders thrown out by the forced draft now used. The committee, however, expects to take the matter up with the borough president and the mayor to see if some legal action cannot prevent the power company from using soft coal and compel them to use better cinder screens.

An agreement between the Brooklyn Heights Company and the South Brooklyn Railway Company, filed in Kings County, states that "the Heights company hereby sells, assigns and transfers to the Brooklyn company the lease dated June 17, 1899, between the Prospect Park and Coney Island Railroad Company and the Brooklyn Heights Railroad Company, together with all the right, title and interest thereby conveyed in the Prospect Park and Coney Island Railroad Company and the Prospect Park and South Brooklyn Railroad Company, and together with all the rights and benefits thereby conferred upon the Heights company." E. H. S.

Dominion of Canada.

Ottawa, June 1.—The town of East Toronto, Ont., has decided to grant a franchise to, the Independent Telephone Company to install and operate a telephone system in that town in opposition to the Bell company. The rental will be $15 a year for house, and $24 for business telephones.

The Ontario Hydro-electric Power Commission has received from a private company an offer to deliver electric energy to Port Arthur, Ont., from Dog Falls. The power is to be stepped down and delivered at the city limits for $17.50 per horsepower for the first 3,000 horsepower, and $16.50 up to 6,000 horsepower. For an amount over 6,000 horsepower, $15.50 per horsepower will be charged.

Plans have been consummated for the amalgamation of the Brantford Street Railway Company, the Grand Valley Radial Company and the Woodstock and Ingersoll Railway Company, all in Ontario. The new organization, which will operate under the name of the Grand Valley Radial Railway Company, is headed by M. A. Verner, a capitalist of Pittsburg, Pa.

The capacity of the Renfrew Power Company of Renfrew, Ont., has been increased and an official test has been made. In the development and distribution of power, the sum of $110,000 has been expended, and the enlargement cost in the neighborhood of $30,000. The former capacity of the plant was about 400 horsepower, and the new unit, just installed, brings the capacity up to 1,000 horsepower.

It is proposed to amalgamate the Electric Company and the Sherbrooke Street Railway Company of Sherbrooke, Que., with a capital of $700,000. A syndicate has an option on the street-railway stock, and it has made a proposition to the city for an extended franchise, and, in return, giving the city 500 horsepower, to be used for manufacturing purposes, at $15 per horsepower per annum.

Concurrent with the issue of the sixth annual statement of the Montreal Light, Heat and Power Company, comes the announcement of efforts being made to secure control of the concern by English and American interests. It is said that leading capitalists are willing and anxious to take up the company's stock and pay a substantial price for it. The company's offer to Montreal to sell its stock to the city, together with all its property, for $25,000,000, gives an idea of the amount that would be necessary to float such a plan. The gross earnings for the year amounted to $3,453,490, and the net profits, after providing for fixed charges, interests, etc., were $1,440,582, being an increase over the previous year of $267,387 gross and $162,092 net. A dividend of five per cent. for the year was paid. The surplus is now $1,491,740. W.

Winnipeg, June 1.—Edmonton, the capital of the province of Alberta, has been particularly successful in its municipal lighting plant. Good management and careful administration have brought the civic plant to a high state of efficiency for present requirements. At the present time there are approximately a quarter of a million incandescent lamps in use in the city, and the number is ever on the increase. The rates to consumers are said to be lower than in other western cities, with the result that the city electrician is constantly in receipt of communications asking for information regarding the plant. The demand for electric power for power use is also increasing rapidly. In December last the motors installed in Edmonton rep-

resented about 110 horsepower, while at the present time 300 horsepower is being used and additional motors are being installed every week. Another tax on the supply will be the incline railroad, which will be completed during the present summer. The street-lighting system is a modern one, and experts have pronounced it to be the most up-to-date in the Dominion. The system now in use is the constant-series arc, manufactured by the Westinghouse company. There are at present 76 arc lights in use, but owing to the extensive growth of the city, a number of the outlying districts will shortly need service. The plant will soon be too small, and already orders have been placed with Allis-Chalmers Company of Milwaukee for the necessary machinery, and it is expected the new plant will be in operation before the coming winter.

J. H. Ashdown, mayor of Winnipeg, states that the council and civic board of control will take steps to secure center trolley poles for a number of the street-car lines in the city. The Board of Control has written to a number of American cities to ascertain which class of pole is most suitable. Wilford Phillips is manager of the Winnipeg Electric Street Railroad Company.

There is an excellent prospect that the Crow's Nest Pass will have a telephone system this year. The Cranbrook Electric and Power Company of Cranbrook, B. C., is having plans prepared for such a system to connect the lines in British Columbia with the Alberta government lines. The company already has the line built as far as Elko, while the Alberta government is engaged in constructing a line between Calgary and Le Pas. When completed, telephone connection between Winnipeg and Vancouver will be possible.

J. W. Fitzpatrick and Hon. Frank Latchford, directors of the Nipissing Central Railroad, are interested in the construction of an electric railway between Cobalt and New Liskeard. They state work will be commenced on the line at once. Their charter enables them to build and operate from Temagami to Abitibi.

H. Y. Anderson, the newly appointed manager of the Beatrice mine, Nelson, B. C., states that the company will at once make arrangements for the building of a tramway from the mine to Nelson, a distance of 11 miles. At present there are some 250,000 tons of ore held at the mine waiting transportation.

The Canadian Pacific Lumber Company of Port Moody, B. C., the British Columbia Power and Electric Company of Vancouver, B. C., and the Port Haney Lumber Company of Port Haney, B. C., have been given permission to develop three water-powers in British Columbia. R.

Indiana.

Indianapolis, June 1.—Two new traction companies will begin operations on regular schedule time on June 3d. The Evansville, Rockport and Eastern Traction Company will open up service between Evansville and Rockport, and W. H. McCurdy, president of the company, says the Grandview extension will be constructed at once. The other company is the Indianapolis, Crawfordsville and Western, and will begin the regular operation of cars between Crawfordsville and Indianapolis. The new cars built at Newark, Ohio, are geared to a high speed and will make the trip in less time than the Northwestern Railroad.

New traction terminal stations will be built in Evansville, South Bend and Michigan City. The one at Evansville will be erected by the Evansville, Southeastern and Newburg Railway Company and the others by the Chicago, South Bend and Northern Indiana Railway Company.

The Great Eastern Traction Company is securing bonuses and subsidies for the construction of a traction line between Indianapolis and Evansville by way of Nashville.

About 50 of the 100 street-car employes of the Evansville Street Railway Company, who went on a strike 10 days ago, have returned to work. The wages will be 17 cents an hour for first-year men, 18 cents for second-year men and 19 cents for third-year men, and an 11-hour day.

The Indianapolis and Eastern Traction Company is preparing to install a 480-horsepower steam boiler and a 2,500-horsepower steam turbine in its power plant at Spring Lake.

The driving of the last spike, which will be of silver, to complete the line of the Indianapolis and Crawfordsville line, to be known as the Ben Hur route, will be done next Monday by E. A. Reynolds, president of the new road.

The interurban roads carried 22,000 people to Indianapolis on Decoration Day without a mishap of any kind. Some of the cars with a seating capacity of 90 to 100 carried as high as 215 passengers.

The Indianapolis and Louisville Traction Company began the regular operation of cars between Scottsburg and Henryville on June 1st. The line will be opened to Louisville in another week, and there will be through service between Indianapolis and Louisville by July 1st.

Hugh J. McGowan, president of the Terre Haute, Indianapolis and Eastern Traction Company, held a conference with the city authorities of Terre Haute during the week. He asked that the ordinance calling for an eight-minute schedule be repealed, and promised to give good service. He also asked that the pay for street lighting, which has been held up for several months, be turned over to the company. The council withheld the bill because the company was not complying with the street-car-schedule ordinance and because the candlepower of the street lights was 25 per cent. weaker than stipulated in the contract. Mr. McGowan promised to drop all 10-cent fares and give transfers from the interurban lines to the city lines.

The Indiana Railroad Commission has given a knockout blow to the so-called half-interlocking switch that several of the interurban roads have erected at the crossings of the electric and steam lines. The commission decided that in the future towers must be erected and a man kept in charge to operate the interlocking devices. The interurbans of the state will be forced to spend thousands of dollars in complying with the ruling of the commissioners.

The properties of the National Light, Power and Heating Company in Indiana, for which contracts or options were made two weeks ago, were formally taken over during the last week. These include the electric-light plants in Bloomington, Columbus and Shelbyville. The deals were put through by W. H. Schott and I. L. Meloon, the latter general manager at New York. The second day after the transfer the Bloomington plant was destroyed by fire. The company announces that the plant will be rebuilt at once and that the lines will be extended to the quarries south of the city. A new building will be erected at Columbus and improvements made at Shelbyville.

It is reported that an electric current of high voltage to supply operating power to the whole of the Oolitic stone district and some of the coal mines of Southern Indiana is one of the development schemes planned by the Central Indiana Lighting Company, the $3,000,000 corporation recently organized by New York capitalists.

Oliver Ong, superintendent of the municipal light plant at Rushville, has been asked by the mayor and council to resign. Charges of mismanagement have been made. During the last year the plant ran behind $4,000. The city is planning to invest $1,500 in new improvements for the plant, but no action will be taken until the present troubles are remedied. S. S.

New England.

Boston, June 1.—The New England Telegraph and Telephone Company has opened its new exchange in Quincy, Mass. The operating room has a switchboard with a capacity of 8,000 circuits. At present the exchange has 1,020 subscribers.

The Submarine Signal Company has finished a long test of a submarine bell designed by Edward C. Wood of Somerville, Mass. The bell was placed on the bottom of Boston Harbor, in water 70 feet deep, and connected to an electric generator operated by a 2½-horsepower oil engine, at Point Allerton, 2¼ miles away. The current was turned on and the bell was made to strike about 20 blows a minute. It was made to strike almost continuously until over 1,000,000 strokes had been made, which kept the generator at work 789½ hours. During this time the apparatus required no attention. The ringing of the bell was distinctly heard in the cabin of the Boston lightship, a distance of five miles, and it could be heard six miles away. The company is making 11 bells, eight for the Canadian government, two for the United States Lighthouse Board to be stationed at the mouth of St. Mary's River, and one for a Fall River Line steamer.

The New England Telegraph and Telephone Company has opened a new telephone exchange in Needham, Mass. It is operated on the common-battery system and its switchboard will accommodate 800 lines.

Governor Woodruff of Connecticut has vetoed the bill for the incorporation of the Windsorville and East Hartford Street Railway Company.

Vice-president Townley of the Consolidated Railway Company announces that the company will this year expend $200,000 in improvements on its electric railways in the New Britain (Conn.) district.

In the United States Circuit Court at Hartford, Conn., the Johns-Pratt Company has filed a bill of complaint against the Sachs Company, alleging an infringement of electric safety-fuse patents, and asking for an injunction preventing the manufacture of the fuses by the Sachs Company. The latter was organized by Joseph Sachs, formerly of the Johns-Pratt Company. B.

Illinois.

Peoria, June 1.—The Taylorville Utility Company has been incorporated with a nominal capital of $5,000, to operate a light, heat and power plant, also cold storage. The incorporators are Albert Morgan, J. A. Adams and Merkle Perkins.

Within a short time direct connection will be opened by the Interstate Telephone Company to Canton. The new service will be made possible through the combined action of the Citizens' company of Pekin and the Home Telephone Company of Canton.

The Decatur-Champaign interurban bridge across the Sangamon River east of Decatur is now practically completed.

The Illinois Traction Company will inaugurate a freight service between this city and Bloomington on Monday. Two trains a day will be run; one will be a local and the other a through train to handle St. Louis freight. The company will use some of its passenger cars at first, but the intention is to use regular freight cars with their large electric locomotives as soon as the equipment is received. This will make a train through from St. Louis every night at 11 p. m., due to arrive in Peoria the next morning early, with a like service in the opposite direction.

Illinois Central telegraph operators have asked for a nine-hour day, to be granted them September 1, 1907, instead of waiting till March 1, 1908, as provided by federal law.

A. N. Fisher and a corp of assistants are making a new survey of the Mattoon-Shelbyville-Hillsboro line and this week reached Shelbyville. The new line will parallel the Big Four within a mile of Shelbyville, where it passes through the city. It is announced that eastern capitalists are ready to build the line as soon as the survey is finished, and the right-of-way secured. The line will form the connecting link between St. Louis and Indianapolis. Construction work is expected to be started this fall.

C. H. Lyons has been reappointed city electrician by the new mayor. During Mr. Lyons' term he has placed the city wires underground in the business part of the city, and is planning to put more of them underground this year. V. N.

Ohio.

Toledo, June 1.—The Lake Erie, Fremont and Southern electric line has been incorporated by H. F. Shunk, A. E. Klauser and others. The home of the company will be at Toledo. It will connect with the Toledo, Port Clinton and Lakeside road and when completed may be merged with that line.

Jere C. Hutchinson of the Detroit United Railways learned of a new way of collecting fares while visiting in Montreal and the system may be used on the lines of the Everett-Moore system in a short time. The plan is to have two doors on each car, one for passengers to enter and the other for an exit. The conductor stands at the entrance and collects fares as passengers enter the car.

As the result of an investigation of telephone conditions in Youngstown, the service will have to be bettered or the companies deprived of their charters. Complaints made against both the Bell and Independent companies by business men resulted in the investigation.

The power house of the Toledo, Fostoria and Findlay line will be enlarged to three times its present size and may be moved from Fostoria to Pemberville, because of the poor water supply at the former place. The line is being extended from Pemberville to Toledo, and when this extension is completed three times the present power will be needed.

Plans for a new municipal lighting plant at Findlay are being made by Engineer George Champe of Toledo, who will have charge of the construction of the new plant.

The preliminary survey for the Fremont, Marion, Tiffin and Southern line was commenced on Monday.

Survey work was started last week on the Northwestern Ohio electric line from Montpelier to Coldwater, Mich. A right-of-way has been secured, and the line may be extended to Kalamazoo, Mich.

Youngstown will probably be connected with Cleveland as the result of the merger of the Northern Ohio Traction lines and the Eastern Ohio lines. The connection will be by the way of Leavittsburg and Hiram. S.

Pacific Slope.

San Francisco, May 29.—The street-railway strike, which commenced more than three weeks ago, is still exerting a very depressing influence on local business of all kinds, not excepting the electrical supply trade. Attempts are made to enforce boycotts on firms whose members or employes ride on the cars, but the number of passengers carried is increasing and exceeds 120,000 daily.

The latest indictments procured in the local graft investigation were those of John Martin, Eugene De Sabla, Jr., and Frank G. Drum, on charge of being responsible for the bribery of the San Francisco Board of Supervisors, in order to secure the fixing of the gas rate charged by the San Francisco Gas and Electric Company at 85 cents instead of 75 cents a thousand. The supervisors confessed that they were paid $750 each. A short time before the time of the alleged bribery the San Francisco Gas and Electric Company was purchased by Martin and De Sabla's California Gas and Electric Company, and the Pacific Gas and Electric Company was organized as the new holding company for all of these properties. It is understood that the grounds upon which the three men were indicted were that they composed the executive committee of the San Francisco Gas and Electric Company, and it was inferred that they must have passed upon the appropriation of the sum claimed to have been paid out in bribes.

The Pacific Gas and Electric Company is con-

constructing a long transmission line from the Rome power house on its Bay Counties division to the Alaska mine, near Pike City. The power house is situated on the South Yuba River, and it is estimated that the profits of the mine will be considerably increased by the change from steam to electric power.

The Snow Mountain Power Company is pushing its preparations for installing a hydro-electric power-transmission plant in Glenn County, Cal. Wynn Meredith or Hunt, Dillman, Meredith & Allen of San Francisco, is engaged in the preliminary engineering work. The company has a capital stock of $500,000.

Frank M. Johnson and his associates in the Port Orange and Santa Ana Railway Company, which they recently incorporated with a capital stock of $500,000, will soon commence the construction of a standard-gauge electric railway from Santa Ana to a new resort, called Port Orange, on Newport Bay. Much of the construction material has already been purchased for this new line, that will be an outlet to the ocean for a number of cities having an aggregate population of 150,000.

The Pacific Lighting Corporation of Los Angeles and Eureka, Cal., has been reorganized by C. O. G. Miller and Alfred Sutro of San Francisco and their associates. Amended articles of incorporation have been filed, increasing the capital stock of the corporation to $20,000,000.

The city trustees of St. Helena, Cal., have granted Henry Brown, a banker, of Napa a franchise to bring a transmission line into the city. He will also apply for permission to enter Vallejo and Calistoga. Mr. Brown is supposed to be acting in the interests of the Western Power Company, which expects to furnish current to customers in the territory already served by the Bay Counties division of the Pacific Gas and Electric Company.

The officers of the Home Telephone Company of San Francisco have announced the completion of plans for the first of five buildings, which are to be erected in the city in connection with the proposed Independent telephone system.

A telephone line, 62 miles in length, extending from Rhyolite to Greenwater, Nev., has been completed by the Southern Nevada Telephone and Telegraph Company. A.

PERSONAL.

C. F. Richardson has been appointed superintendent of the Lincoln (Ill.) Railway and Light Company, to succeed Acting Superintendent Thorp.

Charles A. Hicks, 54 years old, for 42 years in the main New York office of the Western Union Telegraph Company, died recently at his home in Hoboken, N. J.

V. R. Lansingh, general manager Holophane Company (sales department), 227 Fulton Street, New York city, has just returned from a six weeks' business trip to the Pacific Coast.

J. M. Morgan has resigned the presidency of the Cincinnati, Toledo and Detroit Short Line and William McGee of Pittsburg succeeds him. Mr. McGee is president of the Mathers-McGee Coal Company of Pittsburg.

T. F. Grover has been selected as manager of the Terre Haute Traction and Lighting Company of Terre Haute, Ind., having disposed of his interests in Colorado. The property in Indiana which Mr. Grover will manage consists of the local street-railway systems in Terre Haute and Brazil, also the lighting systems, and interurbans to Brazil, St. Marys, Sullivan and Paris, Ill., about 100 miles in all.

John Manderscheid of Fond du Lac, Wis., manager of construction work for the Paxton (Ill.) Electric Company, died at Paxton on May 18th as a result of receiving an electric shock while endeavoring to locate a short-circuit. He was working on an electric-light pole when he accidentally came in contact with a current of electricity. Mr. Manderscheid was formerly in the employ of the Eastern Wisconsin Railway and Light Company at Fond du Lac.

J. Henry Goehst, construction superintendent with the Chicago Edison Company, was married on June 4th to Miss Clara Schulz of Chicago. A number of his associates among the electrical men of Chicago entertained him at dinner at the Chicago Athletic Association on May 31st, the following-named being present: L. A. Ferguson, J. W. Ferguson, J. F. Gilchrist, R. L. Elliott, H. B. Gear, W. L. Abbott, P. Junkersfeld, George H. Jones, E. A. Edkins, H. Jampolis, J. H. Gulick, F. E. Baker, J. Manley and H. E. Niesz.

J. E. Moore has been recently added to the engineering staff of The Arnold Company. Mr. Moore is a graduate of Purdue University, and subsequently entered the employment of the Sprague Electrical Equipment Company, where he was engaged in electric-railway installation and operation. Later he entered Princeton University and did advanced work in electrical engineering, receiving in 1899 the honorary degree of doctor of science. At that time he took up the design and building of electric-light and power plants, and about two years later became electrical engineer for the city of Davenport, Iowa. Mr. Moore held this position for five years, leaving it for his present position with The Arnold Company.

It is reported that A. W. Zahm, the well-known central-station man of Mason City, Iowa, and former president of the Iowa Electrical Association, has been appointed manager of the Fort Dodge (Iowa) Light and Power Company.

C. V. Wood of Canton, Ohio, has been appointed general freight and passenger agent of all the electric railways operated by the New England Investment and Security Company which holds the New York, New Haven and Hartford Railroad Company's stock in the Massachusetts electric railways. Mr. Wood will be located in Worcester and A. B. Smith, general traffic manager on all the railroad company's electric railways, will be his assistant. Mr. Wood, who will control the excursion and the parcel express business, will soon, it is said, inaugurate a general trolley freight and express business on the Worcester Consolidated Railway system, this business to be extended to other Massachusetts electric railways later.

Henry W. Frund, who for a number of years has been manager and director of the Vincennes (Ind.) Light and Power Company, has been appointed manager of the Salisbury and Spencer Railroad Company, with headquarters at Salisbury, N. C. Mr. Frund will have charge of the railway system in and between these two towns and will also have charge of the municipal lighting and the gas and electric properties in Salisbury as well as Spencer. The Vincennes Light and Power Company is owned by E. M. Dean & Co. of Grand Rapids, Mich., as is also the railroad of which Mr. Frund has been given charge. Mr. Frund will be succeeded by Alex Wyness of Manistee, Mich., as superintendent of the Vincennes plant.

Frank W. Pardee, who has been identified with the telephone and electrical business for about seven years and who up to May 1st had been for some time manager of the business of Frank B. Cook, Chicago, is now treasurer of the Durant Electric Supplies Company, manufacturer of telephone and electric material, 56 Fifth Avenue, Chicago. Mr. Pardee, as manager of Mr. Cook's business, achieved a marked degree of success, and saw the concern grow from a comparatively small plant occupying one floor to a large business occupying nearly four floors. A dinner was recently given in Mr. Pardee's honor by the employes of Frank B. Cook at which he was presented with a gold watch in recognition of his services to the firm.

G. U. G. Holman has been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company, and has already entered upon his new work. Mr. Holman is well known in electrical circles. After graduating from the Massachusetts Institute of Technology he was for several years with the Thomson-Houston and General Electric companies in Lynn, Mass., New York city and also in Minnesota. He left the General Electric Company in 1892 to become railway engineer with the Mather Electric Company of Manchester, Conn., and later was engaged in the lighting field in Philadelphia for five years. In the last few years he has been connected with the construction and operation of electrical enterprises in New York, Philadelphia and Canada, so that he is qualified to make the most of the opportunities offered him in his new field.

John A. Walker, vice-president and treasurer of the Joseph Dixon Crucible Company, died at his home, Jersey City, N. J., on May 23d. Mr. Walker was born in New York in 1837. He received his early education in the schools of Brookiyn, and after a business training in New York and serving in the Civil War he became connected with the firm of Joseph Dixon & Co. of Jersey City. In 1868, when Joseph Dixon & Co. became incorporated as the Joseph Dixon Crucible Company, he was made secretary of that company and began his life work in making known the uses of graphite, of which the company has been the widely known exponent. Mr. Walker served the company as secretary and largely as manager until 1891, when he was elected to the dual position of vice-president and treasurer, the latter office having been held by him for some time previous. He held these offices without interruption until his death, the general management of the company also being largely in his hands.

ELECTRIC LIGHTING.

J. F. Heiberg has been granted a franchise to construct an electric-lighting plant at Twin Valley, Minn.

The Federal Light and Heat and Power Company of Asbury Park, N. J., has been capitalized at $125,000 by Daniel Moor and others.

Thomas B. Carter, supervisor of lighting in the city of St. Louis, has recommended to the Board of Public Improvements the introduction of an ordinance to authorize the official inspection of electric-light meters. Mr. Carter believes that the city should have charge of electric meters and not depend upon the inspection by electric companies installing the meters.

A franchise for an electric-light and water plant at Russellville, Ark., has been granted to the Southern Traction and Power Company of Pine Bluff, Ark.

The city of Milwaukee, Wis., has decided to advertise for bids for a gas producer and engine for a municipal electric-light plant. The cost is estimated to be about $40,000.

The Sedalia (Mo.) Ice, Light and Fuel Company has succeeded to the business of the Sedalia Ice and Cold Storage Company and the Lemp Sedalia Ice and Refrigerating Company.

H. M. Byllesby & Co. have been retained as consulting engineers for the Sioux Falls Light and Power Company of Sioux Falls, S. D. A water-power with a head of about 80 feet is to be constructed on the Big Sioux River at this point.

The Municipal Council of Calcutta, India, invites proposals until December 31st for the lighting of the city by either electricity, gas, oil or any other method. Area, 20 square miles; 300 miles of streets, including 170 miles of main streets, all lighted at present by about 9,300 gas lamps of an equivalent of 11,300 24-candlepower lamps and 2,400 24-candle-power oil lamps.

Much is at stake in a suit brought before Vice-Chancellor Emery at Newark, N. J., on May 28th, by the Consolidated Railway and Electric Equipment Company, a concern with a capital of $25,000,000, against the United States Lighting and Heating Company, with $16,000,000 capital. The suit was brought to decide the ownership of some of the patents issued to Morris Moskowitz for generating electricity from car axles for the purpose of lighting passenger coaches and to compel the defendant company to transfer the patents to the complainant. Moskowitz was the inventor of this system, and in 1894 he assigned his patents to the National Electric Car Lighting Company, which subsequently assigned its interest, together with a contract with Moskowitz, to the complaining company. It is of the patents issued to Moskowitz since 1902 that the court is asked to settle the ownership. The defendant contends that the patents issued to Moskowitz since 1902 relate to a different system of lighting cars than that patented by him previously and assigned under his contract.

More than passing interest, says Electricity of London, attaches to the electric-light installation on board the training ship Impregnable at Devonport, which is now nearing completion. The generating plant is not installed on the training ship proper, but located in the hold of the Inconstant, the two vessels being connected by a bridge. The dynamos are three in number, each of 200 amperes capacity, and feed the bus-bars on the main switchboard, whence distributing cables are led across the bridge, through a special three-way switch, to sectional boxes, and, by distributing boxes, through sub-mains to the various consuming points. A necessary feature of the installation was the provision for any ultimate removal of the bridge connecting the two vessels, without having to cut the main cable connections. To this end the main leads connect to junction boxes at either end of the bridge, so that, if it be necessary at any future time to remove the latter, the cables can be disconnected at these points by a very simple operation. Over 300 incandescent lamps will ultimately be installed.

ELECTRIC RAILWAYS.

The report of the New York City Railway Company for the quarter ended March 31st shows a deficit of $1,401,410, compared with a deficit of $926,367 last year in the same quarter. The total income decreased from $1,863,357 to $1,461,600, while fixed charges rose to $2,863,010 from $2,789,724.

Representatives of the syndicate which is financing the Philadelphia and Western Railroad, a new electric line running out of Philadelphia, have reported that the details of the financial readjustment of the company have not yet been decided upon. The property was recently sold at foreclosure in Philadelphia in pursuance of a plan to readjust the road's finances.

The branch of the Spokane (Wash.) and Inland railway system, extending 25 miles from Oakesdale to Garfield and Palouse, was opened to passengers on May 27th. For the present trains will reach Garfield by electric power and then proceed to Palouse by steam, as the overhead construction is still incomplete between those towns. The company is now operating 150 miles of electric railway.

The Southern Pacific Railroad Company and the Huntington interests, which are joint owners of the Pacific Electric Railway, which controls several hundred miles of electric lines in Southern California, have acquired control, it is said, of the San Bernardino Valley Traction Company and will connect the San Bernardino lines with the Pacific Electric lines at Riverside, Cal. The capital of the Pacific Electric Railway is $20,000,000, of which $10,000,000 is held in the treasury of the Southern Pa-

cific. The San Bernardino Valley Traction Company operates 34 miles of electric lines in and around San Bernardino.

Justice Fitzgerald, on May 25th, handed down a decision granting the application of the Board of Rapid Transit Commissioners for an injunction restraining the Interborough Rapid Transit Company from supplying electric power to the New York City Railway Company. The judge declared that the city is the owner of the subway and all of its appurtenances, having built it at an expense of $50,000,000. This property is leased to an operating company for a term of years. When the ducts were put in for the transmission of electricity it was found that there was a greater number than was required for the operation of the trains, and some of these conduits have been used by the subway company for the transmission of power to the surface lines, without paying any rent to the city. The subway company, according to Justice Fitzgerald's decision, generates a great deal more electricity than is necessary for the operation of the present road or than will be needed for its Brooklyn extension, and this extra electricity is furnished to the surface roads.

PUBLICATIONS.

The Chase-Shawmut Company, Newburyport, Mass., has just received from the hands of the printers, circulars and miniature bulletins covering some of its special lines, as follows: Shawmut ground connection clamps, extended terminal fuses, pocket test lamps, Boston cable clips, Red E solder paste and porcelain cut-out blocks.

The monthly bulletin for May of the Ohio Brass Company, Mansfield, Ohio, contains illustrated short descriptions of the equipment for the Marion, Bluffton and Eastern Railway, a modern private electric-railway car, the Tomlinson automatic radial car coupler, manufactured by the company, and a short article on electric haulage in mines. The company's new 600-page catalogue on electric-railway and mining supplies will soon be ready for distribution.

The Chase-Shawmut Company, Newburyport, Mass., has issued a folder in which are described "Shawmut" all-copper ground connection clamps, which are approved by the Underwriters' National Electric Association. The clamp is made in two parts and when installed is locked in such a manner as to give the maximum contact on the device upon which it is installed. It is also largely used for grounding the metal sheaths on cable and for grounding conduit installations.

"Substitution of the Electric Locomotive for the Steam Locomotive," by Lewis B. Stillwell and H. St. Clair Putnam, is the title of a book reprinted from the transactions of the American Institute of Electrical Engineers and containing exclusively the paper presented by Messrs. Stillwell and Putnam, with the discussion that followed, at the meeting of the Institute held in New York on January 25, 1907, an abstract of which, with the discussion, appeared in the Western Electrician of February 2d.

The Automatic Electric Company, Chicago, is sending out a letter "To the Public Everywhere" (with apologies to the Postal Telegraph Company), in which are reproduced facsimiles of the telegrams received by officials of the city of New York from the mayors of various cities and from the officials of many Independent telephone companies, concerning the merits of the automatic telephone system. Their opinions were received during the agitation in New York city for a franchise for the Atlantic Telephone Company, which purposed installing the automatic system.

Magneto switchboards are exhaustively described and profusely illustrated in bulletin No. 104, issued by the Dean Electric Company, Elyria, Ohio. Chapters are given on arrester switchboard protection, cut-in station equipment, divided circuit party line ringing, construction of an exchange ground, care of gravity type transmitter batteries, harmonic selective party line equipment, operator's equipment, customers' protection and guarantee, repeating coils, switchboards for railroad dispatchers, transfer equipment and the disks, jacks, keys, cords, plugs, etc., of a modern switchboard. The bulletin embraces 116 pages, the text being written in concise language.

The Crocker-Wheeler Company, Ampere, N. J., has issued bulletins Nos. 78 and 80. The former treats of form L motors and the latter of direct-current lighting and power generators. Form L motors are built to meet any condition requiring small power for either belt or gear drive or for direct connection. They are furnished for outputs varying from one-tenth to five horsepower for operation on 115, 230 or 500-volt direct-current circuits. They are especially suited for application to small tools, printing presses, pumps and all kinds of light machinery. Illustrations are given of the motors operating a pipe threader, a contractor's portable pump, a row of drills, a lathe, cutting-off machine, traveling hoist and an automatic mailing machine. The generators described in bulletin No. 80 embody all the features peculiar to Crocker-Wheeler machines. They are designed to meet the most approved requirements and to comply with the standards adopted in the most recent practice. The machines have ample cooling surface, special ventilation, nearly flat efficiency curve, low armature reaction and good commutation characteristics. Several illustrations are given of generators of different capacities operating in various plants.

SOCIETIES AND SCHOOLS.

The April bulletin of the University of Minnesota, the College of Engineering and the Mechanic Arts, sets the dates for entrance examinations and registration for the year 1907-1908 at September 9th to 16th. C. D. Decker of Austin, Minn., is secretary of the board of regents.

The Chicago Commercial Association is sending out to 10,000 prospective members a circular letter on what the association has accomplished together with an immense picture of the good fellowship supply held in the Coliseum on March 12, 1907, which was attended by 1,300 members and 1,200 guests.

The International Association of Municipal Electricians will hold its twelfth annual convention at Norfolk, Va., August 7, 8 and 9, 1907, in the City Hall. Norfolk has been selected as the meeting place, not only for its position geographically, but also on account of the Jamestown Exposition. The papers selected for the meeting are: "Electrical Inspections and Records;" "Modern Application of Storage Batteries;" "The Value of Volt and Ammeter Tests for Insulation;" "A Modern Fire-alarm Central Office," and "Operation of a Municipal Electric-light Plant." August 9th has been set aside by the exposition management as Municipal Electricians' Day, and special features and attentions will be given the electricians at the grounds on that day. Frank P. Foster, Corning, N. Y., is secretary of the association.

MISCELLANEOUS.

A terminal depôt and office building covering almost an entire city block and costing in the neighborhood of $1,000,000 is being planned by the incorporators of the Oklahoma City Electric Terminal Association in that city.

The New York Times of a recent date says that an attempt came to light in Wall Street a few days ago to merge the New York Air Brake Company with the Westinghouse Air Brake Company. These concerns are credited with controlling the air-brake business in this country besides having a large business abroad, where the companies maintain plants to supply the European demand for American types of air brakes. Options, it is stated, were taken some time ago on blocks of New York Air Brake stock, and it was said they were taken for the purpose of paving the way for a merger of the two companies. President Starbuck of the New York company denied that any plan for a merger was under consideration.

The exhibit of Allis-Chalmers Company in the Machinery and Transportation Building at the Jamestown Exposition includes a Corliss engine, an alternating-current generator, a line of induction and direct-current motors suitable for all purposes, and a model showing the movable and stationary blading from an Allis-Chalmers horizontal steam turbine of 1,500 kilowatts capacity. The company has also on exhibition many of its publications, one of the most attractive being a pamphlet entitled "Allis-Chalmers Engines at Home and Abroad." It contains 68 large pages without reading matter except brief descriptions underneath the cuts and a list of the company's products at the end. Visitors desirous of obtaining a copy may leave their names with one of the company's representatives at the exposition, Section 8, Machinery Hall, and the pamphlet will be mailed as directed.

The New York, New Haven and Hartford Railroad Company has recently placed on the four-track drawbridge over the Housatonic River at Naugatuck Junction a rail-locking device that may render impossible the recurrence of an accident similar to that which occurred on the Atlantic City drawbridge last year. The rails instead of meeting with blunt ends overlap each other fully a foot and a half. By the use of a bolt or plunger the two ends of the rails can be locked. In each rail there is a hole, and when the two rails are in their proper position the towerman by a movement of a lever drives the bolt through the holes, which firmly fastens the rails in rigid alignment. By means of a dial the towerman can tell whether the bolt has made the movement necessary to lock the rails.

Walter Wellman and his assistants and the workmen of the Wellman-Chicago Record-Herald polar expedition sailed on June 3d from Tromso, Norway, for Danes Island, Spitzbergen, on the arctic steamer Frithjof. The vessel also carried the airship with which it is intended to make the dash for the North Pole and all the other appurtenances of the expedition except the Siberian sledge dogs, which will be forwarded later. At Danes Island the aeronauts will begin the work of preparing the airship for the flight to the pole. All news of the expedition will come by radio-telegraphy from Danes Island. Stations will be established there, at Hammerfest and at Tromso, Norway, and it is thought that the experts have overcome the troubles which prevented them from keeping the line of communication open last year.

TRADE NEWS.

The Bard Electric Company of Seattle has been incorporated for $250,000 by W. H. Bard and others.

The Monarch Electric and Wire Company of Chicago has increased its capital stock from $50,000 to $100,000.

The Electric Rubber Company of Newark, N. J., has been capitalized at $1,000,000 by Oscar C. Miller, Walter H. Bond and others.

The Olenin Electric Company of Binghamton, N. Y., has been incorporated for $75,000 by Alexis Olenin, P. M. Randall and others of Binghamton.

The Electric Appliance Company has been incorporated with a capital stock of $10,000 by E. A. Menczer and others, to do business in Dallas, Tex.

The Lord Electric Company, on May 1st, moved its office, shop, stock room and factory to its new building in New York city at 213 West Fortieth Street.

The Westinghouse Electric and Manufacturing Company is reported to have bought a site for a plant in Chicago, on Morgan Street, between Thirty-fifth and Thirty-sixth streets.

C. E. Bradshaw, Oliver Holmes and F. H. Bradley are the incorporators of a new electric company, to be known as the Bradshaw Electric Company, to do business in Charlotte, N. C. The authorized capital stock is $50,000.

The deputy postmaster-general, Brisbane, Australia, invites bids until September 2d for four sections of a common-battery switchboard and 650 subscribers' telephones to specifications No. 145, particulars being obtainable from the comptroller of stores at Brisbane, Melbourne, Sydney and Adelaide.

The Postmaster-general's Department, Adelaide, Australia, will on July 10th open bids for five miles of insulated copper wire, 500 copper tapes, 5,000 copper binders, two switchboards, two lightning-arrester boards, 1,000 fuses for telephone sets, 500 Leclanché cells, No. 2 size, 100 mechanical registers, 12 differential galvanometers, 15 electromagnetic transmitters and six registering boxes, plug pattern.

Sealed proposals will be received at the Treasury Department, office of the supervising architect, Washington, D. C., until July 8th, July 2d and July 9th, respectively, for the construction of an extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Postoffice and Courthouse at Fort Worth, San Antonio, Tex., and Colorado Springs, Colo.

The Zoar Storage Battery Company of Zoar, Ohio, is sending out literature concerning Zoar storage batteries. The company, which succeeds the Zoar Community, which was dissolved in 1898, asserts that its batteries are durably and strongly constructed and guaranteed to perform the service claimed for them. The cells range from 34 to 68 ampere-hours. Types "B," "C" and "D" are specially adapted to stationary gas and gasoline-engine sparking. A catalogue will be sent on request to those interested.

William H. Bryan, consulting engineer, 315-316 Lincoln Trust Building, St. Louis, Mo., is sending out a booklet to the trade in which he gives a list of individuals or concerns for whom he has rendered professional services of various kinds, including advice on water supply, central lighting systems, mechanical plants for buildings, heating and ventilation, boiler and chimney installations, furnaces and fuels, smoke abatement, elevators and cranes, railway and other miscellaneous work. Mr. Bryan is a member of the American Society of Mechanical Engineers and other prominent organizations.

George W. Jackson, Inc., contractor, successor to the Jackson & Corbett Company, has established permanent quarters at 169-179 West Jackson Boulevard, Chicago. The firm is prepared to furnish estimates to architects, engineers and corporations for the fabrication of steel in all shapes, and for the manufacture of special machinery. It is stated in an announcement now being sent to the trade that the completion of some sixty million dollars of construction has been done in the time specified without asking for extra compensation and without accidents. A list is given in the folder of contracts now under headway by the firm.

The Westinghouse Electric and Manufacturing Company announces that it has acquired the plants and patents of the Hadaway Electric Heating and Engineering Company of New York, from the nucleus of what is expected to be an important addition to the business of the Westinghouse company, which will begin the manufacture of electric-heating apparatus as soon as the necessary shops can be erected. The company purposes to manu-

facture on a large scale electric stoves and ranges of all kinds to supplant those using coal and gas. Mr. Hadaway has accepted a position with the Westinghouse company and will direct the operations of the new department.

The Western Electric Company has put in at 280 Lee Street, Atlanta, Ga., a complete stock of general electrical supplies, and at that point has established a supply organization to care for the southeastern trade. The company has but recently completed the construction of its new Atlanta plant, located on the Central of Georgia Railroad, a few moments' ride from the center of the city. The building has an available floor space of 60,000 square feet. With its sidetracks and modern interior equipment, the plant is peculiarly well adapted for the rapid and economical handling of the heavy stock which is to be carried. To become permanently established in the South is a plan the Western Electric Company has long had in mind.

BUSINESS.

The Bossert Electric Construction Company of Utica, N. Y., says: "The trade is notified that we own the Bossert patents No. 571,297 of November 10, 1896, and No. 682,233 of September 10, 1901, and is warned that we shall protect our rights under the same, by suits if necessary, against all unauthorized persons or concerns making, using, purchasing or selling outlet boxes for metallic conduit construction containing the inventions of those patents. We also inform the trade of the fact that the Universal Caster and Foundry Company is licensed under our said patents and that it is the only concern licensed under them to manufacture and sell (directly or through its agents, the Thomas & Betts Company) outlet boxes for metallic conduit construction."

ILLUSTRATED ELECTRICAL PATENT RECORD.

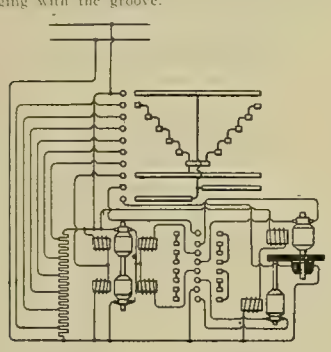
Issued (United States Patent Office) May 28, 1907.

854,700. Electrical Measuring Instrument. Joseph Abrahamson, Detroit, Mich. Application filed August 27, 1906.

The instrument comprises a casing, a coil formed of a rigid conductor the individual turns of which are separated from each other by air spaces, and a contact stud secured in the wall of the casing and projecting inwardly thereof a limited distance, the coil being secured to its inner end and supported thereby free and independently of the casing. A flexible insulated conductor passes through an aperture in the wall of the casing and has its inner end secured to the coil and its outer end provided with a contact stud.

854,712. Controlling Motors at a Distance. Norman C. Bassett, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 24, 1902. Renewed March 23, 1903.

In valve-controlling apparatus, combined with the valve, are an electric motor, a rheostat in circuit therewith, a switch-arm for operating the rheostat and a wheel geared with the motor and having a concentric groove with an offset portion at one side of the wheel, the arm engaging with the groove.



NO. 854,721.—MOTOR CONTROL.

854,717. Dynamo-electric Machine. Walter M. Coffman, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed September 5, 1905.

In a dynamo-electric machine are a core comprising an annular body of laminated material divided into sections separated by spaces, and separators between adjacent sections each having two substantially radial portions in the spaces and a connecting portion within the inner surface of the core proper.

854,720. Dynamometer. William F. Dawson, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 14, 1905.

The device comprises a rotatable shaft, a drum sleeved thereon, annular plates splined in the drum, disks splined on the shaft and alternating with the plates, one or more fluid-pressure devices for forcing the plates and disks together, and means for conducting liquid to and from the surfaces of the disks and plates.

854,721. Motor Control. Maxwell W. Day, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 15, 1906.

Combined are an electric circuit, a pair of mechanically connected shunt-wound regulating machines having their armatures connected in series across the circuit, means for varying the relative strengths of the shunt fields of the machines, a motor connected in parallel with one of the machines, and a field winding for the machine connected in series with the motor. (See cut.)

854,723. Thermal Cut-out. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 7, 1904.

An electric fuse comprises a casing, a fusible strip supported thereon, and a series of independent metallic washers arranged in planes at right angles to the strip.

854,724. Thermal Cut-out. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 7, 1904.

A fuse comprises a fusible strip and a series of independent metal plates provided with slots in which the strip is supported.

854,726. Time-controlling Mechanism. Prescott W. Eames, Delphos, Kan. Application filed December 12, 1906.

The mechanism embraces a support, a stationary contact, a movable controlling element traveling over the stationary contact and having means for completing an electric circuit therethrough, a support for the conducting element provided with an opening having a longitudinally extending groove therein, a contact pin slidably and rotatably mounted in the opening and having a projection to enter the groove of the opening and a spring for actuating the contact pin.

854,727. Device for Controlling Electric Currents. Henry B. Emerson and George H. Dorgeloh, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed October 3, 1906.

A starting rheostat comprises a controlling arm biased to starting position, a no-voltage magnet for maintaining the arm in running position, a brake resistance, an electromagnetic device controlling the resistance and a series of switches each arranged to actuate the device and simultaneously de-energize the retaining magnet.

854,730. Control of Electric Cars. John J. Frank, and Jesse S. Pevear, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 19, 1906.

In an electric car designed for operation on both alternating and direct current are a transformer in shunt to the power circuit of the car, two magnet windings connected respectively in series with the primary and secondary windings of the transformer, and switch contacts controlled by the windings arranged to connect the power circuit of the car for operation on direct and alternating current respectively.

854,739. Alternating-current Motor. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1906.

The motor described has a primary winding, a secondary winding comprising distributed coils connected to form a number of independent closed circuits, a magnetic circuit for the windings arranged to produce an unequal distribution of the primary flux in the coils, and cross-magnetizing coils included in the closed circuits.

854,741. Reverse-phase Relay. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 4, 1905.

The relay has a central core, a series of coils surrounding the core and energized with currents of different phase whereby a progression of flux is produced in an axial direction in the core, a normally inoperative member movable upon a reversal of the direction of progression of flux in the core, and a switch contact operated by the movement of the member.

854,743. Motor-control Device. Andrew Kidd, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1906.

Means for controlling an electric motor circuit comprise armature-control mechanism, field-control mechanism, means normally tending to return the latter mechanism to full-field position and means responsive to movement of the armature-control mechanism for controlling the returning means.

854,748. Resistance Unit. Frederick Mackintosh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 11, 1906.

The unit includes a reflex resistance conductor and insulating washers locking the several loops into a rigid unit.

854,749. Power-transmission Mechanism. Campbell Macmillan, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 1, 1905.

In combination with a driving member and a driven member are a unipolar generator having its field magnet carried by one of the members and its armature carried by the other member, and connections whereby the induced armature current assists in magnetizing the field magnet.

854,751. Cut-out. John T. Marshall, Metuchen, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 26, 1905.

In an automatic cut-out for electric translating devices are combined, with opposing contacts, an intervening conductor insulated from each of the contacts by an interposed film of insulation and normally holding them under strain.

854,756. Dynamo-electric Machine. Jacob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 30, 1904.

The machine has a revolving armature carrying a number of armature conductors connected to collector rings, the points of connection forming one or more spirals, and brushes bearing on the rings, the points of contact forming one or more opposite spirals. (See cut.)

854,759. Trolley Pole. Lee Radcliff, Danvers, Ill., assignor of one-half to Addie Hay, Bloomington, Ill. Application filed June 29, 1906.

The pole is pivotally mounted at an intermediate point upon the standard of the car and has a rocking movement whereby either end thereof may be thrown into engagement with a line wire.

854,760. Induction Motor. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 11, 1906.

The motor described has a squirrel cage armature and a number of short-circuiting rings having conductor-receiving openings and having flanges adjacent the openings and bearing upon the armature conductors.

854,764. Three-phase Current Arc Lamp. Guido Semenza, Milan, Italy, assignor to the General Electric Company, Schenectady, N. Y. Application filed October 25, 1902.

A multiphase alternating current arc lamp has a number of electrodes arranged side by side so as to permit an arc to be formed at adjacent ends, the electrodes presenting flat sides toward the arc to assist in maintaining the arc at the ends of the electrodes.

854,767. Switch Stand. Fred W. Snow, Hillburn, and William C. Kidd, Suffern, N. Y., assignors to the Standard Equipment Company, Mahwah, N. J. Application filed February 23, 1907.

Details are described.

854,768. Shaking-table Separator. Frederick T. Snyder, Chicago, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed October 31, 1904.

Means are employed for feeding a mixture of magnetic and non-magnetic minerals and gangue to the head of a transversely inclined shaking table provided with longitudinal channels. An electromagnet is suspended above the table and is adapted to exert a lifting force upon the magnetic constituents of the mineral concentrate sufficient to cause the constituents to be washed by water which flows across the table transversely to the channels in the table.

854,772. Reversing the Polarity of Dynamo-electric Machines. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 29, 1904.

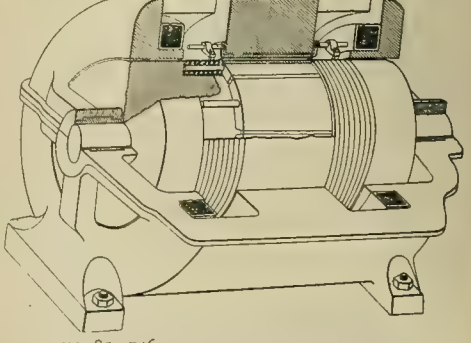
The method of reversing the polarity of a rotary converter consists in reversely closing the field circuit at a multiplicity of points, and then changing the connections to their normal running condition.

854,773. Equalizing Loads on Motor-generator Sets. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 11, 1904.

Combined are a transformer, a motor-generator set consisting of a synchronous motor coupled to an alternating-current generator, connections between the synchronous motor and the transformer, and means for shifting the phase of the voltage supplied from the transformer to the synchronous motor.

854,774. High-voltage Transformer. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1906.

A high-voltage winding has an effective cross-section gradually increasing from its center toward its terminal.



NO. 854,756.—DYNAMO-ELECTRIC MACHINE.

854,777. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 21, 1902.

The meter described embraces load coils, a damping disk and permanent magnets therefor, and a magnetic shield consisting of a number of sheet-iron rings separated by air spaces.

854,780. Combined Annunciator and Ringer for Telephone Lines. Henry Tideman, Menominee, Mich. Application filed January 16, 1905.

In a combined magneto bell and drop are a mounting plate, a drop pivoted in front of the mounting plate, and having a conical hole near the edge farthest from its pivot, a pair of gongs mounted on the front of the

plate, a striker adapted to play between the gongs, a catch carried on the striker adapted to engage the shutter and the conical hole, and a pair of electromagnets for moving the striker and catch.

854,781. Commutator. Louis E. Underwood, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 9, 1905.

The commutator has a pair of adjacent conductor bars and a layer of insulation between the bars, the layer consisting of an inner portion and a portion protecting the inner portion arranged adjacent the brush-engaging surface and which is usually worn away by the brushes during the life of the commutator.

854,782. Dynamo-electric Machine. Louis E. Underwood, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 24, 1906.

The machine has a field-magnet structure, energizing coils having axes transverse to the axis of the machine, pole pieces having offset pole faces, and means for securing the pole pieces so as to locate the pole faces on either side of the axes of the coils.

854,784. Dynamo-electric Machine. John B. Wiard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August. 10, 1906.

In a dynamo-electric machine are a distributed winding, and a separate cable connected to the coils of the winding comprising conductors arranged to establish predetermined connections between the coils and between the winding and the external circuit.

854,813. Wireless-telegraph System. Henry H. C. Dunwoody, Washington, D. C. Application filed April 30, 1906.

A wave-responsive device comprises a concrete crystalline mass of iron and oxygen.

854,817. Flexible Electric Connection for Storage Batteries. Bruce Ford, Philadelphia, Pa. Application filed September 24, 1904.

An acid-proof flexible connection comprises a conductor having an insulating cover and an enlarged bare end, and a non-corrosive lug cast onto the enlarged end and adjacent portions of the cover.

854,824. Electromagnetically Actuated Device. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

Combined with a magnetizable core having separated, opposing pole faces and a magnetizing winding, are an armature pivotally supported between the pole faces and having a closed-circuit winding, the central plane of which is parallel to the armature axis, a spring that tends to hold the member in such position that its winding shall be angularly disposed with reference to the magnetic flux between the pole faces and a pair of contact terminals, one of which is supported by the armature.

854,825. System of Electric-motor Control. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 2, 1905.

In combination with a translating device and a number of separately actuated accelerating switches are means for preventing reversal of the direction of current flow in the device while any of the switches are closed.

854,827. Suspending Device for Electric Arc Lamps and Similar Objects. Ernest Kuhne, New York, N. Y. Application filed January 31, 1907.

The device comprises an insulating block, a spring-influenced insulating slide, a metal bottom plate secured thereto, a pair of metal shanks depending from the slide, non-conducting sleeves on the upper ends of the shanks, and metal end pieces adapted to be engaged by the shanks in one position of the slide and to make contact with the sleeves in the other position of the slide.

854,829. Potential Regulator. Edwin Lehr, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 20, 1906.

Combined with a main transformer winding and two similar auxiliary windings are means for varying the effective turns of the windings that comprise a pair of regulating contact-carrying drums adapted to occupy a number of predetermined positions, an operating handle therefor, and resilient means interposed between the handle and the drums.

854,830. Call Register for Telephone Systems. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed October 18, 1906.

In a call register for telephone systems are toll-registering and signaling devices, a base plate for supporting the devices, a transmitter and means for securing the base plate to the transmitter, the means also securing the transmitter to its support.

854,831. Alternating-current Apparatus. Ralph D. Mershon, New York, N. Y. Application filed October 31, 1904.

Combined with an alternating-current machine, and a single-phase circuit connected therewith, are a condenser connected with the primary element of the machine, the connections thereof being at an angle to those of the single-phase circuit, and means for shifting the connections of the condenser.

854,834. Electric Heater or Rheostat. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed June 27, 1902.

The heater has a resistance conductor formed of an alloy of copper, zinc, nickel and ferro-manganese.

854,846. Fuse Box of Molded Insulation. Arthur C. Savage, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 12, 1905.

In combination with a fuse box of insulating material is a pole-piece embedded therein, having its main portion thicker than the end portions.

854,862. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed August 29, 1906.

Combined are a polyphase alternating-current supply circuit, static transformers having their primary windings connected to the circuit and their secondary windings connected as two independent three-phase stars differing in phase by 180 electrical degrees, a six-phase rotary converter, the alternating current terminals of its armature being connected to the corresponding terminals of the secondary windings of the static transformers and the magnetic poles being divided each into three parallel paths, means for varying the distribution of magnetic flux in the three paths, a three-wire direct-current consumption circuit the outside conductors of which are connected to the respective brushes of the rotary, a reactance connected between the centers of the two secondary stars, and a connection from the neutral conductor of the three-wire consumption circuit to an intermediate point in the reactance.

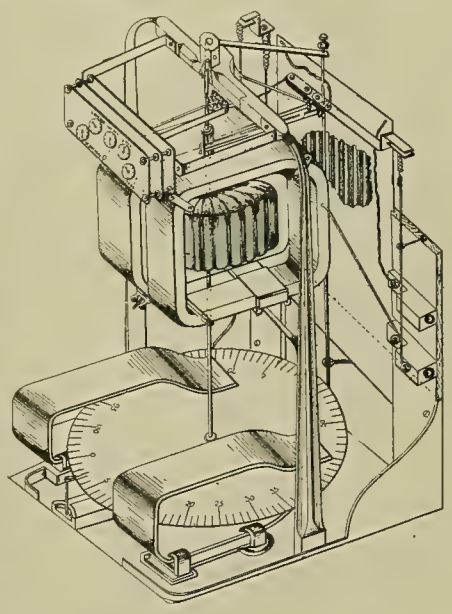
854,866. Mail-chute. Robert W. Ashley, New York, N. Y. Application filed December 23, 1905.

The apparatus comprises a mailing slot in the chute, closing and opening means interposed in the mailing slot portion, two sets of oppositely operating solenoid magnets interposed therein and means for actuating the oppositely operating solenoid magnets.

854,867. Animal Trap. Fred R. Baker, Chicago, Ill. Application filed September 4, 1906.

The trap embraces a cell, a pair of rocking trap doors therefor geared together, motor means for rocking them, a catch for locking them in closed position, an electromagnet for releasing the catch, an electric generator and circuit for energizing the magnet and a circuit closer in the circuit mounted on one of the trap doors in position to be operated by the animal to be trapped.

854,881. Portable Test Meter. Christian H. Evers, Birmingham, Ala. Application filed November 23, 1905.



NO. 854,881.—PORTABLE TEST METER.

In a test meter are a potential circuit which includes a resistance, an armature, commutator, brushes and suitable connections, a current circuit which includes field coils and suitable connections, and means to connect the resistance in series with both of the circuits and pass the line current at full voltage through it. (See cut.)

854,892. System of Control for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1905.

Combined with an electric motor, are two pairs of switches for connecting the motor armature respectively for forward and reverse rotation and means for preventing operation of the first switch of each pair when the noncorresponding second switch is closed.

854,897. Armature for Dynamo-electric Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 20, 1906.

In combination with a magnetizable core having peripheral slots the outer portions of which are wider than the inner portions, are a winding that comprises a number of coils the sides of which are located respectively in the outer and wider portions and in the inner and narrower portions of the slots, and conductors for connecting the winding to a commutator cylinder that are also located in the outer and wider portions of the slots.

854,918. Electric Governor. Herman Weber, Colorado Springs, Colo. Application filed April 30, 1906.

In connection with an electrically operated signal for cars are a circuit including the signal, a source of energy, a pair of stationary contact members forming terminals of the circuit, a revoluble shaft receiving motion from one of the car axles, a collar rigidly secured to the shaft and a second collar loose on the shaft.

854,926. Electric-railway Signaling System. Antonio Casale, Scranton, Pa. Application filed June 23, 1906.

In the system described three continuous roadbed conductors are arranged in parallel and three traveling contacts are carried by each train and engaging the respective conductors. Each train is provided with an alarm.

854,937. Game Apparatus. Edward C. D'Yarmett, Bartlesville, I. T. Application filed November 17, 1906.

A magnet and magnetic and non-magnetic balls are employed.

854,958. Combined Burglar-alarm and Sash-holder. James M. Montgomery, Berl, W. Va., assignor of one-half to Franklin W. Sine, Bond, Md. Application filed June 18, 1906.

An electric circuit has one of its terminals connected to the other of coacting contact plates and the other of its terminals to a cam upon a window frame.

854,965. Ozonizer. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Original application filed January 6, 1904. Divided and this application filed January 20, 1905.

Combined with a tube of silica having electrodes therein, are means for causing electric current to pass between the electrodes, an envelope surrounding the tube, and consisting of material impervious to ozonizing radiation; and air inlets and outlets leading to and from the envelopes.

854,970. Electrical Block Signal. Elza S. Stotts and Lester O. Dickey, Omaha, Neb. Application filed August 13, 1906.

In combination with a signal tending to move to its danger position, are means for holding it normally in its safety position comprising a holding lever, an electromagnet thereon, an armature for the magnet pivoted upon the lever, and a keeper for engaging the armature lever.

854,978. Connection for Electrical Sockets and Conduits. Reuben B. Benjamin, Chicago, Ill. Application filed September 19, 1906.

A lamp socket support for electric conduits comprises a sleeve arranged to fit over an electric conduit, a second sleeve extending at an angle thereto arranged to receive the lamp socket, and a common means for drawing the sleeve tightly upon the conduit and upon the socket.

854,983. Massage Machine. Richard V. Clark, St. Louis, Mo. Application filed August 1, 1906.

The device is driven by an electric motor.

854,996. Dynamometer. Claude M. Garland, Urbana, Ill. Application filed December 15, 1906.

The machine comprises a rocking member, a rotative member, means for producing electrical eddy currents between the members, means for measuring the magnetic drag between the members, and means for maintaining a water circulation between the members.

854,997. Apparatus for Separating Gold from Magnetic Sands. Elmer Gates, Chevy Chase, Md., assignor to the Washington Loan and Trust Company. Application filed March 19, 1900.

The apparatus includes a feed apron and a magnet pole piece relatively movable with respect to each other, both of them having roughened surfaces.

855,002. Secondary Electric Clock. William S. Guthrie, Terrell, Tex. Application filed July 5, 1906.

Details are described.

855,010. Alternating-current Motor. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed June 18, 1904.

Combined are a repulsion motor having two sets of commutator brushes, the sets being displaced from each other by approximately 90 electrical degrees and both sets being displaced from the line of magnetization of the primary member, means for short-circuiting one set, and means for connecting the second set to a portion of the winding of the primary member of the motor.

855,021. Electric Self-playing Violin. Henry K. Sandell, Chicago, Ill., assignor to the Mills Novelty Company, Chicago, Ill. Application filed October 29, 1906.

The instrument comprises in combination, a motor, an electrical contact-roller in a branched circuit, contact fingers co-operating with the roller and an electromagnet in each of a number of sounder devices, the magnet having an oscillatory armature. Electromagnets are also employed in a number of fingering devices for the strings.

855,034. Warp Stop-motion for Looms. Carl Adams, Easton, Pa. Application filed January 25, 1906.

An electric alarm circuit is arranged to be closed by the engagement of a contact member with a reciprocating member.

855,046. Starter for Blowers. Louis B. Cousans, Lincoln, England. Application filed December 17, 1904. Renewed April 22, 1907.

Combined with an electrically-driven organ blower, are a switch for making and breaking the circuit, a rheostat controlling the current in use, a pneumatic apparatus controlling the rheostat, and an electrically-operated valve for releasing the pressure at the rear of a diaphragm when the current is cut off.

855,060. Process for Manufacture of Incandescent Bodies for Electric Lamps. Alexander Just and Franz Hanaman, Budapest, Austria-Hungary, assignors to Egyesült Izzólampá és Villamossági Részvény Társasag, Uj-Pest, Austria-Hungary. Original application filed July 6, 1905. Divided and this application filed January 5, 1907.

The method consists in heating a mixture of carbon and tungsten to a red heat in the vapor of oxyhalogen compound of tungsten by an electric current in the presence of hydrogen to cause the carbon to be replaced totally by tungsten.

855,066. Means of Control for an Electrically Actuated Body. Benjamin McInnerney, Omaha, Neb. Application filed April 9, 1906.

In the system described are a mechanically operated station switch in a single controlling circuit and a manually operated switch adapted to render the controlling circuit effective or ineffective.

855,081. Electrically Insulating Wire and Other Electrical Conductors. Allen D. Whipple, Chicago, Ill. Application filed November 11, 1905.

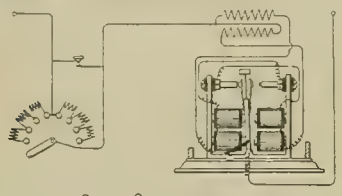
[illegible] electrical conducting wires [illegible] coating the same with a number of [illegible] layers of fibrous fluid insulating material [illegible] each layer is chemically different from and a [illegible] preceding layer, each layer being allowed to [illegible] another layer is applied.

855,085. Telegraph Key. Benjamin F. Bellows, Cleveland, Ohio. Application filed July 9, 1906.

In combination with a contact, a vibrating controller for [illegible] a circuit with the contact, restoring means normally holding the controller in an idle position, additional contacts independent of the controller and a pivoted key comprising a key lever for operating the restraining means.

855,093. Controller for Electric Motors. Fredrick H. Burmester, St. Louis, Mo., assignor to the William A. Miller Elevator Manufacturing Company, St. Louis, Mo. Application filed February 1, 1905.

The controller described comprises a motor provided with an armature and field windings, a solenoid controlling the connections to the field of the motor, two solenoids controlling the connections to the armature of the motor, and means for energizing the first-named and either of the second-named solenoids.



NO 855,158.—DEMAGNETIZER.

855,114. Suspender for the Contact Wires of Electric Railways. Joseph Mayer, Rutherford, N. J. Application filed February 5, 1907.

The device consists of two longitudinal sections and means for connecting them at their upper edges, the sections having a central curved portion for supporting the contact wire and longitudinal channels gradually enlarged toward the ends both in height and width.

855,117. Apparatus for Testing Telephone Wires. James M. Miller and Clinton J. Murray, Newtown Square, Pa. Application filed June 20, 1906.

In a lineman's testing set for telephone lines, are a bell, a magneto, a circuit in which the bell and magneto are included, a switch for cutting the bell and magneto circuit in or out of the line circuit, a receiver jack, a circuit in which the receiver jack is included, the last-named circuit being so arranged as to be cut in or out of the line-wire circuit by the switch, a secondary coil also included in the receiver-jack circuit, a transmitter jack, a local circuit in which the transmitter jack is included, a battery and a primary coil also included in the last-named circuit.

855,134. Commutator Assembling and Finishing Device. John Risbridger, North East, Pa., assignor of fifty-five one-hundredths to the Eureka Tempered Copper Works, North East, Pa. Application filed December 1, 1905.

The device consists in part of a compression ring of sufficient mass and rigidity to practically maintain its shape under ordinary use, and a contractible former ring adapted to engage commutator bars arranged in annular form.

855,138. Cross-arm for Carrying Telegraph, Telephone or Other Wires and Ropes. Henry M. Sciple, San Francisco, Cal. Application filed August 2, 1906.

Combined with a pole are a number of cross arms disposed thereon, one of the arms resting on the upper end of the pole, and means connecting the upper arm to the lower arms, the lower arms being suspended from the upper arm.

855,147. Reversing Switch. Charles A. Tunstall, Kamloops, British Columbia, Canada. Application filed December 18, 1905.

As a means for directing an electric current in either direction through a circuit, two similar tubes have upwardly turned ends and partially filled with quicksilver the tubes being secured to and insulated from one another and susceptible of being inclined endwise to one side or the other. There are means for connecting the positive wire of an exterior circuit to the contact stem in one end of one tube and to the stem in the opposite end of the other tube.

855,157. Process of Reducing Metallic Sulphides. Frederick M. Becket, Niagara Falls, N. Y. Application filed March 5, 1907.

The process consists in commingling a metallic sulphide and a silicon-bearing reducing agent, and electrically smelting the mixture.

855,158. Demagnetizer. Donald M. Bliss, New York, N. Y., assignor to the Engineering Specialty Company, a corporation of New York. Application filed March 1, 1906.

The demagnetizer has a solenoid provided with coils reversely wound, an electromagnet in circuit with each coil, and a switch controlled by the electromagnets for electrically connecting the coils in circuit with a suitable source of current. (See cut.)

855,162. Stop Mechanism for Bobbins. Richard H. Cook, Fall River, Mass., assignor to the American Thread Company, Fall River, Mass., a corporation of New Jersey. Application filed March 15, 1906.

An arrester is carried by a pivoted lever, and electromagnetic means operable means retract the armature and [illegible] contacting ring upon the breaking of the yarn.

855,166. Magnetic Ore Separator. Edgar A. Edwards, Cincinnati, Ohio, assignor to Alice V. Edwards, Cincinnati, Ohio. Application filed July 30, 1904.

In an electromagnetic separator, are an inclined magnetic element the under surface of which co-operates with the material under treatment, a circuit therefor, a source of energy adapted to produce in the circuit an alternating current having periods of rest between successive alternations, and means for feeding stock beneath the element.

855,168. Signaling Key. Oscar F. Forsberg and Jules A. Birsfield, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed October 27, 1902.

In a key, combined with a switch, are a number of distinctive signal transmitters, a plunger adapted in its rotation to bring any of the transmitters and the switch into operative correlation, the plunger being adapted in a longitudinal movement to cause the co-operation of the selected transmitter with the switch to produce a distinctive signal.

855,208. Insulator. Herbert Sinclair, Trenton, N. J. Application filed February 19, 1907.

A knob insulator is described.

855,209. Ignition Device for Explosive Engines. John Stadtherr, Gibbon, Minn. Application filed February 8, 1907.

The device comprises a spring-controlled electrode mounted free to oscillate a slidable electrode which co-operates therewith, an explosion cylinder into which the ends of the electrodes project and means operable from outside the cylinder to limit the travel of the oscillatory electrode, and thereby to control the time of ignition.

855,220. Electric Meter. Riccardo Arno, Milan, Italy. Application filed January 6, 1906.

An instrument for measuring variable electric currents comprises a rotatable magnetic member, means for impressing thereon a rotary magnetic field, means for opposing the torque due to the field, and means for causing the variable currents to affect the member.

855,221. Electrolytic Diaphragm and Method of Making Same. Leo H. Baekeland, Yonkers, N. Y., assignor to the Development and Funding Company, New York, N. Y. Application filed March 10, 1906. Renewed February 16, 1907.

A diaphragm comprises a base of asbestos cloth and a permeable coating or filling applied thereto, the coating comprising an alkaline mixture of ferric oxide, asbestos, and a hydroxide of iron.

855,224. Apparatus for Firing Explosives in Wells. Luke H. Broadwater, Findlay, Ohio, assignor to the E. I. du Pont de Nemours Powder Company, Wilmington, Del. Application filed February 18, 1907.

The explosives are fired by a current of electricity.

855,249. Self-winding Electric Clock. Maximilian Juruick, New York, N. Y. Application filed December 10, 1906.

A rotary circuit-breaker with a sliding contact consisting of an insulated disk cut out in the front, and a contact plate in the cut-out portion form part of the mechanism.

855,253. Insulator Pin. William S. Lee, Jr., Charlotte, N. C. Application filed February 10, 1906.

Details are described.

855,261. Insulator Pin. Louis Steinberger, New York, N. Y. Application filed October 9, 1905.

The pin comprises an enlarged body portion of metal having a metallic tube integral therewith and projecting therefrom.

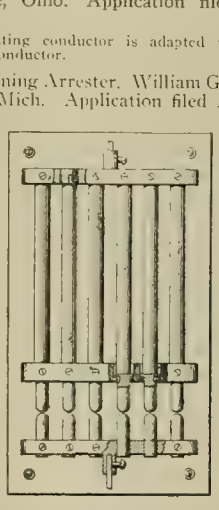
855,262. Spiral-core Insulator. Louis Steinberger, New York, N. Y. Application filed June 11, 1906.

The device embraces a cylindrical member of insulating material threaded externally and provided with a spiral armor wound thereon.

855,269. Electric Igniter. Andrew D. Wilkinson, Wellsville, Ohio. Application filed October 6, 1906.

An oscillating conductor is adapted to coact with a stationary conductor.

855,300. Lightning Arrester. William Gifford, Thompsonville, Mich. Application filed April 21, 1906.



NO. 855,300.—LIGHTNING ARRESTER.

The arrester embraces an insulating base, resistance elements mounted thereon, a metal rack which secures the elements to the base and connected with the elements to distribute the electric charge thereto, and a series of spark gaps secured to the base in co-operative relation to the resistance elements. (See cut.)

855,323. Strain Adjuster for Contact Wires of Electric Railways. Joseph Mayer, Rutherford, N. J. Application filed February 5, 1907.

A frame is suspended by means of insulators, hanger-brackets being attached to the frame.

855,355. High-potential Insulator. Louis Steinberger, New York, N. Y. Application filed September 12, 1906.

The insulator comprises a hood provided with an outer edge and with drip points mounted upon the hood and nearer to the center thereof than the outer edge, and means for supporting the hood.

855,365. Relay. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company, a corporation of Illinois. Application filed May 20, 1901.

In a relay are combined a number of electromagnets and an armature operated by each, an inwardly directed contact member on each armature the contact members having intersecting paths of movement, a contact piece located to engage either of the contact members, and means whereby separate and independent circuits are closed dependent upon the order in which the armatures make contact with the contact pieces.

855,389. Electric Attachment for Movable Objects. John R. Dawkins, McKinney, Tex. Application filed February 19, 1906.

Combined are a ground working device, a source of electrical energy, an electrical connection between the source and the device, and electrical connections between the source and the ground thereby completing an electrical circuit to prevent the adhering of earthy substances to the device.

855,391. Telephone Switchboard. John M. Dosbaugh, Cedar Vale, Kan. Application filed August 1, 1905.

Combined are a swinging frame, a hand lever for moving the same into different positions, contacts to be closed by movements of the hand lever, operators' circuits connected with the contacts, contact strips mounted upon the swinging frame, a number of subscribers' lines, contacts connected with the lines, and means for bringing the last-mentioned contacts in connection with the contact strips.

855,394. Telephone. Oscar F. Falk, Boston, Mass., assignor to the American Telephone and Telegraph Company, New York, N. Y. Application filed July 1, 1905.

In a hand-set or combination telephone are a handle bar having a receiver at one end and a transmitter at its other end, the diaphragm of the receiver and transmitter being in planes approximately at right angles to each other, and the transmitter including a granular carbon button connected and disposed at an angle to the transmitter diaphragm, whereby contact between the granulated conducting material of the carbon button and its co-operating electrodes will be maintained in all positions which the hand-set may take while in use.

855,395. Telephone Transmitter. Oscar F. Falk, Boston, Mass., assignor to the American Telephone and Telegraph Company, New York, N. Y. Original application filed July 1, 1905. Divided and this application filed July 2, 1906.

In a telephone transmitter are a case or shell, a diaphragm secured to and closing the shell, a variable resistance button inclosed within and supported by the shell in a position oblique to the diaphragm, the button having electrodes and containing granular carbon between the same, one of the electrodes being secured to the diaphragm and the other to the wall of the shell, the whole constituting a unitary device comprising the several parts of the transmitter.

855,427. Electric and Percussion Firing Mechanism. William H. Bevans, Bridgeport, Conn. Application filed May 9, 1904.

The mechanism comprises an electric circuit, a contact maker and breaker for making and breaking the circuit, a firing pin, tripping means for the pin, a member for operating the tripping means, and means arranged to operate the member upon a certain movement and upon a further movement to operate the circuit maker and breaker to make the circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on June 3, 1907:

429,107. Electromagnetic Locomotive. R. N. Allen, Cleveland, O.
429,109. Apparatus for Rectifying Electric Currents. F. Anderson, Peekskill, N. Y.
429,115. Printing Telegraph. J. Burry, Boston, Mass.
429,199. Electric-railway System. W. D. MacQuesten, New York, N. Y.
429,233. Multiple Telegraph. E. N. Dickerson, Jr., New York, N. Y.
429,251. Cover for Electric Subway. J. Stafford, New York, N. Y.
429,273. Secondary Battery. C. Hering, Philadelphia, Pa.
429,274. Electrode for Secondary Batteries. C. Hering, Philadelphia, Pa.
429,304 and 429,305. Electric Conductors. H. B. Cobb, Wilmington, Del.
429,306. Joint for Electric Conductors. H. B. Cobb, Wilmington, Del.
429,307. Conduit for Electric Wires. H. B. Cobb, Wilmington, Del.
429,314. Electric Motor. W. D. MacQuesten, New York, N. Y.
429,315. Insulator. W. D. MacQuesten, New York, N. Y.
429,316. Bracket for Trolley Wires. W. D. MacQuesten, New York, N. Y.
429,318. Electric Fire Alarm and Extinguishing Apparatus. C. E. Ongley, Yonkers, N. Y.
429,327. Electric-railway motor. F. J. Sprague, New York, N. Y.
429,377. Telegraph. S. M. English, New Orleans, La.
429,396. Electrical Clock-winding Mechanism. C. A. Ward, Waterbury, Conn.
429,413. Trolley for Electric Railways. W. S. Blauvelt, Asbury Park, N. J.
429,478. Interlocking Electric-railway System. J. Ramsey, Jr., Cincinnati, O.
429,490. Field Magnet for Dynamos. E. Wagemann, Little Rock, Ark.
429,559, 429,560 and 429,562. Electric-heating Apparatus. C. A. Carpenter, Minneapolis, Minn.
429,561. Electric Soldering Iron. C. E. Carpenter, Minneapolis, Minn.
429,576 and 429,577. Printing Telegraphs. A. T. McCoy, Boston, Mass.
429,582. Electric-railway Signal. H. A. Parrish, Jackson, Mich.
429,583. Electrical Converter. G. Pfannkuche, Cleveland, O.
429,584. Fuse Box. N. S. Parsons, Cleveland, O.

1ST NATIONAL ELECTRIC LIGHT CONVENTION REPORT NUMBER.

Western Electrician

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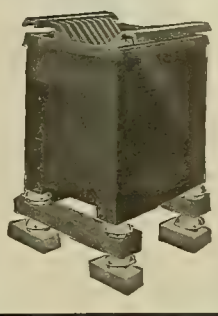

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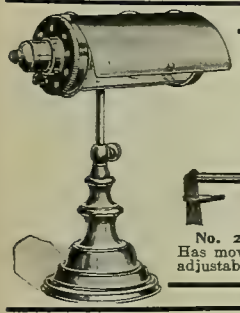

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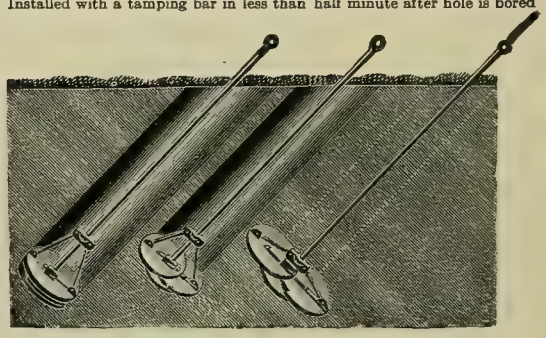

1 2 3
Fig 1—Represents Anchor placed at bottom of hole.
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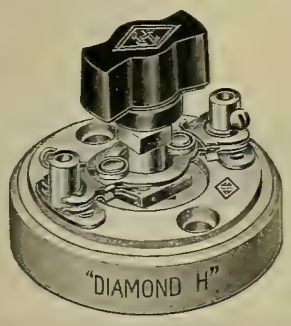

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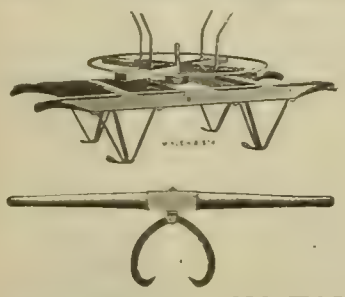

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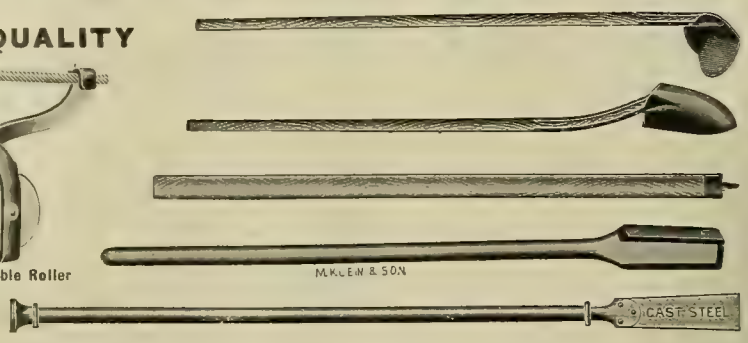

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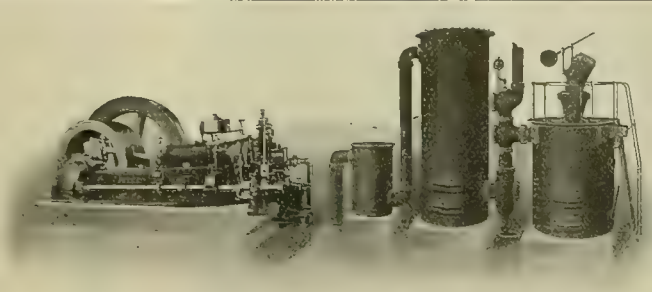

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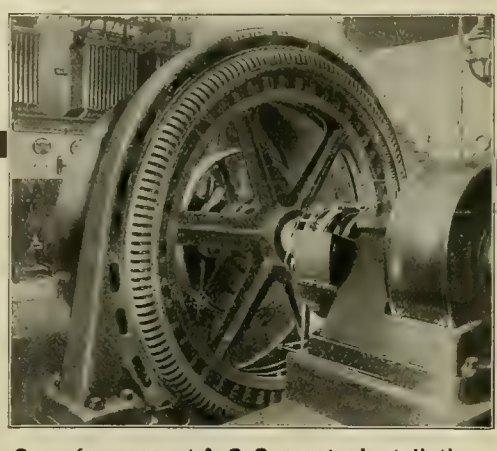

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Western Electric A. C. Generators have a comparatively flat efficiency curve which is obtained by nicely proportioning what are known as the natural copper and iron losses. These losses are kept at a minimum, thus giving high operating efficiency, low temperature rise and large overload capacity.

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Are always Favorable – Because it is our constant aim to maintain their high Quality.

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The demand for fans of all kinds will be something tremendous this summer, and you should order now and avoid slow deliveries which will be a natural consequence of the rush at the last minute.

These fans are equipped with Direct-Current motors and are wound for 110, 220 or 500 volts. The Standard has 3 speeds, 60-inch blade sweep, and can be furnished in brass or copper finish. The Western has one speed and 54-inch blade sweep. These fans run noiselessly and will stand the severest tests, running all day long day after day. Our New 1907 Fan Motor Catalogue will tell you all about them. Write today. Just ask for Catalogue No. 4007-F.

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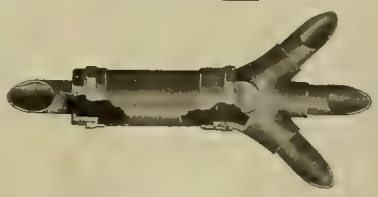

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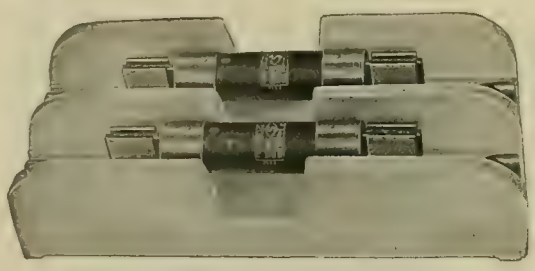

Full description and prices in Bulletin No. 36

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A steel cross-arm support fastened by a through bolt and consisting of two plates, one engaging the pole and the other the arm. It makes braces unnecessary on 5-ft. or 6-ft. arms. It saves the expense of cutting again. It strengthens the pole instead of weakening it and affords a support against lateral strain. It eliminates loss of current from leakage through braces.

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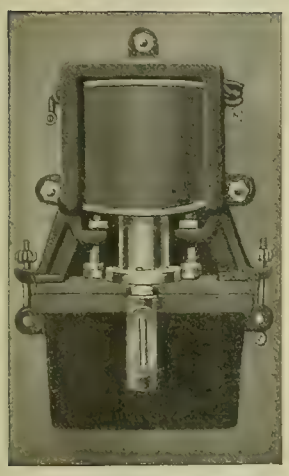
CUTLER-HAMMER

WE give below the gist of a number of inquiries culled from our daily mail together with an indication of the type of apparatus best adapted to meet the requirements of each particular case. Readers may perhaps find here information that will be helpful to themselves.



Self-starter for Alternating-current Motors. (Bulletin 33.)

THE PROBLEM: An electrical contractor writes that he has a customer who wishes to procure an automatic pump controller for starting and stopping a 7½-horse power, 3-phase, 200-volt motor, used for driving a deep-well pump. The water is to be pumped into an air-tight steel tank, and he wishes the motor to be automatically started when the pressure falls below a certain point and stopped when the pressure rises to a predetermined maximum.

THE SOLUTION: This case calls for a Cutler-Hammer Alternating-current Self-starter, to be used in connection with our gauge-type pressure regulator. If, instead of a closed tank, an open tank was to be used, then the proper automatic control would be a Cutler-Hammer Self-starter, operated by a Float Switch.

Note.—The subject of automatic pump control is covered by Cutler-Hammer Bulletins Nos. 33, 34, 35, 70, 71, 71C, 73 and 73B. Bulletins 33, 34 and 35 describe and illustrate Self-starters designed for use with alternating-current motors single, two or three phase, squirrel-cage and slip-ring type. Bulletins 70, 73 and 73B describe Self-starters for direct-current motors, while Bulletin 71 illustrates the float switch and gauge type pressure regulator used in connection with both alternating and direct-current equipments.

THE PROBLEM: A firm of consulting engineers asks for information concerning the best type of controller to use on two 20-horsepower and two 10-horsepower motors, operating ventilating fans in an office building. The current available is D. C., 120 volts. The 20-horsepower motors are to be belted to the fans and will be run at 690 R. P. M. One of the 10-horsepower motors will run at 1,250 R. P. M. and the other, connected direct to a fan, at 200 R. P. M. It is desired that the controlling apparatus shall be capable of reducing the speed of each fan 50 per cent. Also, that the controllers shall be installed in the basement, although two of the motors are to be installed in another part of the building.

THE SOLUTION: Any one of several Cutler-Hammer Motor Speed Regulators will answer in this case. Probably the best, all things considered, would be the Universal Motor Speed Regulator, standard in sizes from ¼ to 50 horsepower. This type of controller is provided with all protective features—underload and overload release, double pole knife switch and fuses. It is described in Bulletin 42. Other speed regulators suitable for controlling motors driving ventilating fans are described in Bulletins 40, 41, 44, 44½ and 45.

THE PROBLEM: An electrical contractor wants to know what type of controller is best adapted for use with a 3-horsepower, 500-volt, direct-current, shunt-wound motor, to be used for operating a 10-gallon ice-cream freezer. The maximum speed of the motor is 1,800 R. P. M. and the low speed about 1,000 R. P. M. It is desired to run the motor at the low speed until the cream begins to freeze, when speed will be increased to the maximum until the freezing is completed.

THE SOLUTION: The Cutler-Hammer Motor Speed Regulator described in Bulletin 40 will answer perfectly in this case.

THE PROBLEM: From an electrical engineer in the far West comes this inquiry: "We are in need of an attachment for breaking the circuit on an A. C., 7½-horsepower, 220-volt, two-phase, squirrel-cage type motor. This is a small motor that we run in a place where there is no one to watch it, and as the power house frequently cuts off the current we want a device to break the circuit so as to protect the motor from injury when the power comes on again. Can you furnish such a device?"

THE SOLUTION: A Cutler-Hammer Self-starter (Bulletin 34) will exactly fulfill the conditions stated above. This type of Self-starter is designed for use with squirrel-cage type motors. In similar cases, where a slip-ring type motor is used, Bulletin 35 Self-starter should be specified.

Motor Speed-Regulator, Universal Type. (Bulletin 42.)

THE PROBLEM: In a foundry a two-ton overhead traveling crane is in use, being pulled along the runway by hand. It is proposed to equip the crane with a motor to drive it back and forth along the runway and a controller is desired which can be conveniently operated from the floor by means of a rope. It is considered essential that the controller be so arranged that as long as the operator has hold of the rope the motor will continue to drive the crane, but the moment the rope is released the motor must stop; otherwise it is anticipated that damage may some day result through the operator forgetting to shut off the current.

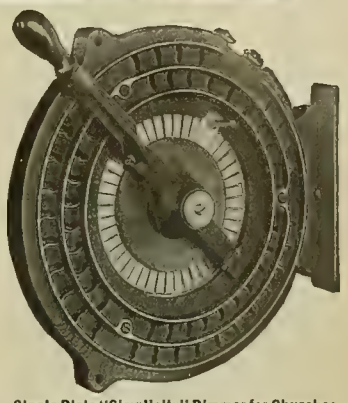
THE SOLUTION: The Cutler-Hammer Radial Arm Crane Controller rope-operated type, will exactly fulfill the conditions stated in this case. It is designed to be operated from the ground by means of a rope, and the moment the pull on the rope ceases a strong, centering spring throws the operating lever to the "off" position.

Note.—Cutler-Hammer Controllers for Cranes and Hoists are described in Bulletins 59, 66, 66A and 69. Bulletin 59 describes Radial Arm Reversible Controllers for bridge, hoist and trolley duty. This type of controller is made in various forms, one of which is the rope-operated type. Another form of rope-operated controller is described in Bulletin 69. Bulletins 66 and 66A describe reversible drum controllers for crane and hoist duty. The latter is known as the "slow speed" controller and is especially adapted for foundry work where it is necessary to lift patterns from the sand gently and without jerking. Cutler-Hammer controllers intended for foundry and steel mill work are of unusually rugged construction and all parts subject to wear are renewable.

THE PROBLEM: An electrical supply house has a customer—a tailor—who wants a small rheostat to use in connection with several electric irons, on a 110-volt D. C. circuit. He wants some device that will care for one, two or three irons, each taking about 6 amperes of current.

THE SOLUTION: For the purpose set forth above a Cutler-Hammer Single-plate Dimmer answers admirably. Probably the best type to use in this case would be Dimmer No. 24,118, listed in Bulletin 92A-2. This dimmer has a total resistance of 15 ohms, with ampere capacity tapering from 20 down to 5 amperes. When used in connection with three irons on a 110-volt circuit, the resistance will be sufficient to reduce the current from 18 to approximately 5¼ amperes. When used with only two irons the resistance would be capable of reducing the current from 12 amperes down to about 4½ amperes, while with only one iron in circuit with the dimmer the resistance would be sufficient to reduce the current from 6 amperes to approximately 3½ amperes.

Note.—Cutler-Hammer Single Plate Dimmers and Theater Dimmers are described in a handsomely illustrated booklet, which may be had free on request. The theater dimmers—known as "Simplicity" type—are used by nearly every leading theater in New York city, Chicago and other important theatrical centers. We furnish them in any size from a single plate capable of dimming fifty 16 C. P. lamps up to (or beyond) an equipment similar to that furnished the Knickerbocker Theater, New York city, which has a capacity of 2,400 lamps. Our single plate dimmers are much used in churches and lodges, where



Single Plate "Simplicity" Dimmer for Churches, Lodgerooms, etc.

positive control of the lights is desired to augment the impressiveness of religious and masonic ceremonies.

THE PROBLEM: A firm of electrical contractors advises us that they have an inquiry from a customer who wants "a very peculiar arrangement for a motor." He wants to install a 3-horsepower, 220-volt, direct-current motor, belted to an exhaust fan. This fan exhausts from six vents and he wants to arrange a switch on the door of each vent so that whenever one of the doors is opened the fan will start up. It is also specified that the controlling device shall be so arranged that the fan shall operate at its minimum speed when only one vent is open, but shall automatically increase its speed as the other five doors are opened.

THE SOLUTION: A Cutler-Hammer Self-starter (Bulletin 73-B) and six double-pole Float Switches (Bulletin 73)—one for each door—constitute an equipment that will meet every requirement of this case. The tumbler arm of the float switches should be mechanically connected to the doors by suitable chains and weights. One pole of each float switch would be arranged to control a circuit to the main solenoid switch of the Bulletin 73-B Self-starter, while the other pole would be connected so as to cut out a section of resistance from the motor circuit. With this equipment the opening of one vent would energize the Self-starter and at the same time one section of the resistance would be cut out of the motor circuit, allowing the motor to start with five sections of resistance in circuit, which would reduce the speed to 40 per cent. below normal. If a second vent is now opened another section of resistance will be cut out, allowing the motor to operate at a somewhat higher speed, and when all six doors are open at the same time all resistance will be cut out of the armature circuit and the motor will be driving the fan at maximum speed.

THE English alphabet contains only 26 letters, but by using these in various combinations it is possible to spell any of the 300,000 words listed in the Century Dictionary. Our complete catalog contains descriptions of more than 2,500 types and sizes of **STANDARD CUTLER-HAMMER APPARATUS**, and by combining these in various ways we are able to spell the solution of any problem involving **ELECTRIC CONTROL.**

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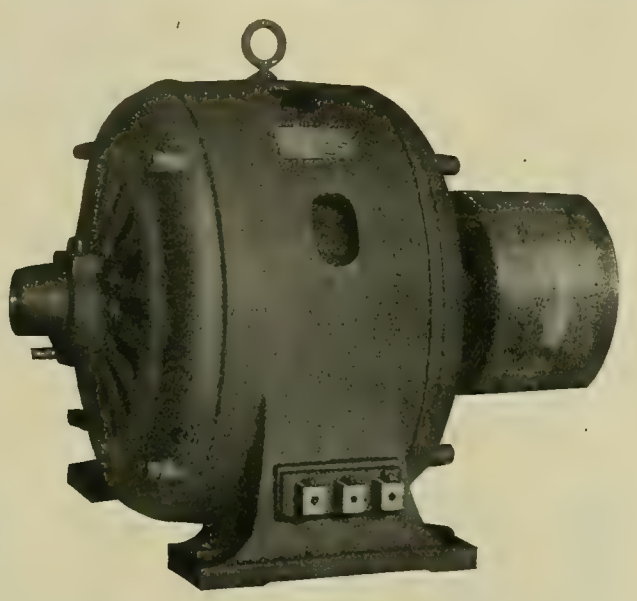
that every manufacturer of prominence in this country, making a machine requiring a motor to drive it, is using Wagner Motors for Single-phase requirements?



Our Contracts with these manufacturers show that Wagner Single-phase Motors are recognized as standard drives for

Pumps
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The manufacturers of this special machinery are vitally interested in getting a form of drive which is dependable, which is simple and which will run for a long time without care or attention, and they are using Wagner Motors.

If you have use for a motor, we can interest you. Write for bulletin No. 75-H.

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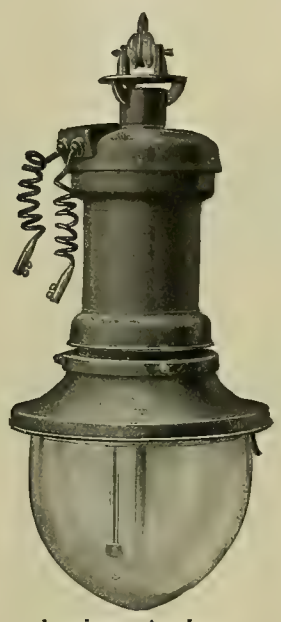
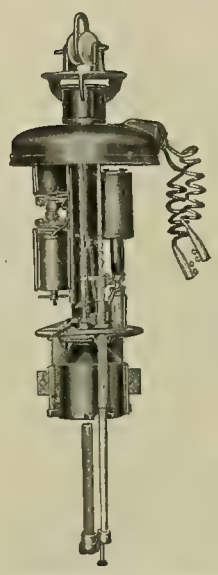
General Electric Company

Series Luminous Arc Rectifier System for street illumination



Luminous Arc Lamp

The luminous arc surpasses the enclosed arc as the enclosed arc excelled the open carbon arc for street illumination. All the light comes directly from the long luminous arc, resulting in an abundance of effective illumination. The light is white, steady, and produces no shadows from interference of electrodes.



Luminous Arc Lamp without case

Advantages of this System

Higher efficiency
Greater illumination
Improved distribution of light
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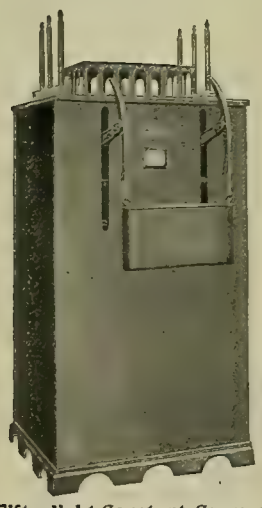
No moving machinery
Adapted to any frequency



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Standard outfits are furnished for 12, 25, 50 and 100 lights to be operated from 25 to 60-cycle 2200-volt circuits.

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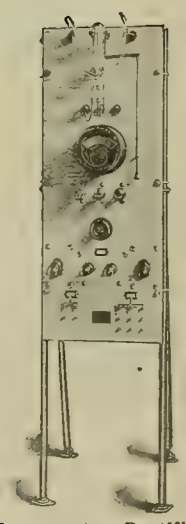

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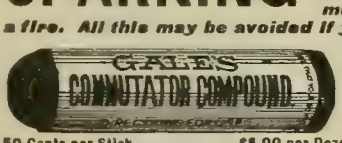

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Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
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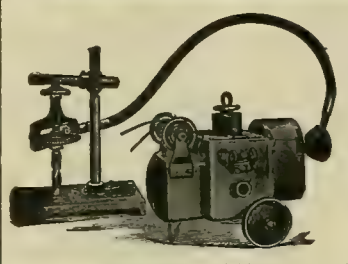

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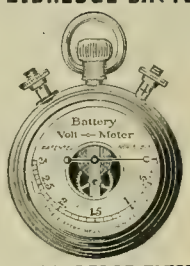

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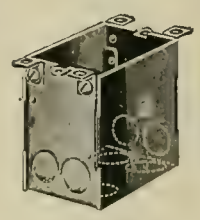
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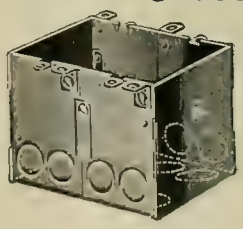
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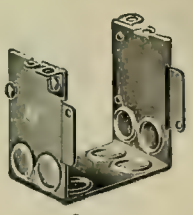
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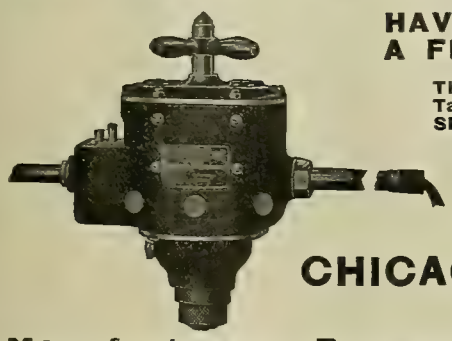

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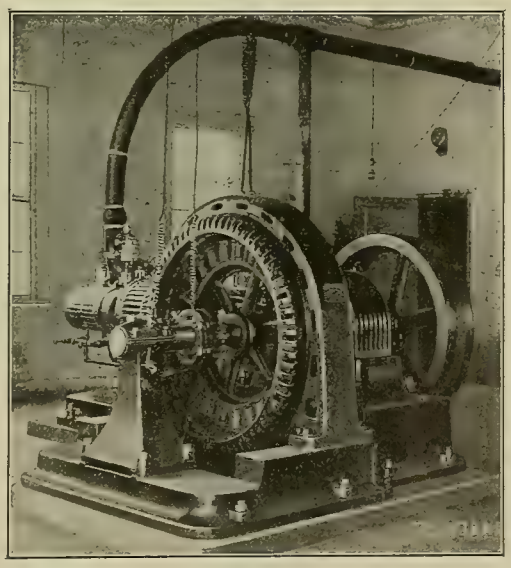

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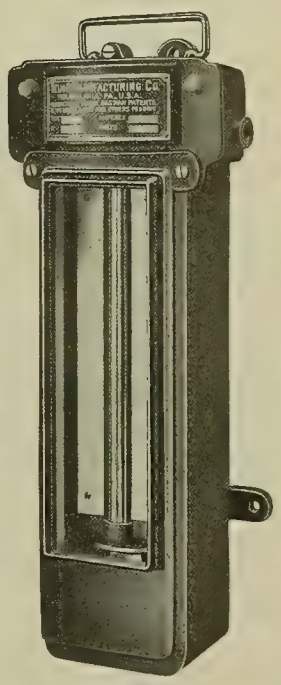

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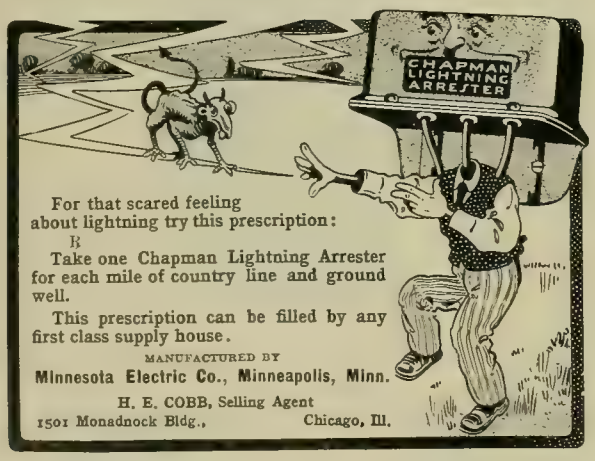

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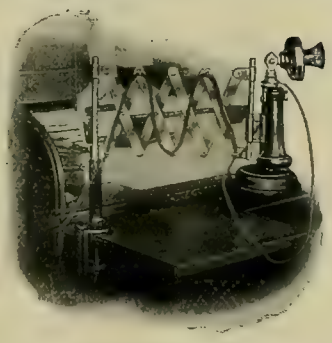

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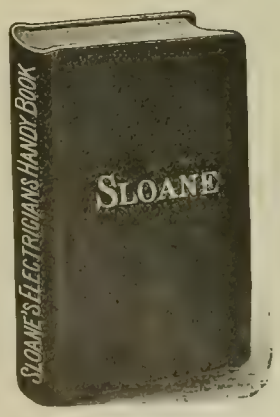

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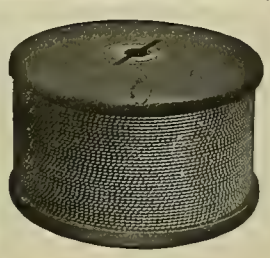

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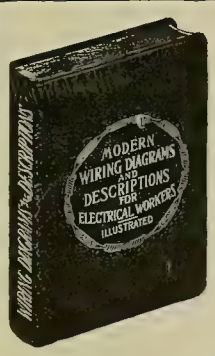

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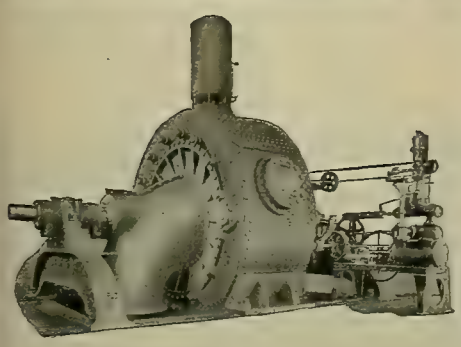

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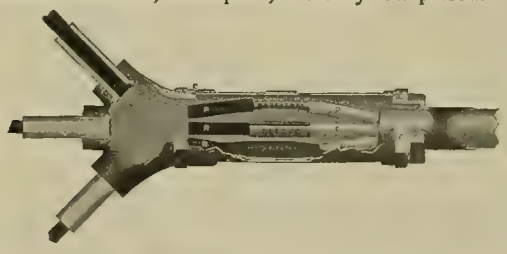

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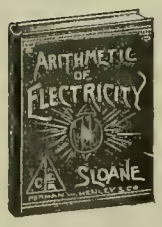

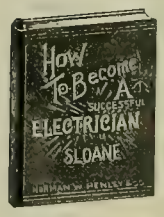

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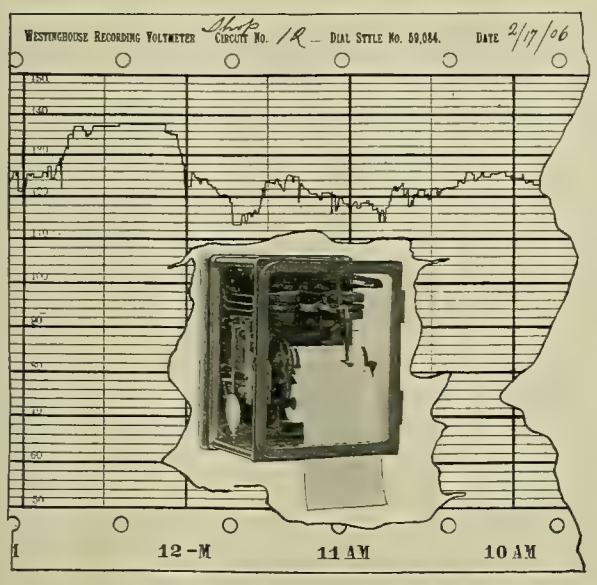

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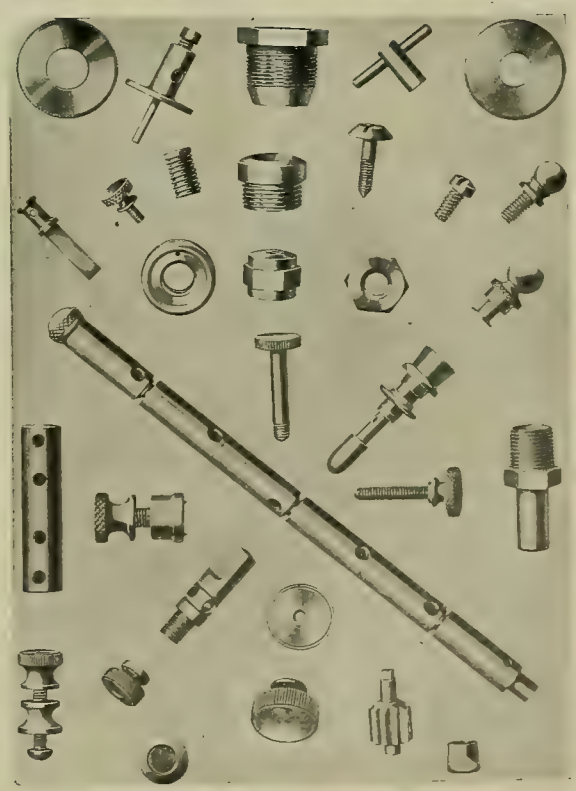

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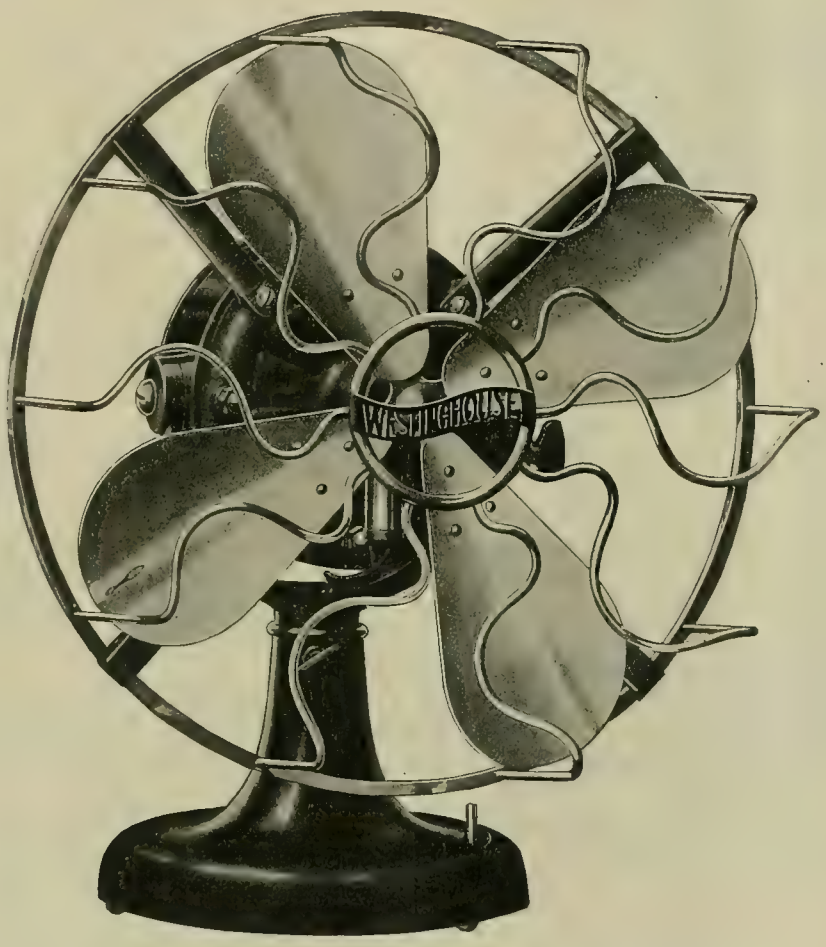

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EVERY SATURDAY

Vol. XL. CHICAGO, JUNE 15, 1907 No. 24

First Electrically Driven Cement Works in Great Britain.

[From the London correspondent of the Western Electrician.]

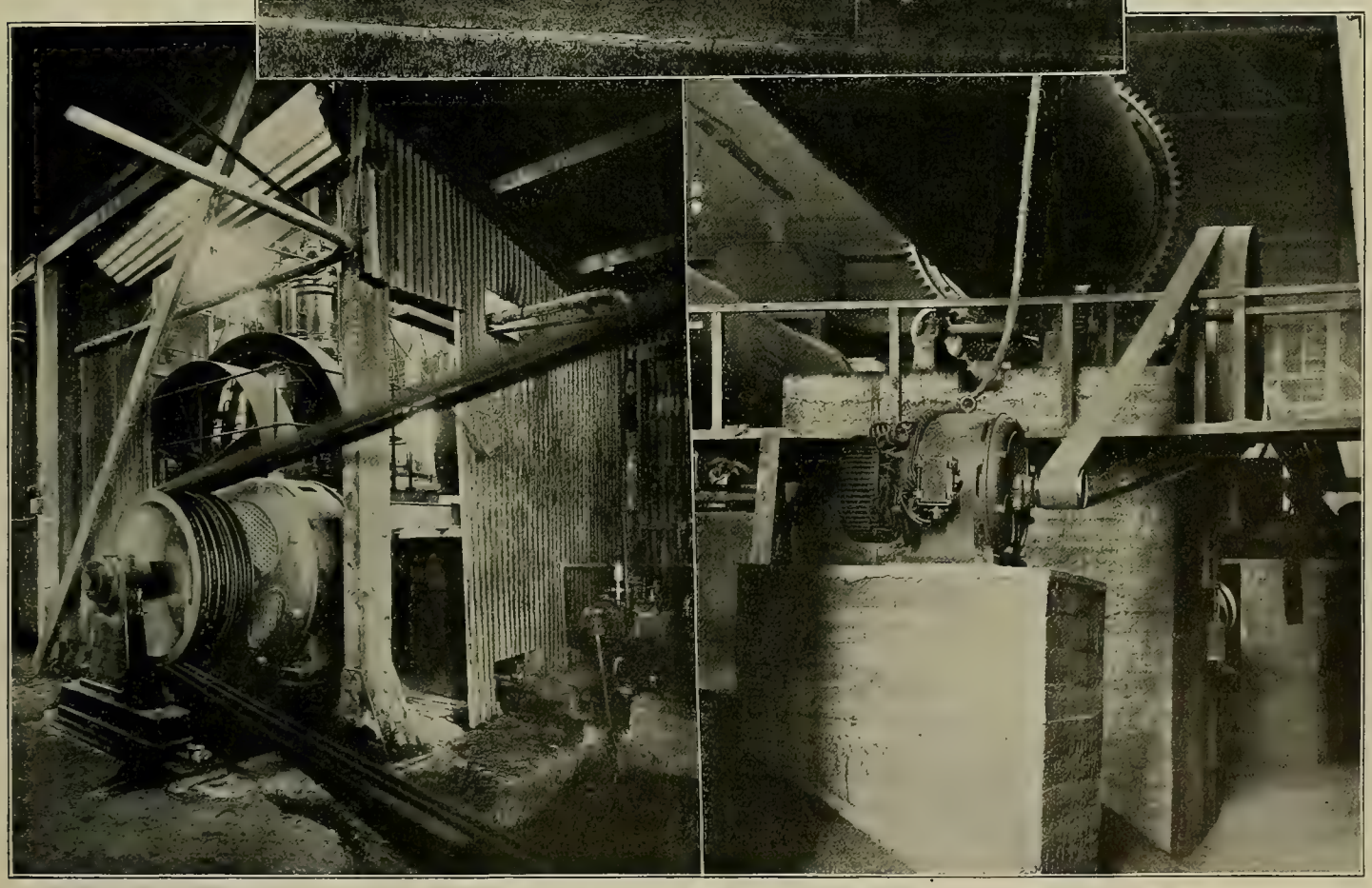
Some interest attaches to the installation described in this article in that it is the first cement works in Great Britain to be driven entirely electrically. The factory is that of Casebourne & Co., Portland cement manufacturers, Haverton Hill, West Hartlepool, which is in the area of supply of the Cleveland and Durham Electric Power Company. It covers a space of 5¼ acres and is built almost entirely on reinforced concrete, owing to the marshy nature of the site. The motive power has hitherto been oil engines, but having realized that a change to electric driving would both increase the output and cheapen the cost of production the directors at first decided to enter into a contract for a generating plant, subsequently abandoning this idea in favor of a supply from the power company, the price being, it is stated, unequaled in Great Britain outside the Newcastle area. The contract for the induction motors and switchgear was awarded to the British Westinghouse Electric and Manufacturing Company.

The method of operation at the works may be summed up as follows: The chalk is brought from Kent, in the south of England, by sea in 1,000-ton steamers to a private jetty at the works. Here it is hoisted and emptied into the hoppers of two large elevated crushers through which it passes into a bucket conveyor. This conveyor is driven by a 20-horsepower motor and each bucket is swung on a center pivot and travels to the end of a raised gantry, where it is tipped. The chalk falls near the "wet mill," into which department it is run in bogies and emptied into "wash mills." The clay, which is dug locally, is brought in wagons and also emptied into the wash, the proportion of chalk to clay being approximately three to one.

These wash mills are octagonal in shape and are fitted with harrows, which are attached to radial arms and rotated by a central vertical shaft. Water is kept constantly flowing into them and combines with the chalk and clay until the mixture is in liquid form, technically termed "slurry." This is taken by a bucket elevator into the slurry grinding or tube mills, situated immediately behind the wash mills.

In passing through the tube mill the slurry is very finely ground. It is then pumped through underground pipes by means of a three-throw 10-inch pump into a ferro-concrete mixer holding about 900 tons, from which after being continually rotated by means of large arms the mixture is pumped up to the nose or entrance of each of the four rotary kilns. These latter, which have completely revolutionized cement manufacture in Great Britain, consist of an iron cylinder about 100 feet long by six feet six inches in diameter, which rotates upon its own axis at one revolution per minute, and lined with fire brick. The cylinder is slightly inclined downward from the chimney, at which end the finely ground slurry is fed in continuously. Into the further end the fuel in the form of pulverized coal is blown by means of a fan, and burns with an intense gas-like flame.

The slurry, passing steadily forward by the rotation of the kiln, reaches the white-hot zone and is converted into clinker. This falls through a hood at the lower end of the kilns into a rotating cooler, where it is air cooled. From this it falls by gravity into a shaker conveyor, thence on to an inclined bucket elevator, from which it is discharged into an elevated 300-ton ferro-concrete silo situated over the dry mill. In this the clinker divides and shoots into steel ball mills for preliminary grinding. Having been weighed, the partially ground



Sub-station Supplying Current for the Cement Works.

Motor of 200 Horsepower Driving Wet Mill at the Cement Works. Motor of 15 Horsepower Driving Rotary Kiln at the Cement Works.

FIRST ELECTRICALLY DRIVEN CEMENT WORKS IN GREAT BRITAIN.

material passes into two 26-foot 4-inch by 5-foot Krupp tube mills, in which the final grinding is done. From here the finished material is conveyed to the packing warehouse, which has a capacity of 6,000 tons, where it is sacked.

A brief mention might here be made of the coal-

INTERIOR OF PENSTOCK AT KERN RIVER PLANT NO. 1.

drying and crushing department. From wagons the coal is tipped into a ferro-concrete coal pit, from which it is elevated into a rotary dryer heated by hot air. One per cent. of moisture is the maximum that the coal should contain on leaving this dryer for the crushing mills, which are similar to those described above. The finely ground coal is then transferred by a screw conveyor to the four five-ton hoppers at the end of the rotary kiln house, where it next passes to the coal-feed fans, which blow it into the kilns. A stream of hot air from the clinker coolers furnishes the supply of air for the fans and gives a still further drying effect to the fuel.

To come to the electrical equipment, one of the illustrations shows the sub-station at the cement works to which the three-phase 40-cycle 11,000-volt overhead lines from the power station of the Cleveland and Durham Electric Power Company are brought. The power station is 13 miles distant. At the sub-station the current is transformed to 440 volts. A Westinghouse low-tension switchboard is erected in the sub-station and consists of six white Sicilian marble panels with fittings of copper finish. Each of the panels is of approximately 150-kilowatt capacity and is fitted with an ammeter, an oil-break switch, a lightning arrester and an integrating wattmeter.

The motors controlled from these panels are distributed in six different sections of the works, and it is easy to calculate from the wattmeter reading the operating expenses of each section. A large integrating wattmeter fixed on the wall immediately facing the switchboard gives the total consumption of electrical energy taken from the power company's mains. The whole of the alternating-current motors are of the Westinghouse induction type, and excepting three of 50-horsepower capacity are provided with wound rotors and slip rings so that resistance can be introduced into the rotor circuits when starting.

The wash mill and tube mill in the wet-mill department are driven by a 200-horsepower variable-speed motor, shown in the illustration. An important advantage of the electric drive in this department is this: Should the wash mills be shut down for an appreciable period the slurry practically solidifies around the interior frame, which circumstance together with the heavy nature of the machinery makes a large torque at starting essential. As the 200-horsepower induction motor is designed for a starting torque of not less than twice the full-load running torque the advantage is obvious. Each of the rotary kilns is driven by a 15-horsepower motor by belt through spur reduction gearing. One of these is shown in the picture. These are also of the variable-speed type and are capable of giving their full-load torque at any speed between 400 and 800 revolutions per minute, the motor speed being varied to suit the amount of slurry passing through the kiln.

A 100-horsepower motor drives the line shaft in the kiln house, also the clinker coolers and the shaker conveyor. The inclined bucket elevator which the latter feeds into is operated by a 15-horsepower induction motor, and the ball and tube-grinding plant in the dry mill is driven by two 200-horsepower motors. The controller for these, which is of the drum type, has nine starting notches, and the current-carrying portions are fitted with cheap copper tips which may be renewed when arc deterioration and wear render this necessary.

The screw conveyors leading from the dry mill to the warehouse are operated by a 50-horsepower motor and the coal-crushing plant is driven by a 150-horsepower motor. In addition there are two 50-horsepower motors driving direct-current generators for lighting purposes and also for supplying direct current to the 20-horsepower motor operating the jetty conveyor, etc.

All the alternating-current motors are of the Westinghouse semi-enclosed type, with open stator slots, and coils so arranged as to be readily interchangeable in case of accident; and the design of each stator and rotor is such as to produce a continuous flow of air through the internal parts while running. The guaranteed full-load efficiency of the 200-horsepower and 150-horsepower motors is 92 per cent., of the 100-horsepower motor 90 per cent., and of the 50-horsepower and 15-horsepower motors 87 per cent. and 85 per cent., respectively. The aggregate capacity of the motors installed is 1,100 horsepower and the electrical energy required is estimated to be from 3,500,000 to 4,500,000 units per annum. Messrs. Casebourne and the British Westinghouse Company have given every facility for the preparation of this article.

Cheap Power for Southern California.

An event of considerable importance in the development of Southern California was the placing in operation a week or two ago of Kern River

FLUME LEADING TO EDISON POWER STATION NO. 1 ON THE KERN RIVER

Station No. 1 of the Edison Electric Company of Los Angeles. This plant, from which is developed enough power to double the capacity of all the Edison company's other plants combined, is located far up in the lower Sierras of California, almost at the headwaters of the Kern River, whence, through a great channel, comprising 20 tunnels in all, water is led down 12 miles from the mountains for a fall of nearly a thousand feet, where it operates four large impulse wheels aggregating over 40,000 horsepower, and direct-connected to electric generators.

The engineering problems involved in building tunnels, flumes, penstocks and power houses to endure the heavy strains put upon them, were no more difficult to solve than the transmission of the electrical output from the new station under a pressure of 75,000 volts over a distance of 117 miles to Los Angeles. The route of transmission lies through the canyon in a direct line, thence over the hills, plains and divide, to follow the course of the Piru River and its tributaries. Large galvanized-iron towers carry the heavy wire cables of the transmission line.

In many respects the Kern River development is unique. It is claimed to be the largest hydraulic electric plant west of Niagara. The transmission line is one of the longest in the world. The pressure of 75,000 volts over such a length of cable is said to be the highest ever attempted. The conduit which leads to the pressure main is the longest underground tunnel system in use for this purpose. The concrete-encased penstock, tapering so as to accelerate the force of the water at the power house, is said to be the first of its kind ever placed in service. The accompanying pictures are reproduced from photographs showing these features of the enterprise.

The four big impulse wheels which convert hydraulic to electrical energy were built by the Allis-Chalmers Company of Milwaukee, and have each a capacity of 10,750 horsepower at full gate and a speed of 250 revolutions per minute when operating under a net effective head of 865 feet. In addition to the main turbines there are two exciter turbines, each with a capacity of 450 horsepower, and a speed of 430 revolutions per minute.

The Kern River installation of the Edison Company is but one of three waterpower developments owned by this company, in addition to six or seven steam plants, located within a radius of 200 miles, all of which will operate in synchronism. A portion of the output of this plant will be disposed of along the line to Los Angeles. A very considerable amount of power will be utilized in the city of Santa Barbara. The demand for power in Los Angeles, Santa Barbara, and San Luis Obispo counties far exceeds the supply, and the output from this station will help to satisfy the general requirements rather than be devoted to any specific purpose. The Edison Company contemplates the building of plants Nos. 2, 3 and 4 on the Kern River, which will aggregate over 100,000 horsepower, in addition to the output of the present station.

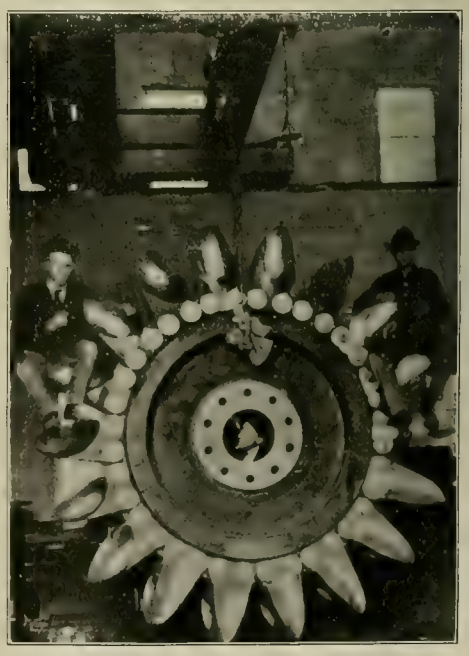
Electricity in Turkey.

Turkey is practically a virgin soil for electrical enterprise. Up to a year ago there was not a single city or town in the 800,000 square miles of Turkish possessions which could boast of a telephone system or of a central station for electric light or power purposes. Now Damascus and Beirut have their electric central stations, however queer it may seem that the former ancient city should lead in progress the important and quasi European cities of Constantinople, Smyrna and Salonica.

Quite recently concessions were granted for electric light and traction in Constantinople, Salonica and Brussa. Smyrna, the second city in the empire, and perhaps the first in commerce and future prospects, seems to have no immediate future for electrical appliances, although perhaps no city feels more the need of them. It is rumored, however, that permission has been granted for the electrification of the two-mile tramway line between Smyrna and the suburbs on the southern shore of the gulf.

Aside from a few isolated plants in mines and private residences, the concessions referred to represent the sum of electrical work in Turkey. Belgium has so far taken the lead in securing large contracts, while Germany, with the exception of the Constantinople concession, nearly monopolizes the smaller business, the material for which has to be imported by special permission from Constantinople. The prohibition now covers everything relating to electricity, even the serviceable electric bells, which cannot be imported except with the approval of the direction of customs in Constantinople.

It is persistently rumored that this unaccountable prohibition of electrical apparatus will be raised within the near future. Consul Ernest L. Harris at Smyrna writes that it would be wise for American



RUNNER FOR 10,750-HORSEPOWER IMPULSE WHEEL AT KERN RIVER PLANT NO. 1.

manufacturers of electrical appliances to turn their attention to this unexplored field and use their characteristic energy in securing a fair share of the coming trade.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Continuing the report begun in the Western Electrician last week of the thirtieth convention of the National Electric Light Association in the New Willard Hotel, Washington, D. C., on June 4th to 7th, inclusive, there is little to add to the report of the morning session of Tuesday, June 4th, except to say that at the executive session with which it concluded, among other business, two committees were appointed, as follows: Resolutions, E. H. Davis of Williamsport, Pa., George B. Stetson of New Bedford, Mass., and Paul Spencer of Philadelphia; president's address, L. A. Ferguson of Chicago, Samuel Scovil of Cleveland and W. W. Freeman of Brooklyn.

The evening session of Tuesday has been already reported briefly in the Western Electrician.

First Papers of Wednesday.

As the first feature of Wednesday morning's session G. M. Little of Pittsburg read his paper on "New Developments in Arc Lamps and High-efficiency Electrodes." The paper was based on the new Westinghouse metallic flame-arc lamp, several of which were exhibited outside the hotel, burning with great brilliancy, while one, disconnected, was shown in the meeting room. There was no discussion. The paper will receive attention in a later issue.

Municipal Contracts for Street Lighting.

Two papers and one committee report related to the general subject of the unsatisfactory nature of municipal contracts for street lighting. The papers were by E. L. Leavenworth and Henry Floy, both of New York, and were entitled, respectively, "Indefinite Candlepower Ratings in Municipal Contracts" and "Indefinite Obligations in Municipal Contracts." The committee report was presented by Dudley Farrand of Newark, N. J., and was the report of the committee appointed "to consider specifications for street lighting." A very interesting discussion, with Dr. A. E. Kennelly in the chair, followed this report, which was adopted. A brief telegraphic summary of report and discussion appeared in this journal last week, while the report in full and a long abstract of the discussion are given in this issue.

Bureau of Standards.

Dr. S. W. Stratton, director of the Bureau of Standards of the United States government at Washington, was introduced by President Williams and addressed the association briefly. Among other things, he said:

"I came here this morning to say to your president that we shall be glad indeed to welcome at the Bureau the members of this association, whose work is so closely allied to our own work. You perhaps know that the Bureau of Standards is but a few years old. However, one of the very first parts of the work to be organized was the electrical work, and not a little part of the electrical work is confined to photometry, and the problems in which you are more directly interested. It was not an easy matter to get together the equipment and the personnel for this kind of work. We have been a little loath to advertise the bureau or to advertise what we expected to do. We rather preferred to let the work speak for itself. The Bureau in its electrical department is not only carrying on many researches which look forward to better measurements in all lines of electrical work, and especially in photometric work, but it hopes to be a clearing house of scientific knowledge, a place where any electrical engineer or any manufacturer in other lines may secure the latest scientific developments in matters which apply to his work.

"We look forward to your visit for two reasons: First, that you may become familiar with the Bureau and its work, and that you may possibly pick up some information which may be of use to you; secondly, that you may give to us a great many practical suggestions. We have found in all of the lines taken up by the Bureau that the only way to reach the best results is by the combination of the scientific men, the men who are carrying on these researches in the laboratory, with the practical men, the men who make these applications, and we have tried in all our lines to bring about this association and learn as much as we can from those who are engaged in the application of the principles which we are trying to establish."

DUDLEY FARRAND, NEW PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Other Papers of Wednesday.

So much time was taken up by the discussion of street-lighting specifications that not much time was left at the morning session for other papers. Two were, however, presented. One was the report of the committee on the present methods of protection from lightning and other static disturbances, of which Alex Dow is chairman. A brief abstract of the paper was presented by Robert S. Stewart of Detroit, secretary of the committee. The conclusions arrived at are presented elsewhere in this issue.

An interesting paper was that of C. D. Wood, Jr., of New York on "Electric Heating Without Special Concessions from the Central Station." A number of unusual examples of electric heating were given by the author. E. F. McCabe of Lewiston, Pa., added some unique experiences of his own. An abstract of Mr. Wood's paper was printed in last week's issue of the Western Electrician.

On Wednesday evening Edward A. Norman of New York told of the "Efficiency of Various Methods of Illumination," with lantern-slide pictures. The speaker advocated a combination of direct and indirect lighting methods, and gave a number of examples of interior lighting. V. R. Lansingh discussed the paper briefly.

A scholarly paper was on "The Frequencies of Flicker at which Variations in Illumination Vanish," by Dr. A. E. Kennelly and S. E. Whiting of Harvard University, abstracted by the former. The authors stated that the maximum frequency of vanishing flicker with stationary retinal image (stationary target and stationary eye) is in the neighborhood of 66 cycles a second. P. O. Keilholtz of Baltimore discussed the paper.

Dr. Steinmetz's Lecture.

The feature of Wednesday evening was, however, the lecture of Dr. C. P. Steinmetz of Schenectady, who, with the aid of a few lantern-slide pictures, discussed "Lightning and Lightning Protection." This was indeed a masterly effort, and it was listened to with close attention by a large audience of ladies and gentlemen. Speaking without a scrap of paper and with the utmost fluency and ease, the lecturer analyzed the causes that produce lightning in the atmosphere and described the formation of a lightning flash and its characteristics. He then turned easily from these abstruse yet clearly presented phenomena of nature to the practical subject of protecting the electric circuit from lightning. He concluded by describing the very recent application of the aluminum cell as a lightning arrester. He denominated the aluminum cell, used for this purpose, as a "voltage flywheel in the alternating-current system." The lecture was a fine intellectual effort by a remarkable man, and it will undoubtedly become a classic in electrical literature. On motion of Mr. Ferguson, seconded by Mr. Dow, a hearty vote of thanks was given to Dr. Steinmetz.

Nominating Committee.

A short executive session was held after the open meeting of Wednesday evening, and the following-named gentlemen were selected as a nominating committee to nominate officers for the ensuing year: John F. Gilchrist, Chicago; W. W. Freeman, Brooklyn; Percy Ingalls, Newark; Henry L. Doherty, New York; J. E. Montague, Niagara Falls.

Gas Engines.

There were three gas-engine papers—two presented on Wednesday evening and one on Thursday morning. The first was by J. R. Bibbins of Pittsburg, whose subject was "Application of Gas Power to Central-station Work." This was a careful consideration of present practice in gas-engine work. An interesting feature was a comparison of anthracite and bituminous producer plants. The bituminous plant is more efficient but not so simple in operation. Furthermore, the possibilities of small-size fuels are so marked that the anthracite plant has a very definite advantage, even in districts fairly remote from the coal fields. The speaker also considered such practical subjects as station arrangement and size of units. He also described a novel electric automatic load regulator which has for its object the maintenance of a constant load on the prime mover, irrespective of the outside fluctuations, which are entirely carried by a storage battery.

The second paper, "The Future of the Gas Engine," by Lewis Nixon of New York, was of a different character, being rather visionary. A few paragraphs may be quoted:

"The use of steam is prolonged for the present by the somewhat absurd claims made for the turbine, but it is only a temporary reliance, and it must give way to a prime mover which does its work in every respect as well and at far less cost."

"The physical tax upon the workers who must stoke, handle ashes, oil and look out for the integrity of boilers and long lines of pipes under pressure, with the accompaniment of heat and dirt, saps their vitality and shortens their lives. Such conditions being absent from the gas-engine plant, the men are always in condition to render intelligent and useful service."

"The United States uses about 100,000,000 tons

DELEGATES AND VISITORS TO WASHINGTON ELECTRIC-LIGHT CONVENTION ON STEPS OF TREASURY BUILDING AFTER RECEPTION BY PRESIDENT ROOSEVELT.

of coal in its manufactures. The saving of half of this vast coal pile will not only benefit every calling, profession and trade in the cost of production, but will cheapen the cost of the remaining 300,000,000 tons used."

"As a conclusion, I predict that soon all towns using in the aggregate 2,000 horsepower will have central gas power plants furnishing power for municipal and private use at a minimum of cost, because for such power and upward the by-products recovered will enable gas to be delivered to the engine free of cost."

Mr. Nixon was not able to be present, which he regretted, as he could, perhaps, have advanced more radical ideas. His paper was read by Mr. Wells of the Brooklyn Edison Company.

"Producer Gas Engines for Central-station Work" was the title of the paper of Robert T. Lozier of New York. Like that of Mr. Bibbins, it was well received. It was illustrated by lantern slides, diagrams showing gas-engine construction and by photographs of stations, including one of the large gas-engine stations in San Francisco, the most important installation in the country. Mr. Lozier said that natural gas, illuminating gas (coal), coke-oven gas, producer gas and blast-furnace gas were valuable for engines in the order named. He gave an interesting diagram showing that it might be cheaper to operate a gas sub-station rather than an electric sub-station.

Mr. Ferguson of Chicago suggested that the gas sub-station might cost much more for real estate. Mr. Keilholtz, Mr. Camp, Mr. Martin, Mr. McCabe and Mr. Sands participated in the discussion.

Mr. Lozier said that he did not advocate necessarily gas engines for sub-stations. A plot of ground 40 by 100 feet would answer for 1,000 kilowatts with gas engine. You can get the B. T. U.'s out of the coal better with the producer than with the steam boiler. In producer gas there are no by-products.

Freight Classification.

Ernest H. Davis of Williamsport, Pa., presented the report on freight classification. The committee found a strong sentiment among electrical men approving universal freight classification, but the question of the reasonableness of freight rates on electrical apparatus is an intricate one. A special recommendation was made that no action be taken in any particular case without the fullest knowledge and preparation and only where the injustice complained of is certain of being shown. Doubtful demands must always be decided against the applicant. The association adopted a resolution recommending to the Interstate Commerce Commission that a universal freight classification be adopted.

The Steam Turbine.

W. L. R. Emmet of Schenectady read a short but instructive paper on "Recent Steam Turbine Developments." He gave the results of tests of a 9,000-kilowatt turbo-generator in the Fisk Street station, Chicago. "The steam economy shown by these tests we believe to be higher than any previous result within the same range of temperature and pressure." Tests in Boston and Schenectady verify these tests. In the Chicago unit "We get a shaft efficiency of 70 per cent. as compared with a bucket efficiency of only 75 per cent. in the most ideal turbine arrangement that we have been able to devise. This comparison leads us to expect that we may be nearing the limits of possible improvement in the simple production of power from steam."

"The plant in Chicago in which these machines are installed is the handsomest and most substantial steam plant ever built, and yet if the units were assigned ratings equivalent to those of other prime movers, its cost per kilowatt would unquestionably be the lowest that has been produced. Consideration of the economies from this standpoint will show any unprejudiced investigator the wastefulness of using inferior apparatus when such results are obtainable. It will also show the great advantages of power production on a large scale, and will indicate that great changes in existing methods are to be looked for at an early date."

The efficiency of the large newer turbines at overloads is marked. In answer to various questions Mr. Emmet said that condenser bases are decidedly better than separate condensers. It would pay to take live steam to heat feed water, but in Chicago steam is taken from the auxiliaries to heat the feed water. The economy of the plant could be increased by taking steam from the middle of the turbine to heat feed water. As to small turbines, the 250-kilowatt unit will operate on 23 pounds of steam per kilowatt-hour. With the 500-kilowatt four-stage machine, the steam consumption with 28 inches of vacuum and saturated steam will be 19½ pounds on half load and a little better on full load. The 300-kilowatt machine has a steam consumption perhaps two pounds higher. In the Chicago plant the 9,000-kilowatt units show an efficiency in steam consumption of about 13 pounds of steam per kilowatt-hour. In the small sizes of turbines the speeds are slow. But still these small turbines are very much better than engines. They do not need adjustment, and steam engines always need adjustment. In Chicago 1.8 pounds of good coal per kilowatt-hour is reached. The effect of superheat is practically one per cent. reduction in the water rate for 12½ degrees of superheat. There is a gain in superheat, but on the whole it seems to be overrated. The cost of producing superheat largely counterbalances the advantages of reduction in the water rate. But the Curtis turbine is capable of withstanding 600 or 700 degrees superheat.

President Williams expressed thanks to Samuel Insull of the Chicago Edison Company for permission to use figures not heretofore published, as well as thanks to Mr. Emmet.

Other Papers of Thursday.

Budd Frankenfield of Cincinnati gave a portion of his paper on "Balancers versus Three-wire Dynamos," explaining a number of diagrams with which the paper is concluded. The author favors a balancer and a two-wire plant.

"The Effect of Frosting Incandescent Lamps" was the title of a paper prepared by Dr. E. P. Hyde and F. E. Cady of Washington, D. C., and read by Dr. Hyde. The investigations of the authors at the Bureau of Standards showed that from five to six per cent. of the light was absorbed by the frosting. The life of a frosted lamp is, roughly, only about half of that of a plain-bulb lamp.

Alex Dow of Detroit abstracted the paper of Miss Sarah M. Sheridan, sales manager of the Detroit Edison Company, on "Some Electric Power Experience." This was a short, practical, helpful paper, which the Western Electrician hopes to print in a future issue.

Membership Campaign.

The results of the new-membership campaign of the committee headed by J. Robert Crouse, were presented in a report made by that gentleman at the opening of the evening session of Thursday. Appointed March 1st, the committee has done high-class work, adding 243 members to the association, which now has a total of 1,233 members of all classes. Mr. Crouse gave a word of praise to Converse D. Marsh for effective assistance.

Sale of Current for Automobiles.

Herbert H. Rice of Indianapolis abstracted his paper on "Opportunities for the Sale of Current for Charging Electric Automobiles." Mr. Rice made some striking points. Here are a few of them:

"The field is what you make it. Thousands will buy electric carriages, and, of course, current with which to run them if given half the encouragement you extend to other current-using devices. In many instances the policy adopted by the electric-lighting companies concerning the accommodations offered for the charging of batteries is the one element that determines whether a prospective customer selects an electric or a gasoline vehicle. It is seen, therefore, that the electric-automobile industry is closely related to the electric-lighting industry. The electric carriage will use more current in a day than most signs in a week, a fan in a month, a hot-water bag in a year, or the curling iron in five years, and yet you spend dollars in soliciting for and advertising these things, and, with few exceptions, scarcely a cent for the electric vehicle.

"Rates of two, 2.5, three and four cents per kilowatt-hour to garages are reported by central stations as very satisfactory to profit-showing. To individual users, rates of five to seven flat or 10 cents per kilowatt-hour less quantity discounts are quoted. But in some places rates are prohibitive. Why not quote favorable rates and encourage the sale of current, especially off the peak, when you can spare it at almost no additional cost?

"Something besides rates, however, is necessary. Someone in your employ should take a little time to find out what the carriage owner needs in order to take current from your mains. Be prepared with the approximate cost of wiring installation, also the cost of charging rheostat for 110 volts direct current, a motor-generator set for high-voltage direct current, and a mercury-arc rectifier for alternating current. Decide in advance what current you will furnish, what you will do toward installation, if nothing more than advice and over-

NATIONAL ELECTRIC LIGHT ASSOCIATION IN SESSION AT WASHINGTON, D. C.

sight. Cold water could not be more chilling than the lack of a definite policy, a knowledge of what you can, and will do, an idea as to the cost of apparatus for charging, if needed, and the encouragement of reasonable rates.

"The amount of current required to charge a carriage varies, of course, and what interests you is the amount of gross income per month. At five cents per kilowatt-hour, for example, individual customers average about $6 per month, say, from $50 to $75 a year; for small carriages used for pleasure or errands; trucks and commercial wagons, relatively more. Garages with 30 boarders have bills at three to four cents per kilowatt-hour of $200 to $300 a month."

Grounding of Secondary Circuits.

W. H. Blood, Jr., of Boston reported for the committee on the grounding of alternating-current secondary circuits. He said that a joint meeting of insurance and electrical interests would soon be held. The general opinion is that the secondary alternating-current circuits should be grounded, but there are diverging views as to voltages to be grounded, etc. Dr. Kennelly, Professor Puffer, Dr. Louis Bell and Dr. Steinmetz favored grounded secondaries in letters read by Mr. Blood. The underwriters are awaiting the action of the electrical interests. The committee made this important recommendation:

"It is the present opinion of the committee that Rule 13A [of the Code] should make it mandatory to ground all circuits where this may be accomplished without maintaining a difference of potential of more than 150 volts between any part of the circuit and ground. The committee further believes that the most satisfactory method of making the ground is by a solid connection with the water pipes, and where this method is not possible, other means must be resorted to which shall be of sufficient current-carrying capacity to allow the primary voltage to pass ample current to blow the primary fuse. The complication which the committee has encountered in considering the grounding of circuits carrying voltages in excess of 150 volts, and particularly polyphase circuits, requires, in its opinion, further study before making definite recommendation."

Mr. Eglin said the desirability of grounding was known to all; the method of making the ground connection is in doubt. It is often difficult to get good grounds.

Mr. Kemble wanted to know if it was not possible to get something like a lighting arrester that would ground only on passage of exceptional potential.

P. Junkersfeld, Chicago, remarked that an iron pipe driven into the ground sometimes answers the purpose. But in some places this will not do. In such a case a cylinder of sheet copper filled with coal or coke may be used.

Mr. Blood said that prominent electrical manufacturers were much interested in the question, and were willing to spend some money to find out what is the best method of grounding.

Presentation to President Williams.

A pleasant diversion in the proceedings was the presentation of a token of esteem to President Arthur Williams by the exhibitors. General Harries of Washington made the presentation speech in graceful terms, and Mr. Williams responded briefly but with feeling. The gift was a gavel made of the oak from one of the Senate doors of the old capitol as it stood prior to the partial burning of the building by the British in 1814. It is mounted with gold and suitably inscribed with an accompanying certificate of validity, the whole enclosed in a handsome case.

MEMBERS AND GUESTS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATIAN AT MOUNT VERNON, VA., ON JUNE 6, 1907.

Important Declaration of the National Electric Light Association on Public Policy.

Important action was taken by the association on Thursday evening in adopting, after a most interesting debate, the report of the committee on public policy. This committee is made up as follows: Everett W. Burdett, Boston, chairman; Henry L. Doherty, New York; Alex Dow, Detroit; Charles L. Edgar, Boston; Samuel Insull, Chicago; J. W. Lieb, Jr., New York; Joseph B. McCall, Philadelphia; Samuel Scovil, Cleveland; W. H. Gardiner, New York, secretary. All the members of this influential and representative committee were present, except Messrs. Insull and Lieb, and Mr. Burdett occupied the chair during the consideration of the report.

The committee is a new one in the history of the association, and its membership represents lighting interests scattered from Massachusetts to Colorado, thus securing widely separated points of view. The character and scope of the duties of the committee are not defined by any rule of the association and are best indicated by its name. The committee has assumed that any subject touching the general relations of the companies to their customers, their employes, the public or the public authorities—in short, whatever involves questions of external as distinguished from internal policy—is within the scope of its consideration. Accordingly a number of sub-committees were appointed.

In this issue this report, important as it is, cannot be given in full. But the following liberal extracts show its purport:

"The subjects of municipal ownership and of public regulation and control of public utilities are intimately connected with each other. Neither can be adequately discussed without reference to the other. Indeed, one is the alternative of the other. Municipal ownership is demanded largely because of the absence of proper public regulation and control. Public regulation and control, if efficient, removes the necessity or excuse for municipal ownership by securing fair treatment for the public.

"If, therefore, a system of public regulation and control, which is at once fair to the corporate interests involved and efficient in securing the results to which the public is equitably entitled, can be evolved and put into operation, municipal ownership can no longer be alleged to be essential to the public interest. What the public wants is efficient and adequate service at fair prices. This is all that could be hoped for from municipal ownership, which, if successful in those particulars, would involve financial risks and political consequences which it is of the highest importance to avoid. Leaving out of consideration those political theorists who adhere to the doctrine that the government should govern as much instead of as little as possible, and that a public official should be substituted for a private citizen whenever and wherever possible, the great body of our people prefer the original American idea, that the functions of government should, whenever practicable, be restricted rather than enlarged, and that undertakings of an essentially business character are best entrusted to private enterprise rather than to po-

[*Continued on page 526.*]

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DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society (first annual convention), Boston, July 30 and 31, 1907.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7 to 9, 1907.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

TAKE it all in all, it is probable that no convention of the National Electric Light Association has exceeded in importance that held in Washington last week. This is so not so much because the total registered attendance was 1,675, the largest in the history of the organization, but because the whole convention was conducted on such a notably high plane and because so much important work was done. The most notable thing accomplished was the official action of the association welcoming public control of public-service corporations—a step of great significance. Of unusual importance, also, was the adoption of a new standard for street illumination upon which specifications for street lighting of all kinds may be based. Both of these features are the subject of editorial comment on this page.

The convention was also exceptional in the length of the programme and the fact that one whole day was set aside for papers relating to the commercial end of the central-station business. It must be admitted that the programme was too long. It is quite true that President Williams utilized all available time admirably and was punctuality itself in opening sessions. Little was omitted and there was no arbitrary choking-off of discussion. But it was necessary, to come within the time limit, that one event should follow another with great celerity; the atmosphere of the convention was one of haste, and there seemed to be a reluctance on the part of the delegates to exchange views lest an undue encroachment upon available time be made.

Technically considered, Dr. Steinmetz's lecture on "Lightning and Lightning Protection" must be accorded first place, but Mr. Newbury's paper on "Power Factor Correction," Mr. Little's on "High-efficiency Electrodes for Arc Lamps," Mr. Rushmore's on "Protective Apparatus," that of Dr. Kennelly and Mr. Whiting on "Frequencies of Flicker," Mr. Emmet's on "Turbines" and Mr. Blood's report on the grounding of secondary circuits are also to be especially mentioned.

The exhibit of electrical apparatus was the best and most attractively arranged of any ever held in conjunction with a meeting of the association. The exhibitors—class D members of the association—took steps to form a committee, acting under the direction of the executive committee of the association, to take full charge of future exhibitions.

President Roosevelt gave a reception to all members of the association at the White House—a courtesy which was highly appreciated. The other features of the "programme of entertainment" were carried out as arranged and greatly enjoyed. The number of ladies present was large, and their comfort and pleasure were carefully regarded.

Mr. Dudley Farrand of Newark, N. J., was elected president, and he well deserves his promotion from the vice-presidency for faithful work.

In many ways the Washington convention of 1907 of the National Electric Light Association has set a new record—a record which will not easily be beaten.

BY A curious coincidence Washington, which was the scene of the 1894 convention of the National Electric Light Association at which the 450-watt arc lamp standard was adopted, was also the place at which the same association decided, 13 years later, to adopt a new standard method of determining the illumination supplied in street lighting, irrespective of the watts necessary to produce the light. The action of the association last week was based on a carefully thought-out report by Messrs. Farrand, Kennelly, Steinmetz, Ferguson and Spencer, with the assistance of other experts like Sharp, Haskin, Conrad, Hering, Marks, Gilmour and Ryan. This report, adopted by the association (although some data are still to be added to it without, however, changing in any way its purport), is given in full elsewhere in this issue. It is an important document, for it marks a decided change in methods of determining illumination supplied to streets, and is made necessary by advancement in the art.

Lamps are now to be had of several types which supply a greatly increased amount of light for the same wattage consumption, when compared with the older types. It is not fair, threfore, as the committee says, to penalize the central station for "giving more light than contracted for, after having made considerable investment for that purpose, simply because the number of watts consumed is less, notwithstanding that other items of expense and renewals may be considerably increased." Obviously what the city authorities want is illumination on the streets; if the light is satisfactory in quality and quantity, what should they care about watts or any purely technical detail in the making of the light?

Therefore, after careful study, the committee recommended and the association adopted a plan by which all street lighting, from whatever source, is considered as illumination and is planned and judged by another standard source of illumination—a 16-candlepower incandescent electric lamp. It is provided that at a certain test point from the given street lamp (of any type) the illumination shall be equal to that from the standard 16-candlepower lamp at a certain specified distance from the point of test. Thus the test point might be 300 feet from the street lamp and the agreed distance of the incandescent lamp for testing 30 feet. If the light from the former is not less than that from the latter, then the street lamp in question is "up to specification." This plan is simplicity itself and should commend itself to engineer and layman alike.

IN THE matter of public policy—that is, the relation of central-station companies to the public—the National Electric Light Association took advanced ground at the Washington convention last week, and is to be heartily congratulated, we think, on its clear sightedness and acumen. Briefly, the association, cautiously but nevertheless unequivocally, placed itself on record as being willing to accept freely the principle of public control of public-utility corporations if applied in accordance with the principles of fair play and justice. The investment in central-station properties in the United States is half a billion dollars or more. The National Electric Light Association is made up of men representing a large proportion of these properties. With such interests in charge it took some courage to hold out a hand to the principle of public control; it would have been easier to await events, to have drifted on the current of opportunity; and the association is entitled to praise.

The action was taken as the result of the careful investigation of the new public-policy committee of the association, composed of some of the most influential men in the electric-lighting business—Messrs. Edgar of Boston, Doherty and Lieb of New York, McCall of Philadelphia, Scovil of Cleveland, Dow of Detroit, and Insull of Chicago. Serving as chairman of this committee was Mr. Everett W. Burdett, who is not only a director of the Boston Edison Company but a lawyer of fine ability. Mr. W. H. Gardiner of New York rendered efficient service as secretary of the committee. The debate on the adoption of the committee's report was the most important feature of the convention. In the course of it Mr. Burdett, who presided, said that the tenor of the report could be summed up in three sentences. These sentences, quoted from the report, are as follows:

"If, therefore, a system of public regulation and control, which is at once fair to the corporate interests involved and efficient in securing the results to which the public is equitably entitled, can be evolved and put into operation, municipal ownership can no longer be alleged to be essential to the public interest."

"In the judgment of your committee some form of such supervision and control is inevitable in many if not all of the important states of the Union, and we believe that it should be welcomed by the parties in interest, provided it is put, as we believe it can be, in such form as to preserve the rights and properties of the companies as well as to promote the interests of the public."

"We may add that we indulge the hope that, even if the first legislation upon this subject is destined to take the form of non-automatic or discretionary regulation and control, the results of its workings in practice may be the evolution of a highly developed and practicable system of automatic or semi-automatic regulation."

The report was adopted without a single vote being recorded against it. The action thus taken is intelligent and timely. It is particularly pleasing to the Western Electrician, which, while consistently opposing the public ownership of industrial enterprises, has repeatedly declared its belief that in an equitable system of public supervision and control is to be found the best solution now in sight of the vexed questions of public service.

Large Gas Engines Discussed at Chicago Institute Meeting.

At the last meeting for this season of the Chicago branch of the American Institute of Electrical Engineers, held in the rooms of the Western Society of Engineers, on June 11th, Mr. E. T. Adams, general manager of the gas-engine department of Allis-Chalmers Company, Milwaukee, gave a very interesting talk on the application of large gas engines to electrical units. Lantern slides were used and many different sizes and types of gas engines were shown.

Mr. Adams reviewed the history of the gas-engine business, and spoke of the possibilities which the future holds out for producer gas machines. So far, however, practically all that the manufacturer can say about the gas engine is concerning what is proposed to be done with it. A number of firms are at present engaged in building large engines, chiefly from ideas obtained from the manufacture of these machines in Europe, the birthplace of the gas engine. Allis-Chalmers Company has had engineers abroad for a number of years making a study of these machines, particularly the Nuremberg machine. Other prominent American companies which have entered the gas-engine field are the Wellman-Seaver-Morgan Company, the Snow Steam Pump Company and the Westinghouse Company. The Snow company was among the earliest manufacturers in America, and the machines it constructed were used for special service in pumping natural gas from the gas fields into cities.

Mr. Adams stated that the steel corporations are at present the largest users of gas engines, the United States Steel Corporation and its subsidiary companies having spent last year over $5,000,000 in this direction. Electric-light and street-railway companies are also interested in gas engines for power purposes.

Many people abroad can be found who say that they have the soft-coal producer problem solved, but no plant of any magnitude can be found in successful operation. Foreign builders make a strong point of the question of economy, hence the complicated construction of many European machines.

The question of adaptability is an important one as regards the gas engine, and engineers are now giving much attention to the conditions under which machines may be installed to the best advantage. Mr. Adams cited the plants of the Boston Elevated Railway Company and the Warren and Jamestown (N. Y.) Street Railway Company as representative of important installations under certain conditions. The gas engine could be employed to advantage in supplying relay power for waterpower, as it is more quickly put into operation than a steam engine. Another field is the manufacturing plant in which the demand for power is constant, and for 24-hour service, a cement factory being a good example.

It has been proposed to install the gas engine in connection with the steam turbine in large power installations, the former carrying the constant load and the latter the peak load. Another proposition, however, would practically reverse these conditions in large plants. Mr. Adams thought that the gas engine in this connection would stand on its own bottom and that if used at all in large installations it would be used exclusively. A large machine of a maximum capacity of 4,500 horsepower would occupy about the same space practically as a vertical steam engine. While the turbine is compact, its compactness, however, is not enough to preclude the use of the gas engine.

In answer to a question regarding the cost of labor in producer gas installations, Mr. Adams stated that not sufficient data had been obtained from which to make an accurate comparison of the relative cost of labor in gas-engine and steam plants; nevertheless, owing to the fact that there is less fuel to handle, the cost in a gas-engine plant, he thought, would be less than in a steam plant. Referring to the various sizes of producer gas plants, the speaker said that a 1,000-kilowatt engine would be approximately 55 feet long, 25 feet wide, would have a crank-pin of 15 inches in diameter and would weigh about 800,000 pounds.

Questioned as to the time taken in starting the engine, he said that was the principal point in its favor. In an engine of 1,000 kilowatts capacity, if no delays were occasioned, the time taken in attaining full speed from the moment the air is turned on would be considerably less than a minute.

Among those who took part in the discussion were Messrs. Fay Woodmansee, H. R. King, Roper and Sargent.

Incandescent Lamp Testing for Federal Buildings.

The time for submitting proposals for supplying incandescent electric lamps to the government for the year ending June 30, 1908, ends this week. The government requires 175,000 lamps for the various public buildings, and the bids will be opened in the Treasury Department at 2 p. m. on June 15th. Standard lamps for 100-130 volts are required in candlepower of 4, 8, 10, 12½, 16, 20, 24, 25, 32 and 50, and of 8, 10, 16, 20, 24, 32 and 50 candlepower for 200-250 volts. Also metallized-filament high-efficiency incandescent lamps Nos. 2, 3, 4 and 5, and prismo type reflector lamps of 16 and 32 candlepower.

To show construction, bidders must, if requested, submit two samples of each type of lamps proposed to be furnished. All lamps must conform to the samples submitted in shape of bulb, in mechanical construction and type of filament, and no departure from the sample lamps will be allowed without written permission. The successful bidder shall furnish, for check and use in inspecting lamps, not less than four primary standard lamps. These lamps will be returned to the contractor on completion of contract.

In determining the award of a contract bidders may be required to submit for a comparative test 500 lamps. (a) Inspection of 50 per cent. of each lot of 500 lamps to discover faults in construction and sorting. (b) A determination of the uniformity or non-uniformity, of rating and the characteristics of the distribution of light of the lamp, including the measurements of about 100 lamps of each lot of 500 to determine the mean horizontal, tip and mean spherical candlepower, together with the current consumption. (c) Determination of mean spherical candlepower performance throughout the useful life of 25 lamps of each lot of 500 submitted, operated at voltage corresponding to an initial specific consumption of three watts per mean spherical candle.

The unit of candlepower will be the candle as determined by the Bureau of Standards at Washington, D. C.

The basis of comparison of all lamps will be the mean spherical candlepower. The nominal candlepower will be the mean horizontal candlepower of lamps having a mean spherical candlepower value of 82.5 per cent. of the mean horizontal candlepower, which is the standard value for filaments of the oval anchored type. The test quantity will consist of 10 per cent. or more of any lot or package, and in no case be less than 10 lamps.

All lamps, unless otherwise specified, are to be made with moisture-proof standard Edison screw bases, fitted with glass buttons. The shells of the bases to be of good quality brass, firmly and accurately fitted to the bulb with moisture-proof cement, and in length to conform to the code of the National Board of Fire Underwriters.

Filament must be symmetrically disposed in the bulb and not droop excessively during the life of the lamp, when the lamp is burned on test without excessive vibration and in one horizontal position at a voltage corresponding to an initial specific consumption of 3.76 watts per mean spherical candle. All filaments must be uniform and free from imperfections, spots and discolorations.

From each accepted package of lamps two sample lamps will be selected which approximate most closely to the average of the test quantity. One of the two lamps thus selected will be subjected to a life test and designated as the life-test lamp, the second or duplicate lamp being reserved to replace this test lamp in case of accidental breakage or damage during the life test. The test lamps will be operated for candlepower performance at constant potential, average variations of voltage not to exceed one-fourth of one per cent., either side.

The voltage for each lamp is to be that corresponding to an initial specific consumption of 3.76 watts per mean spherical candle, or if tested upon a different basis the results shall be corrected to a basis of 3.76 watts per mean spherical candle. If desired the life tests may be made at such other watts per candle as may be mutually agreed upon.

The average candlepower of lamps during life must not be less than 91 per cent. of their initial candlepower. In computing the results of test of a lot of lamps the average candlepower during life will be taken as the arithmetical mean of the values for the individual lamps of the lot tested.

The individual limits for metallized-filament and round-bulb prismo types of lamps will be 15 per cent. above and 15 per cent. below the mean candlepower rating, and 15 per cent. above and 15 per cent. below the mean total watt rating. The candlepower ratings referred to are the mean horizontal candlepower ratings of clear lamps without reflectors.

The Berlin Wireless-conference Discussion in Great Britain.

The London correspondent of the Western Electrician writes that the committee on the Berlin radio-telegraph convention of 1906 has at last completed its evidence and is now considering its report. The final evidence was by Cuthbert Hall, managing director of Marconi's Wireless Telegraph Company, who dealt with the evidence of certain of the delegates, mainly in reference to a statement by Sir Robert Hunter, solicitor to the postoffice, as to the patent position of the company in the event of the company accepting the principle of compulsory in-intercommunication.

Two very eminent British lawyers, Messrs. Warmington, K. C., and Ashbury, K. C., on behalf of the company have expressed the view that having in mind litigation in respect of owners of certain other systems now in use, the company would seriously prejudice its position as to its patents by accepting the convention, and it is mainly on this ground that the company stands out. Against this Sir Robert Hunter says that the company has already seriously prejudiced its position by standing by so long and not taking action hitherto. Mr. Hall had a ready reply, for he asked if a patentee was to be forced to take action against others or lose the protection which his own patent afforded.

An enormous amount has been said concerning the action by the Marconi Company against De Forest in the United States, and it is certain that considerable confusion exists over here as to the true facts of the case. Marconi asserts that the decision holds good in favor of his system all over the United States. Sir Robert Hunter maintains that as the decision was given by a state court, the decision only holds good in that state.

Asked as to why the decision in question has not prevented the De Forest Company from working in the States, Mr. Hall said that by continually transferring its patents from one company to another the De Forest Company has evaded all liability, and furthermore, for this reason the Marconi Company had failed to recover one halfpenny either of the $100,000 incurred in costs of the action or for damages. He further made the allegation that the De Forest Company had actually raised money by issuing a prospectus in which it was stated that an amalgamation had been made with the American Marconi Company. The company anticipates a close division among the members of the committee as to the ratification of the convention, and in any event looks for a strong minority report.

Prof. J. A. Fleming, F. R. S., consulting electrician to the Marconi Company, in a lecture before the Royal Institution, dealt with the severely technical and practical side of radio-telegraphy. Incidentally he mentioned that wireless telephony was being accomplished between Berlin and Nauen, a distance of 12 miles, in connection with the transmitting station of which 12 copper-carbon arcs are employed in series.

The main theme of his address as it related to radio-telegraphy dealt with modern methods of the generation of electric waves, and a compliment was paid to the work of Poulsen, who, it was stated, had now increased the frequency to approaching 1,000,000 per second. Dr. Fleming, however, does not think that the position of dominance now possessed by "spark" telegraphy will be seriously endangered by "arc" telegraphy for some time to come, owing to the great difficulties in erecting and maintaining the apparatus and the small power which it is possible to make use of—only about two horsepower. Mr. Marconi has, on evidence, stated that he was at work upon a new system, and all that Dr. Fleming said on this point was that it involved the use of neither the arc, spark nor alternator.

An improved method of handling passengers' baggage at large stations is being tried by the Pennsylvania Railroad in Philadelphia. Baggage and mail trucks that are practically miniature automobiles have been adopted. A storage battery and electric motor are mounted beneath the platform. The attendant has merely to steer, the whole work of propulsion being performed by the motor. If the use of these trucks continues as successful as reported, they will, it is said, replace the old hand-propelled trucks at the larger stations on the system.

National Electric Light Association.

[Continued from page 523.]

litical manipulation. The public funds should be employed solely for public purposes and the tax levy should not be subjected to the perils of commercial enterprises.

"But, adhering to these sound tenets, a large body of the public feels itself driven to the more or less favorable consideration of municipal ownership, by the feeling that in no other way less objectionable on general principles can those results to which the public is entitled be obtained. Where private enterprise results only in private gain and not at all or only insufficiently in public advantage, the demand for municipal ownership is natural and inevitable. This fact alone suggests the antidote. If private enterprise results to the public advantage as well as in private gain, the basis for the demand for public ownership is gone.

"Assuming, however, as a knowledge of human nature compels us to assume, that a recognition of these fundamental principles cannot be expected on the part of all owners of private industries, we are forced to the consideration of measures to compensate for that fact. That which is now uppermost in the public mind is public supervision and control. In the judgment of your committee some form of such supervision and control is inevitable in many if not all of the important states of the Union, and we believe that it should be welcomed by the parties in interest, provided it is put, as we believe it can be, in such form as to preserve the rights and properties of the companies as well as to promote the interests of the public. The practical question is not so much whether there is to be such regulation and control as it is what the nature and form of them are to be. The public demand for it is shown, not only in the pronounced attitude of the president of the United States, with respect to interstate railroads, but by the extreme activity of many important state legislatures that are now sitting or have just adjourned. Bills proposing public regulation and control of public-service corporations have this year been introduced into the legislatures of at least 14 states. They deal with the subject in a variety of ways. The diversity of their provisions indicates at once the widespread interest in the subject and the merely tentative hold which as yet those dealing with it often have upon the true principles that underlie it."

"One great difficulty under systems of undefined public control is the inability or unwillingness of officials to distinguish between the regulation and the operation of corporations. Regulation should stop where operation begins. Matters of business discretion should be left to the decision of those who are responsible for business results. The directors of the affairs of a corporation undoubtedly, in most instances, are better judges of questions of business expediency than outside officials, however enlightened.

"But it is always the tendency of public bodies clothed with judicial powers or official discretion to enlarge their own jurisdiction, and it is not therefore to be expected that they will set proper limits to their authority.

"The remedy for this difficulty is to have the obligations of the corporations and the authority of the officials so defined by statute as to make the operation of the provisions of the law upon the state of facts in hand as nearly as possible automatic, calling for the interference of public officials only to the extent of applying the law to the facts as found. The ascertaining of the facts need not, and usually would not, involve to any considerable extent the exercise of discretionary or judicial functions. In short, under such a system the supervisory officials are in the position of a jury, accepting the law directly from the Legislature and merely applying it to the facts as found by them."

"All things considered, it is not necessary to admit that an automatic or semi-automatic system of public regulation and control is impracticable. Its advantages, particularly in delivering vested interests from the perils inseparable from the exercise of more or less arbitrary discretionary powers, are so great that every effort should be made to secure its adoption in practice.

ALLIS-CHALMERS COMPANY'S EXHIBIT.

"While the foregoing statement embodies the conclusions to which the studies and consideration of your committee have brought it in dealing with this great question of public supervision and control of public-service corporations, it nevertheless recognizes the fact that not much has heretofore been said along the lines followed in this report, and that public sentiment may not as yet be ripe for the adoption of a system of the character of that advocated herein.

"While further discussion and experience may be necessary for the education of public sentiment along these lines, it is nevertheless desirable that that plan which will ultimately accomplish the best results should be exploited. If in the meantime legislation is to take the form of regulation and control substantially like that embodied in the New York and Massachusetts laws, we desire to go on record as insisting that the administration of such a system or systems shall be entrusted to men of the highest ability and irreproachable character. So much depends—indeed, everything depends—upon the honesty and wisdom of the men clothed with such powers—capable of accomplishing so much good and of doing so much damage to public as well as to private interests—that every effort should be made to obtain them. To that end we would advocate long terms and secure tenure of office, with adequate salaries, sufficient, as far as possible, to remove the element of self-sacrifice in the acceptance and incumbency of the offices."

"We may add that we indulge the hope that, even if the first legislation upon this subject is destined to take the form of non-automatic or discretionary regulation and control, the results of its workings in practice may be the evolution of a highly developed and practicable system of automatic or semi-automatic regulation. We entertain this hope because of our belief in the economic superiority of the one system over the other, and therefore feel justified in believing that ultimately the best will be adopted, even if it is worked out through experience under a less desirable one.

"The studies, rulings and declarations of principles by competent commissions should ultimately develop such methods of adjustment of the parallel interests of consumers and corporations as may then be embodied in legislation, operating directly upon the subjects of it, without the necessity of the intervention of officials clothed with a large discretion in its application."

Following the reports of the general committee, came the reports of the sub-committees. Very briefly, these may be summarized as follows:

Municipal Ownership (Messrs. Dow and Insull).—Mr. Dow said that although there was a lull in the demand for municipal ownership, it was due to the growing prominence of government control. If the idea of government or state regulation by commission failed, the clamor for public ownership would be more insistent than ever. Hence the importance of the subject. Mr. Dow cited the recent elections in Chicago and London as signs of the times.

Public Regulation and Control (Messrs. Scovil and McCall).—Mr. Scovil said each law should contain a rule by which the reasonableness of the control may be determined. Properly constituted supervision is favored.

London Sliding Scale as Applied to Electricity (Messrs. Insull and Edgar).—Mr. Edgar said that the theory of the sliding scale is that it will substitute a sort of partnership of interest between the public-service corporation and its customers. Reduction in rates paid by customers goes hand in hand with increase of dividend rate to stockholders. In the gas business in England dividends are allowed to increase proportionately with reduction of rates. But electric service is much more difficult to treat, owing to the complications of the schedule of rates. Perhaps, however, the problem of applying the sliding scale to it may be worked out. The sub-committee urges the serious consideration of the subject. The advantages, both to the public and the company, are great. The fixing of a so-called standard base rate of dividends and of rate of service is a matter of great delicacy and importance. In each case the plan should be subject to the acceptance of the company.

Taxation and Franchises (Messrs. Doherty and Dow).—Mr. Doherty said that franchises should be perpetual, as otherwise rates must be higher to provide for making good the investment at the end of the period. Public-service corporations pay more than their fair share of taxes. Reform in taxation will therefore reduce their taxes rather than increase them. An occupation tax is unfair. Corporations should pay simply a straight valuation tax.

Industrial Insurance, Rewards and Pensions (Messrs. McCall and Lieb).—Mr. McCall reported that plans for beneficiary associations or pension organizations are spreading. The committee recommends the adoption of such or similar plans where feasible. The idea promotes the health, happiness and contentedness of employes. Old and faithful employes may well be pensioned at half-pay or some proportion of former pay.

Publicity and Popular Education (Messrs. Lieb and Scovil).—Mr. Scovil made a plea for the active support of the work of disseminating correct information. Bulletins or house organs are recommended. Advertising campaigns are good.

At the conclusion of the reading of the reports

TWO GENERAL VIEWS OF EXHIBITS AT THE WASHINGTON ELECTRIC-LIGHT CONVENTION.

E. H. Davis of Williamsport, Pa., offered a resolution that the general report be adopted and printed for public distribution.

At the suggestion of Mr. Doherty, Mr. Gardiner explained briefly the London sliding scale. He also said that bills to control electric lighting by commission have been introduced in 10 states this year. There is also a contemporaneous movement for all kinds of control in cities and villages. One state has embodied in its law an opportunity for the use of the sliding scale by such companies as may agree to it. The sliding-scale principle is intricate and novel in the central-station business. But the sliding scale is with us; it is a condition, not a theory.

E. N. Wrightington, secretary of the Boston Consolidated Gas Company, explained the sliding scale as it affects his company. The base rates are 90 cents for gas and a seven per cent. dividend. For every five-cent reduction in the price of gas dividends may be raised one per cent. The immediate effect was to reduce gas to 85 cents. The company is satisfied with the sliding scale.

J. J. Burleigh of Camden, N. J., spoke against the Davis resolution. Better file the report than adopt in a hurry without consulting directors at home, he said.

F. E. Barker, chairman of the Board of Gas and Electric Light Commissioners of Massachusetts, was called on and said he represented an interest quite different from those represented in the association. The question of public control is of great importance. He was much impressed by the reference in the report to the arbitrary character of the authority conferred on some of the state or other commissions. There is great force to the suggestion. The law should be supreme, not men or corporations or commissions. The tendency seems to be to enlarge instead of to restrict the powers of commissions. The danger lies right at this point, not alone to the companies but to the public. The subject, in all its bearings, should receive the most serious consideration. The speaker did not know whether the sliding scale is the solution, but something may come out of it. In some form the commission idea seems to be the best method of meeting the public-utility problem.

E. H. Davis advocated the keynote of the report —that regulation may be accepted if it insures protection. Mr. Michaelis of Augusta, Me., Mr. Kemble, Mr. Sands, Mr. Dow, J. H. Bridgers of Henderson, N. C., A. A. Dion of Ottawa, Ont., and Mr. Burdett also spoke in favor of adopting the report. When the vote was taken there were no votes against the Davis resolution, but a storm of "ayes" and great applause followed the announcement that the report had been adopted.

Messrs. Farrand of Newark, N. J., and Freeman of Brooklyn spoke highly of the work of the committee, and President Williams added a word of praise. A standing vote of thanks was given the committee, and, at an hour approaching midnight, the association adjourned for the day, after one of the most important sessions it has ever held.

Italian Methods of Charging.

After President Williams had called the meeting to order on Friday a paper prepared by Guido Semenza of Milan, Italy, on "Methods of Charging for Electric Motive Power" was read by Louis A. Ferguson. The paper dealt specifically with Italian methods of charging for electric current. Owing to the abundance of waterpower easily available at short distances from manufacturing cities and districts in Italy and the complete absence of coal mines there, hydro-electric power is used to such an extent as to make that country unique from this point of view. Moreover, as the water supply of rivers is not constant and during some of the seasons is very scarce, the central stations find it necessary to run steam engines to supply the deficiency, and there is a convenience in cutting off the peaks of the load with steam. Nearly all the largest waterpower plants are supplemented with auxiliary steam plants. All these conditions in Italy have given a special character to the methods of charging for motive power.

Meters for Polyphase Service Discussed.

Apropos of Mr. Semenza's paper, L. A. Ferguson suggested that there be a discussion on the necessity of obtaining some meter that would measure the true energy on polyphase service for general service, not for large customers but for general motor service. The speaker stated that the whole subject of charging for alternating power service was very important at the present time by reason of the tremendous growth of the use of alternating current for industrial power, especially in large cities.

H. W. JOHNS-MANVILLE COMPANY'S EXHIBIT.

Howard T. Sands, Haverhill, Mass., did not believe it right to impose upon a customer the demand charge, when from 80 to 90 per cent. of that demand could be reduced in the sharp peak of a load lasting for only a matter of five or six minutes.

Peter Junkersfeld of Chicago pointed out that in supplying large railroad systems where there are hundreds of cars and the load curve shows no sharp peaks the average demand for one hour does very well, but for industrial power or interurban railways, where the peaks are sharp, that works a hardship on the company.

Alex Dow of Detroit said that the General Electric Company had in the last two years done a great deal of experimenting with a demand indicator for polyphase circuits. He suggested that the people who want to buy such meters get together and settle definitely what sort of a meter it is they require, and having settled that, what price they are willing to pay for it.

Philip Torchio, New York, asserted that any instrument for measuring a large amount of power could be obtained at the present time from the manufacturers. Some of the instruments in operation around Niagara Falls register the maximum output in any one hour, while others register the maximum demand over five minutes. The speaker thought that the manufacturer ought to be impressed with the fact that in connection with the power factor, induction motors should be made with the best power factor that can be had, and that if the motor cannot be made with a good power factor the controlling and starting devices at least should be made to reduce the inrush current to a minimum.

In answer to a question raised by Mr. Sands as to what would be considered the fair time limit on a demand indicator for power work, the speaker having referred to the fact that in England demand indicators are being used for motor work which will not register a maximum demand of less than 15 minutes, or a half hour, or an hour, Mr. Ferguson replied that that would depend on the size of the power station. In a large system like that of New York or Chicago it would not make so much difference; an hour could be used without any difficulty. In a small town, however, where the size of the power house is small, it would be necessary to make the limit of time less.

J. F. Geiser, Waynesboro, Pa., thought that meters should be available that will measure the demand in such a way that all the customers could be taken care of, and all sorts of loads as much as possible on one set of meters and one set of charges. There is a demand for an instrument that will limit the demand in such a way that the customer will know it, at least, if he exceeds that demand.

H. T. Hartman, Philadelphia, believed that a proposition made to the effect that the peaks which integrated over a half hour or hour should be taken as a fair average was entirely too high. As an example Mr. Hartman cited the case of an elevator load which, if the average over a period of an hour or a half hour were taken as its maximum, entirely too little would be allowed. The Niagara Falls, Lockport and Ontario Power Company, which recently has installed a very large transmission system, has adopted as an average the one-minute peaks over the month, the 30 highest one-minute peaks being taken as representing on the average the demand for which it must charge in order to get a sufficient amount for its fixed charges.

A motion made by Mr. Ferguson that a committee be appointed by the president to investigate the whole subject of meters, with especial reference to the particular subject just discussed, was carried. The committee appointed consists of L. A. Ferguson, Chicago; Alex Dow, Detroit, and J. E. Montague, Niagara Falls.

Report on Standard Rules for Electrical Construction and Operation.

The report of the committee on this subject was read by E. H. Davis. It was stated that the committee had but little to do; that the relations between the electrical and fire-insurance interests were on a more harmonious footing, which it was hoped and expected would continue and improve. Reference was made to the proposed amendment of rule 13-A, but the report stated that no action had been taken on the proposed changes, and it was decided to have the matter referred to a committee of the Underwriters' National Electric Association, which should confer with the National Electric Light Association, the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies and the International Association of Municipal Engineers. On motion the report was received.

Commercial or New-business Day.

In taking up this subject, W. W. Freeman was called to the chair, Mr. Freeman being chairman of the committee to assist in the further development and prosecution of the plans of the Co-operative Electrical Development. The first paper on the subject was presented by J. Robert Crouse on "Co-operative Commercialism in the Electrical Field." The objects of the co-operative movement were recited by Mr. Crouse, and the subject treated from two aspects, first, as a theoretical principle in business development, and second, as a practical workable refinement in business organization. Mr. Crouse dealt with the general character of the plans formulated for the creation and extension of the market, and gave the detailed plans, which include representatives in the field; representatives among electrical contractors, architects, builders, etc.; issuance of commercial literature to the electrical and allied trades; co-operating advertising agencies; school of scientific salesmanship; special inducements for commercial work; co-operation with the technical press; national commercial press

General Electric Company.

Westinghouse Companies.

Wagner Electric Manufacturing Company.

SOME OF THE EXHIBITS AT THE WASHINGTON ELECTRIC-LIGHT CONVENTION.

bureau; national campaign of advertising in magazines and periodicals, etc.

J. F. Gilchrist, Chicago, read the report of the National Electric Light Association co-operating committee. The following papers were then read:

DEARBORN DRUG AND CHEMICAL WORKS' EXHIBIT.

"Possibilities of Commercial Development," by Henry L. Doherty, New York; "New Business; How to Get It—How to Keep It," F. M. Tait, Dayton, Ohio; "New Business Results Demonstrated in Cities of All Sizes," J. E. Montague, Niagara Falls; "Sales Policy in Combination Gas and Electric Companies," F. A. Willard, Rochester, N. Y.; "Co-operation of the Electrical Trade Papers in Business Getting," F. W. Loomis, Savannah, Ga.

P. H. Campbell, Windsor Locks, Pa., who referred to a certain town of 7,000 inhabitants where is situated a large carpet mill employing 3,000 operatives, most of whom live in tenements, wished to learn what proportion of these operatives it would be possible to reach either with gas for cooking or electric light. F. H. Plaice, New Bremen, Ohio, stated that they were lighting today 85 per cent. of all the buildings in his town. Many of their customers receive as low as $1.25 a day. He could see no reason why any person receiving $1.50 a day could not be reached for electric light, if the proper price for current were made and the proper conditions of delivery of current provided. In answer to a question raised by Chairman Freeman as to the charges for residential service in such cases, Mr. Plaice said that they worked on a demand system, based more particularly on the area to be illuminated than on the amount of lighting installed. The rate starts at 20 cents for the first 7½ hours out of the thirty hours per month. It rises to 10 cents for the second 7½ hours, then nine cents for the next 15 hours, or an average of 12 cents for the first one hour per day per month; then six cents for the second hour, three cents for the third hour, and after that two cents a kilowatt for all current. The price of gas is 35 cents a thousand.

On the subject of wiring, two papers were read, one, "How to Get the Old Buildings Wired," by F. H. Golding, Dayton, Ohio; the other, "How to Get the New Buildings Wired," by J. Sheldon Cartwright, Knoxville, Tenn.

Co-operation of the Electrical Contractor.

James R. Strong of New York, president of the National Electrical Contractors' Association, then presented a paper on "Co-operation of the Electrical Contractor in the Wiring of Buildings." Lawrence Manning, Owosso, Mich., believed that if the electrical contractor is not left free in the matter of wiring, it would leave the opinion open to the public that the electric-lighting people were getting so much out of that business that they are able to do wiring at cost and sell appliances at cost. Mr. Manning believed in protecting the wiring contractors in this respect.

M. S. Seelman, Jr., Brooklyn, thought that the central station would not interfere with the electrical contractors who are strong enough to take care of the conditions as they exist and wire the buildings as they are built. Leon H. Scherck, Birmingham, Ala., found that in his being associated with a number of electric-lighting companies in different states, the best solicitor the central-station has is the wiring contractor. W. P. Engel, Defiance, Ohio, thought that the average central station preferred that the contractor do the wiring provided he would give the customer full value. George B. Stetson, New Bedford, Mass., remembered a few years ago hearing one of the managers of a large company say that in his district they gave up the matter of wiring themselves, and their solicitor gave his attention to finding new buildings. Then he sent notice of the fact that a building was to be wired to every contractor in his city. He (the manager) said the man either wired his house, moved out of town, or died.

Other Papers of Friday Morning.

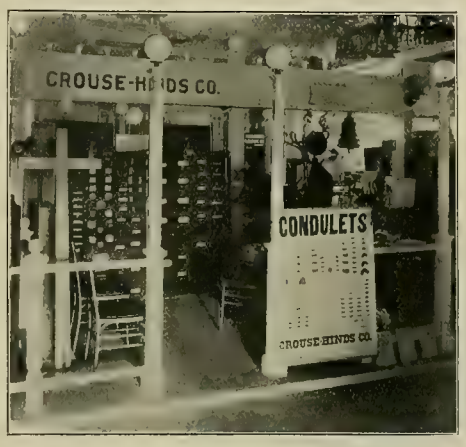
R. S. Hale of Boston read a paper on "Value and Use of Solicitor's Handbook." These papers were then presented: "Sizing Up the Territory—Preparing the Lists of Prospective Customers," George Williams, Cincinnati, read by W. H. Gardiner; "Qualifications of Solicitors for Different Classes of Business," F. W. Frueauff, Denver.

Advertising and Salesmanship.

After the meeting had been called to order at 2:15 o'clock, by Chairman Freeman, two papers were read: "Advertising Results Demonstrated in Cities of All Sizes," E. S. Marlow, Washington, read by Mr. Mangan; "How to Measure Results and Pay Solicitors," by Leon H. Scherck, Birmingham, Ala. J. D. Kenyon, vice-president of the Sheldon School, Chicago, followed with a paper on "Increasing the Efficiency of the Sales Force."

W. H. Gardiner, Jr., thought that the basic principle in business, as in strategy and military tactics, was the sizing up of "the other fellow." By comparing one's methods and resources with those of a competitor, a better conception of the situation may be had. E. N. Wrightington, Boston, favored the paying of solicitors on a commission basis in order to get good results. He thought, however, that the usual method of forming a basis of commission on the amount of sales made of certain appliances or on the increase on net revenue had some inherent defects, prominent among which was the question of the salesman's territory. Mr. Wrightington was in favor of a plan to take out all the percentage of increase throughout the various districts and then give to each salesman the percentage that his percentage bears to the total.

C. W. Lee, Newark, N. J., then projected upon a screen illustrations of various forms of advertising literature used by electric-light companies



CROUSE-HINDS COMPANY'S EXHIBIT.

throughout the country, which he described.

The following papers were then presented: "How to Make the Most of Newspaper Advertising," A. D. Mackie, Peoria, Ill.; "Measuring the Results of Advertising," M. S. Seelman, Jr., Brooklyn; "Value of the Service of the Advertising Agency or Specialist," Lawrence Manning, Owosso, Mich.; "Display Room and Demonstration as Business Getters," E. R. Davenport, Providence, R. I.; "New Business by Indirect Methods," L. D. Mathes, Dubuque, Iowa.

M. S. Seelman, Jr., thought that the matter of advertising could be made of much more value than it is today. Instead of merely telling a prospective customer the advantages of electriicity for lighting and other purposes, Mr. Seelman thought it preferable to urge upon the "prospect" the necessity for using electricity, and after impressing upon him the fact that the only reason he has not adopted it is that the house is not wired, find out how much it will cost to wire it, and if he has not the money to pay for the wiring at once, tell him he will be given time on it.

New-business Wrinkles.

The following papers were then presented: "Co-operative Lighting of Streets by Merchants," H. J. Gille, St. Paul, Minn.; "Illuminating Engineering as an Aid to Securing and Retaining Business," C. F. Oehlmann, Cincinnati; "Methods of Securing Residential Business," R. W. Hemphill, Ann Arbor, Mich.; "Methods of Securing Sign, Window and Outline Lighting," Homer Honeywell, Lincoln, Neb.; "Methods of Securing Power Business," George N. Tidd, Scranton, Pa.; "Catering to Power for Automobile Charging," R. W. Rollins, Hartford, Conn.; "Establishing Day Circuits in Towns of 10,000 Population and Under," F. H. Plaice, New Bremen, Ohio; "Methods of Exploiting Electric Heating Devices," T. K. Jackson, Mobile, Ala.

L. H. Scherck, Birmingham, Ala., disliked the idea of the central station making special rates. In an extreme case he would rather make a present of a motor than vary the rate. The central station, also, he thought, does not give sufficient attention to the off-peak business. He believed that the off-peak contract was in its experimental stage and could be worked out. It has been worked very satisfactorily in Montreal. Moreover, much might be accomplished through the co-operation of labor unions, which might be interested in having different hours of labor during the winter months. A laborer might, during the holiday season, quit work at 4:30 or 5 p. m. instead of 6 p. m., by going to work an hour earlier.

Kenyon Collier suggested the idea of sterilizing milk by electricity. In Atlanta, he said, they had just placed an electric milk sterilizer on the line, 15 kilowatts at 2,200 volts, and the city physician, who made experiments on the milk after it was sterilized, said that there was no trace of germs, and none of the food properties were in any way injured, the milk being perfectly sweet six days after sterilization. The sterilizer is operated between five and 11 o'clock at night, and seems to work no hardship on the company. With regard to the matter of special rates, Lawrence Manning said that in the town of Flint, Mich., a rate of 10 cents per kilowatt-hour for the first 25 days' current is charged, then 7½ and five cents; but they have 1,600 customers in a town of 15,000, and get better than $4.50 per capita for lighting, and their rates for power are five cents straight, no discount. One man does all the meter reading and all the collecting for the 1,600 customers, and they carry from month to month less than $400.

F. H. Plaice, New Bremen, Ohio, in referring to the fact that they were wiring 85 per cent. of the buildings in his town, said that they did not have as many service taps as buildings, by reason of the fact that some of the customers have two or three different services. In one instance an application had been received for a 10-horsepower motor from a person who wanted to use it 1¾ miles away from the station. The generating plant is for 125 volts, and he could not be reached with that voltage. Accordingly a 350-volt generator was installed, and it was only a short time when someone farther out made an application for current, and it spread until three lines were running out from the town, covering a radius of about five miles.

Frank W. Bullock, Jamestown, N. Y., in referring to gas competition, said that in the district in which he is located gas has a value of 1,000 British thermal units per cubic foot, and that for large motor service, in view of competition, they had to get down to something like one cent a kilowatt-hour.

Closing Proceedings.

J. F. Gilchrist moved a vote of thanks to the publishers of the Convention Daily for rendering such good service to the association, which was carried.

Chairman Freeman took occasion to congratulate the association on having accomplished its work within the prescribed time. Speaking of the Commercial and New-business Day papers, he said that such a variety of papers had never before been gathered together under one cover. Their value would become increasingly apparent as they are studied.

President Williams then resumed the chair, and the report of the committee to draw a resolution of thanks to the people in Washington was presented by Mr. Davis. Among those who were the recipients of the thanks of the association were: The President of the United States; the ladies of the District of Columbia; Hon. H. B. F. Mac-

G. M. GEST'S EXHIBIT.

farland, president, and the other members of the Board of Commissioners of the District of Columbia; Col. C. A. P. Hatfield, U. S. Army; the Columbia and Chevy Chase Golf clubs; G. T. Dunlap and D. S. Carll of the Capital City Traction Company; F. B. Hubbell and T. P. Garrett of

the Washington, Arlington and Falls Church Railway Company; Gen. George H. Harries, H. W. Fuller, E. S. Marlow, L. E. Sinclair, and others of the local member company, and the members of the entertainment committee.

EXECUTIVE SESSION.

At the executive session certain changes in the constitution and by-laws were made, after which the committee appointed to report on the address of President Williams, composed of L. A. Ferguson, Samuel Scovil and W. W. Freeman, presented its report. The position assumed by the president in discussing the relations that should exist between the public and the members of the association was heartily approved of. The committee indorsed with great satisfaction the suggestion of the president regarding "the desirability of agreeing upon some approximately common method or methods of charging for electric current. If one method cannot be considered best, several eventually might be recommended, each possessing recognized elements of fairness to the public as well as to the supplying companies." The attention of the members of the association was solicited on the importance of exercising the greatest care and discretion in the making of rates, since ill-considered or unintelligent rate-making in one city or town may result—as has been the case, even in these later days—in unfortunate and disastrous comparisons in other cities and towns where more careful and more intelligent consideration has been given to the science of rate-making. The committee expressed its approval of the suggestion of the president as to the value to the industry and to the public were there a method through which every member in a given state could be advised of pending legislation in other states, and of the history of such legislation. It recommended that provision for disseminating such information be made by the committee on public policy.

At the close of the executive session it was decided that the committee on a uniform system of accounting be continued and enlarged as necessary and that the committee be authorized to confer with similar committees of other associations, notably the American Street and Interurban Railway Association and the Gas Institute. It was further decided that if it be considered desirable by the executive committee to arrange for an "Accounting Day" at the next annual convention of the association, and if it be advisable that accounting subjects shall be presented at a special meeting, to be held contemporaneously with the meeting of the main body, the executive committee shall be empowered so to arrange.

ELECTION OF OFFICERS.

The following-named officers were elected for the ensuing year:

President—Dudley Farrand, Newark, N. J.

First vice-president—Alex Dow, Detroit, Mich.

Second vice-president—W. C. L. Eglin, Philadelphia.

Secretary and treasurer—W. W. Freeman, Brooklyn, N. Y.

Executive committee—Gen. George H. Harries, Washington, D. C.; A. J. De Camp, Philadelphia, and Samuel Scovil, Cleveland.

Dudley Farrand of Newark, N. J., the new president of the National Electric Light Association, was promoted from the vice-presidency. He was formerly secretary, and in both positions has done valuable work for the association. He is general

FORT WAYNE ELECTRIC WORKS' EXHIBIT.

manager of the Public Service Corporation, a $25,000,000 company, which does electric lighting in 147 cities and towns in New Jersey, to say nothing of its electric railways and other interests. He has 27 generating stations and 30 sub-stations under his care. Mr. Farrand, who is a practical central-station man, is the youngest of a family of 11 children, and was born within four miles of Newark in a house that has been in his family since 1732. He is married and has one child. Mr. Farrand is one of the best-liked members of the association, and his election gives general satisfaction.

Convention Notes.

Pittsburg Transformer Company had a much-talked-of exhibit.

Curtis Advertising Company was, as usual, decidedly in evidence.

Hugo Reisinger of New York appeared in the person of C. A. DuBosch.

The two "Sunbeams," the Vanswell brothers, were in decided evidence.

To quote the senior Mr. Crouse's own words, "J. Robert Crouse's father" was at the convention.

Standard Paint Company of New York made its usual interesting exhibit of the company's products.

Of course George Manson of the Okonite Company, New York, was the first to come and the last to go.

The Oil and Waste Saving Machine Company of Philadelphia exhibited its turbine centrifugal oil filter.

Mr. Hicks of the Convention Daily distinguished himself as a star reporter on quick work.

No one was more warmly welcomed at Washington than John Dale of the John Dale Electric Company of New York.

Metropolitan Engineering Company, New York, manufacturer of electric signs, presented a number of very interesting types of electric signs.

WESTERN ELECTRIC COMPANY'S EXHIBIT.

Sales Manager Albert of the Standard Electrical Manufacturing Company of Niles, Ohio, was well in evidence every day during the convention.

There was no more popular or warmly welcomed man at the convention than Mr. E. W. Rockafellow of the Western Electric Company of New York.

Secretary and Treasurer C. L. Bundy of the Philadelphia Electrical and Manufacturing Company, Philadelphia, Pa., was present, assisted by R. H. Manwaring.

Manager Coale of the Sterling Electrical Manufacturing Company, Warren, Ohio, appeared Thursday morning and was seen constantly around the exhibition hall.

Of course Secretary Harry C. Adams of the R. B. Corey Company of New York made his appearance and received that usual welcome. Harry's laugh has made his fortune.

President James G. Biddle of the American Instrument Company of Philadelphia, accompanied by T. G. Seixas, New York manager, and D. S. De Cou did the convention honors.

"Hughes," the quick Philadelphia man of the Standard Underground Cable Company, played cards all during the convention—but each card was a Standard Underground Cable trump.

The Oneida galvanized chain for "lifting the light" was very cleverly advertised by a fob made of a piece of the chain and a tiny arc lamp. The Oneida booth was very cleverly and artistically designed.

The indefatigable "Kirkpatrick" of the McRoy Clay Works, Chicago, was prominently mentioned in the Convention Daily and the article was illustrated in a highly artistic manner. Ask "Kirk" about it.

Those who went to the convention by the Chicago special train were greatly pleased to find awaiting them on arrival in Washington Secretary W. C. L. Eglin of the association and Mr. H. W. Fuller of the local committee, with a very large double-deck electric auto. The great vehicle was appropriately placarded and the ride up Pennsylvania Avenue to the Raleigh and New Willard was made in great state. Always thoughtful, Mr. Eglin

NEW YORK BECK LAMP COMPANY'S EXHIBIT.

had arranged this cordial reception for his western friends.

The trip to Mount Vernon on Thursday was greatly enjoyed, as were all the entertainment features. A photograph, reproduced in this issue, was taken, especially interesting from the historical association.

President H. L. Parker of the Emerson Electric Manufacturing Company of St. Louis, accompanied by Mrs. Parker, found time to spend a few days of their eastern vacation trip at the convention in Washington.

C. C. Baird of the H. B. Camp Company made a hit by presenting special friends of his institution each with a fine watch. As Mr. Baird expressed it, "It was high time you got in line with Camp Conduit."

Southern Exchange Company of New York showed a number of interesting photographs relative to its products, and President and Manager E. G. Chamberlain, with Sales Manager Walter E. Mitchell, did the honors.

American Circular Loom Company issued a very clever bit of advertising in the shape of a poem entitled "Forget It." This request to forget it was so cleverly worded as to really incline one to remember Circular Loom conduit.

General Manager A. D. Blocker of the Electric City, Chicago, was everywhere in evidence. Mr. Blocker also looked after Manager Niesz's interests in the Chicago Electrical Show and brought home a number of good contracts for space.

President Williams took occasion at the conclusion of his annual address to pay a well-merited compliment to Mr. W. C. L. Eglin of Philadelphia, the secretary, and Miss Harriet Billings of New York, the assistant secretary of the association.

George B. Foster, accompanied by Mrs. Foster, came from Chicago on the convention special and did the honors for the following-named companies: Power Improvement Company, De Laval Steam Turbine Company, Wilkinson Mechanical Stoker.

John L. Gleason, assisted by Secretary Thomas F. Welch, was untiring in pushing Gleason's patent molding boxes and the Fancleve electric specialties. The box was shown in section and undoubtedly the exhibit was a paying investment.

The photograph of the interior of the convention hall, showing the delegates at work—a snapshot picture—is reproduced in the Western Electrician by the courtesy of the Convention Daily, issued by the C. W. Lee Company of Newark, N. J.

Assistant Manager T. G. Whaling of the Sawyer-Man New York office represented General Manager Carey, now abroad; Mr. Whaling has been with Mr. Carey several months and has done much to increase the already large demand for Westinghouse lamps.

Following were the gentlemen that looked after the interests of the Crocker-Wheeler Company of New York: W. C. Appleton, Rodman Gilder, publicity manager; R. J. Randolph, Jr., G. W. Johnston, manager of Birmingham office; Harold Lomas, manager of Baltimore office. The Crocker-Wheeler exhibit consisted of photographs, especially views of installations of alternating-current generators driven by gas and steam engines and waterwheels. Souvenir postals were given of the Washington

monument, the elevator of which, being the highest in the world, is driven by a Crocker-Wheeler motor.

The Jandus Electric Company, Cleveland, had one of the biggest booth displays in the show, and Jandus arc lamps certainly were in evidence.

General Manager John Speer of the Speer Carbon Company of St. Mary's, Pa., spent Wednesday in the rotunda of the New Willard. Mr. Speer was on an eastern business trip and merely dropped in to say "how do" to his host of old friends in the electric-lighting business.

The Holophane Company was represented at the convention by V. R. Lansingh, the well-known illuminating engineering and author. Mr. Lansingh has just returned from a six weeks' trip to the Pacific Coast, where he established a branch office with Mr. F. H. Poss in charge.

Secretary Willard S. Sisson was duly in evidence doing the honors for the D. & W. Fuse Company of Providence, R. I. Mr. Sisson had no exhibit, but D. & W. fuses were in evidence in the booths of the Pettinggell-Andrews Company and the Western Electric Company.

Fred Bissell of the F. Bissell Company, Toledo, Ohio, arrived on Friday. "Better late than never," said Mr. Bissell, and he was warmly welcomed. The Bissell Company is now doing a large business and the head of the institution finds it very difficult to leave Ohio's "center of distribution."

An elaborate luncheon was given by the executive committee of the association at the New Willard on Friday in honor of General George H. Harries, vice-president of the Washington Railway and Electric Company, who did so much for the success of the convention. About 40 gentlemen were present.

Eastern Manager Frank Donohoe of the American Electrical Works, New York, attended the convention, accompanied by Mrs. Donohoe. It will surprise no one to learn that again Mrs. Donohoe distinguished herself by her golfing conquest on the Washington links. Mr. Donohoe made a very efficient caddy.

National Carbon Company of Cleveland this time made no attempt at an exhibit. The following-named gentlemen, however, were constantly on hand doing the honors: Secretary J. S. Crider, Sales Manager N. C. Cotabish, Assistant Manager of Sales E. J. Kerlin, C. W. Wilkins, F. C. Park of Boston and A. E. Carrier.

Commercial Engineer W. T. Jackson was most indefatigable in looking after the diversified interests of Engineer and Contractor G. M. Gest of Cincinnati. Mr. Jackson presented handsome photographs of Mr. Gest's work in the United States, in a number of Mexican cities and in Canada. He also exhibited Mr. Gest's new cable rack.

United Brass Manufacturing Company of Cleveland, Ohio, through the energetic efforts of H. H. Trayte, made a special test at 300 pounds air pressure for the benefit of the convention people, illustrating the operations of the Corcoran

FEDERAL ELECTRIC COMPANY'S EXHIBIT.

wipe joint machine. This company demonstrated the strength of the joint for submarine work.

That the Sheldon School of Chicago was represented with a booth in the convention hall called forth considerable comment. J. D. Kenyon, vice-president of the company, attended the gathering and had a place on the programme. The Sheldon booth was in charge of Dr. Francis Raymond and was a popular place for seekers after "more light" on salesmanship and efficiency of employes generally. The fact that the Sheldon School, through its correspondence course of instruction in scientific salesmanship, is assisting many of the electrical companies in developing efficient sales management, with splendid results, has given the institution a standing of much importance in the electrical business.

Weston instruments were greatly in evidence. Special enterprise was shown by Charles P. Frey of the Weston Electrical Instrument Company of

AMERICAN INSTRUMENT COMPANY'S EXHIBIT.

Newark, who arrived in Washington a week before and had the four booths used by his company ready the Friday before convention. Dr. Weston was, of course, on hand and cordially welcomed.

President H. M. Hirschberg of the Excello Arc Lamp Company of New York is eloquent when he is describing the wonderful sale of Excello lamps in the United States during the last year. He now predicts that they will be as much in universal use in America in another year as they are in England, Australia, the Continent, Japan and China.

No one will be surprised to know that at the Washington convention "Flexduct" and the Sons of Jove, with Harry Kirkland in between them, were seen daily arm in arm. Mr. Kirkland has his hands full, so to speak, in two senses. Looking after the interest of "Flexduct" and acting as Jupiter of the Sons of Jove kept the grass from growing under his feet.

Western Manager Conover of the J. A. Roebling's Sons Company had pledged himself to take the convention special from Chicago to Washington, accompanied by Mrs. Conover. At the last moment, however, he was obliged to send regrets and take another route, owing to Mrs. Conover's enforced absence in the East. Mr. Conover was daily on hand "pulling" the usual Roebling "wires."

No more popular contingent appeared at the Washington convention than Messrs. Corrigan and Kirkland of the Flexduct Company. This team of brainy "good workers," together or alone, was continually surrounded by "progressive people." The Flexduct Company is doing a large business and the present success may be taken as the strongest evidence of the good team work of these two popular men.

Fibre Conduit Company, Orangeburg, N. Y. (20 miles from New York city), manufacturer of Orangeburg fiber conduit, was very capably represented at the convention by W. K. Sparrow, sales manager, Orangeburg; F. A. Curtis, Orangeburg, and Stephen G. Thompson, manager of the Boston office. The exhibit consisted of fiber conduit and fittings, such as bends, elbows, junction boxes, crosses, etc.

Wagner Electric Manufacturing Company of St. Louis exhibited variable-speed single-phase motors as applied to ventilating fans, and this same type motor in forms suitable for printing presses, pumps, etc. The Wagner company's new type B. A. standard single-phase motor was also shown, both types in operation. There was also presented a complete line of indicating instruments in both round and horizontal edgewise patterns for direct and alternating current. The Wagner company was represented by Mr. W. Robbins, assistant general manager, from St. Louis; Mr. Brooks Faxon, manager of Boston office; Mr. John Mustard, manager of Philadelphia office; Mr. E. W. Goldschmidt, manager of New York office; Mr. F. N. Jewett, manager of Chicago office.

President Gilchrist of the Federal Electric Company came down from Chicago on the electrical special, accompanied by Mrs. Gilchrist. The Federal company had a handsome booth in the exhibition hall, in which were tastefully displayed various types of Federal signs. The Federal company is now doing a large business not only in Chicago but in practically all of the prominent cities of the United States.

Electric Storage Battery Company of Philadelphia, headed by Third Vice-president Charles Blizard, made an exhibit of Chloride accumulators and presented the company's new type end-cell switch, automatic water-filling, compensating, recording and signaling hydrometers. Assisting Mr. Blizard were E. L. Reynolds, manager of Pennsylvania sales office; Albert Taylor, New York office, and A. H. Ackerman, engineer, New York office.

"All I got was sympathy," said Manager L. P. Sawyer of the Buckeye Electric Company, Cleveland, but Mr. Sawyer got more than sympathy, as a glance at the Buckeye sales sheet would reveal. The Buckeye Electric Company was clever enough, through Mr. Sawyer's foresight, to be in a position to take advantage of the recent famine in incandescent lamps. Mr. Sawyer has done good work for his company during the last six months.

The Simplex Electric Heating Company of Cambridge, Mass., exhibited two large ranges that were strictly up to date and ahead of anything. The line of electric heating products was a complete exhibition of "Simplex quality." James I. Ayer, president of the company and a former president of the National Electric Light Association, arrived Tuesday. He found his booth just being given the finishing touches by his corps of assistants—Roger Williams, Percy H. Howard and Clyde A. Flint.

One of the features of the electrical exhibition and a significant incident of the convention was the arrival of Charles Lewis Drain of Marshall Field & Co., Chicago. Mr. Drain, with the electrician of the big Marshall Field stores, came on the Chicago special to inspect the electrical exhibition at Washington. The object of his visit was to study lighting methods and illumination and gather data to decide upon the most efficient and the most artistic system of lighting for the great Marshall Field stores in Chicago.

American Electrical Heater Company of Detroit, Mich., made an interesting exhibit of the company's product. President B. H. Scranton and Secretary Robert Kuhn were in attendance. The display illustrated 187 different varieties in heating apparatus. One specialty that attracted much attention was the American "steel-clad" iron. The latest American improved chafing dish also won many compliments, as did the disk heaters. The American Electrical Heater Company has made a remarkable name for itself among the companies that have been long in the heating field.

Franklin Electric Manufacturing Company of Hartford, Conn., represented by Assistant Manager P. S. Klees, showed its wisdom in the selection

SIMPLEX ELECTRIC HEATING COMPANY'S EXHIBIT.

of a position in the exhibition hall, and as a consequence booth No. 2 was one of the most prominent at the Washington convention. Assisting Mr. Klees were the following gentlemen: C. Leonard, manager of Baltimore office; G. O. Curtis, manager of Buffalo office; C. N. Thorpe, manager of Chicago office; T. G. Truitt, representative, Pennsylvania. The company exhibited Franklin Gem, Franklin tantalum, Novi and Femco incandescent lamps with Holophane reflectors. In the back of the exhibit was a sign four feet in diameter with 704

miniature lamps in blue and white, an exact reproduction of the Novi label.

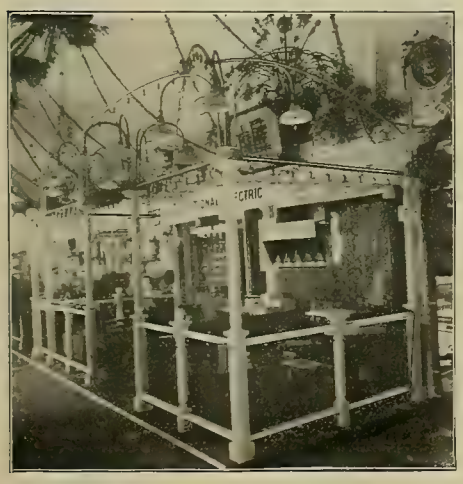
There was no more popular man at the convention than Press Representative John Craig Hammond of the New York Central system. Mr. Hammond now bears the burden of the advertising of one of the greatest railway systems in the world. His appointment to this position was a well-earned tribute to his ability along the line of original and brainy advertising.

The popularity of the luxuriously furnished double booth of the Dearborn Drug and Chemical Works was made conspicuous because of the many handsome ladies and distinguished gentlemen who stopped to rest and enjoy the show from a reserved seat in the grand stand. The ladies were given souvenir bottles of perfume. W. B. McVicker, vice-president and eastern manager of the company, did the honors for his company during the convention. Mr. McVicker was assisted by H. G. McConnaughy, manager of the New York office, and Frank Duemler, manager of the Philadelphia office.

Of course there were a large number of incandescent lamp men at the Washington convention. B. G. Tremaine and F. S. Terry of the National company arrived on Thursday. Western Manager Haughton and Eastern Manager Lockwood looked after the interests of the Bryan-Marsh Company of Chicago and New York. Manager Kulas of the Brilliant Company of Cleveland was in daily attendance. Manager Rice of the General Incandescent Lamp Company, Cleveland, was seen everywhere. Manager of Sales H. H. Geary came on from Fostoria on behalf of the Fostoria Incandescent Lamp Company.

Edward Schildhauer displayed a curious and interesting beetle with phosphorescent spots which glow with greenish light when the insect is disturbed. Two of the spots are on the head back of the eyes, and one on the abdomen of the beetle, which is from the Isthmus of Panama, where it feeds on sugar cane. The light is pleasing and strong enough to show that the insect is of remarkable efficiency compared with artificial means of producing light. Mr. Schildhauer, formerly of the Chicago Edison Company, is now connected with the Isthmian Canal Commission, and he procured his prized beetle while on a trip to Panama.

At the convention it was worth while to note the actual working exhibit of the Western Electric Company. This company furnished the four direct-connected generators that supplied the current for the entire illumination of the New Willard. Of the four machines, three have a capacity of 75 kilowatts each, and one has a capacity of 50 kilowatts. Delegates and visitors were asked by Advertising Manager H. M. Post of the Western company to visit the basement of the hotel and inspect the generators in operation. The engineer in charge said that there are no better machines in Washington. Mr. Post was indefatigable in his energetic and successful efforts for his company. He presented a fine map of the city of Washington.

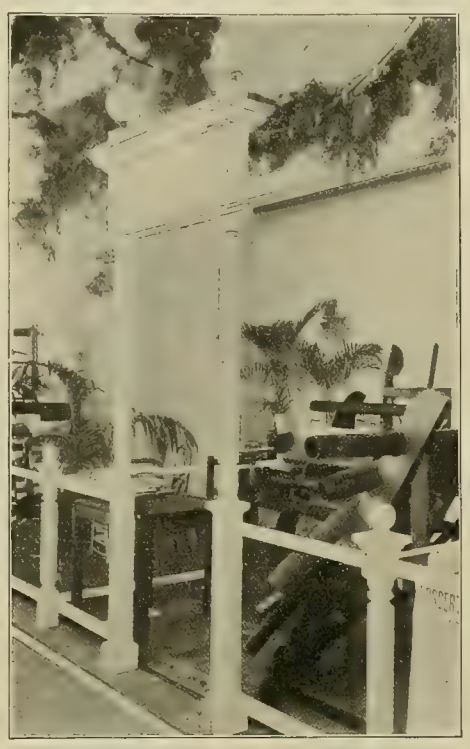


NATIONAL ELECTRIC LAMP ASSOCIATION.

The map bore the name of the Western Electric Company on the cover and was certainly one of the cleverest advertising souvenirs distributed.

President R. K. Mickey of the Novelty Incandescent Lamp Company of Emporium, Pa., arrived at Washington late Monday evening. Mr. Mickey reports a most gratifying increase of business during the last six months. The Novelty Incandescent Lamp Company is now operating two lamp factories—one on new lamps and one on refilled bulbs—the latter at St. Mary's, Pa., and the former at Emporium. Both of these plants were illustrated in the first convention issue of the Western Electrician, and, to say the least, stand greatly to the credit of President Mickey's enterprise in a most difficult branch of the electrical business. Mr. Mickey was accompanied at the convention by the company's indefatigable New York representative, G. A. Nisbet, and I. H. Warner, general sales agent.

Crouse-Hinds Company of Syracuse, N. Y., occupied space 14, center section, where it had an interesting exhibit in charge of A. F. Hills of Syracuse and F. M. Hawkins, New York representative. The most prominent exhibit was the large sample board containing 500 or 600 various types of condulets. The type F surface entrance condulet attracted particular attention. Representatives of the various electric-light companies who also operate street railways were much interested in the Imperial arc headlight on exhibit, and also in the new incandescent headlight which the Crouse-Hinds Company has just placed upon the market.



THE FIBRE CONDUIT COMPANY'S EXHIBIT.

Sales Manager C. R. Wood of the Moline (Ill.) Incandescent Lamp Company arrived from Philadelphia late Monday night. Mr. Wood has recently been appointed to the position of sales manager of this company, and the Washington convention was his first in that capacity. The Moline company made no exhibit in the exhibition hall, but Mr. Wood brought with him the company's new metallic filament lamp. This lamp as shown "cold" and also in operation created many favorable comments, as many had been skeptical up to the time of the exhibition of this lamp as to its appearance as promised by the company. Mr. Wood was duly in evidence during the convention period and made many friends for his company. He reports a most active business in the West, and with the new management as established recently by Mr. Wood in New York the company expects to do not a little business this year in the eastern market. Mr. Wood left for Jamestown on the boat Friday night.

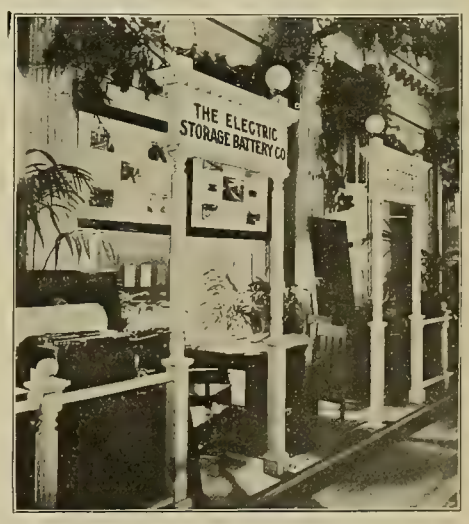
Fort Wayne Electric Works of Fort Wayne, Ind., as usual, was decidedly to the front. Doing the honors for the company at the convention were Sales Manager F. S. Hunting and Assistant Sales Manager A. A. Serva. These gentlemen were assisted by the following Fort Wayne men: J. C. Lott (manager), J. C. Moulton, New York office; T. L. Sturgeon (manager), E. H. Porter, C. A. Woolsey, C. W. Brown, J. B. H. Van Zandt, C A. Thomas, A. A. Morton, Philadelphia office; H. W. Smith (manager), S. O. Ochs, Boston office. A. Garfield Lucas from the home office at Fort Wayne was also in attendance. The company's exhibit consisted of transformers, meters, arc lamps, fan motors and small power motor application. In connection with the Fort Wayne exhibit was the Shelton Electric Company's exhibit of vibrators, which are manufactured by the Fort Wayne company. Mr. Shelton, accompanied by Mrs. Shelton, was also in attendance at the convention. They are en route to Europe.

The H. W. Johns-Manville Company, as usual, had a large and interesting exhibit, a notable feature of which was the "Victor" combination meter. A new "automobile" type of meter was exhibited, as well as a variety of the regular switchboard and portable meters and Noark subway and service boxes. The company distributed samples of its J-M friction tape. The following representatives of the company were present: J. W. Perry, manager electrical department; R. R. Draggins, manager electrical department, Cleveland; H. M. Frantz, manager electrical department, Chicago; H. M. Voorhis, manager electrical department, Philadelphia; S. G. Meek, New York; A. J. Saylor, Milwaukee; W. F. Little, electrical engineer, New York; G. U. G. Holman, manager electrical department, Boston; S. F. Quirke, New York; R. C. Buell, assistant secretary, Johns-Pratt Company; R. C. Cole, electrical engineer, Johns-Pratt Company; C. T. Bishop, salesman, government department, New York.

Dossert & Co., 242 West Forty-first Street, New York, manufacturers of the well-known solderless connectors and terminals for wires and cables, had a prominent place in the center of the exhibition hall in which they had installed an interesting and unique display of their devices. They have aroused more than ordinary interest, owing to the radical departure of the National Board of Fire Underwriters recently in amending the code to allow the use of an approved mechanical joint without solder. The Dossert exhibit included an imposing array of approved connectors, including two-way types "A" and "B," front and back terminal lugs, three and four-way, cable taps, motor lead connectors, service box plugs, etc. H. B. Logan, president of the company, was in charge, ably assisted by E. A. Dossert, sales manager. Dossert & Co. also announced that the Dossert joint has been specified and will be used in the wiring throughout of the magnificent new office building of the national House of Representatives. This is a notable achievement for the new solderless device which has just been approved by the National Board of Fire Underwriters.

Allis-Chalmers Company of Milwaukee, under the management of Assistant President W. S. Heger, made a most interesting exhibit of the Allis-Chalmers products and publications. Photographs were mounted in swinging racks and gave those interested a most satisfactory idea of just what the Allis-Chalmers Company has been doing in the field as one of the great electrical units. No exhibit of the apparatus was offered at Washington for the reason that the Allis-Chalmers Company has now running at Jamestown a very comprehensive exhibit of all its products, electrical and non-electrical. The following gentlemen represented the company at Washington: Maurice Thomas, manager of Atlanta (Ga.) office; J. C. M. Lucas, manager of Baltimore office; Representative Nicholson, Philadelphia office; H. W. Rowley and A. P. Peck, New York; E. T. Pardee, manager of Boston office; J. R. Jeffrey, superintendent, Cincinnati works; R. B. Nathanson and B. Frankenfield, Cincinnati; W. S. Heger, assistant to the president; St. John Chilton, Milwaukee; A. H. Whiteside, manager of electrical department; James Gardner, manager of Chicago office.

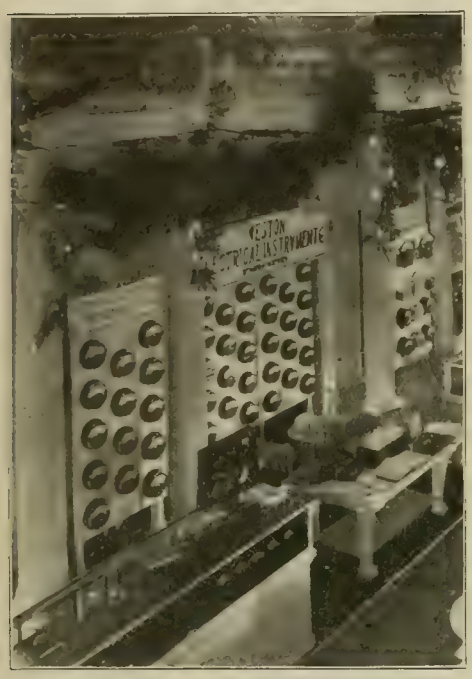
General Electric Company's exhibit as elaborated by Advertising Manager F. H. Gale was up to date and occupied four adjoining booths. The chief feature of the company's display was the General Electric tungsten lamp for standard lighting service. A large number of the General Electric staff were in attendance and the above specialty was pushed to a degree that will undoubtedly redown to the credit of tungsten as a filament. A specially prepared bulletin was distributed at the General Electric booth, going into the merits of tungsten in a most thorough and scientific manner. This bulletin should be in the files of every central-station man. Following are the names of the usual General Electric "army": J. R. Lovejoy, vice-president and sales manager; C. D. Haskins, manager of lighting department; Dr. C. P. Steinmetz, E. E. Gilbert, W. L. R. Emmett, P. D. Wagoner, F. G. Vaughn, H. W. Hillman, F. H. Gale, Schenectady; C. B.



ELECTRIC STORAGE BATTERY COMPANY'S EXHIBIT.

Burleigh, Boston; Florence Baran, A. D. Bobson, New York; H. P. Buddy, G. L. Thompson, Philadelphia; A. F. Giles, Atlanta; I. Scribner, S. F. Dibble, W. H. Coleman, Chicago; E. J. Hanley, Columbus, Ohio; J. P. Judge, Baltimore, Md.

The exhibit of the National Electric Lamp Association, by its engineering department, occupied a space across the aisle from the entrance to the ballroom. This exhibit, located on the corner, was extremely well placed to show the high efficiency of incandescent lamps and units of the new types. In Atlantic City the first tantalum lamps were ex-



WESTON ELECTRICAL INSTRUMENT COMPANY'S EXHIBIT.

hibited to the public. Only a year has passed and so great has been the improvement that these lamps are now offered for alternating-current circuits. Two types of tantalum lamps were shown: (1) The 40-watt lamp of approximately 20 candlepower, operating at an average efficiency of two watts per candle, with various styles of frosted bulbs and with different types of Holophane reflectors. (2) The 80-watt lamp of approximately 40 candles is similarly connected. This was shown to the public for the first time. The new tungsten lamp was exhibited in four general different types. Some 30 lamps were thus exhibited. So brilliant was this exhibit that when these lights were turned out the whole exhibition hall was in comparative darkness. The 28-volt tungsten lamps in a similar size bulb (3¼ inches in diameter, pear-shaped) were exhibited. These lamps are designed to operate four in series on circuits of 112 volts. Tungsten lamps were also shown in the 100-watt 80-candlepower multiple 100-125-volt type. These lamps contain five filaments in series and operate at 1.25 watts per candle. These lamps are in rather larger bulbs (3¾ inches in diameter, pear-shaped) than the series-burning tungsten. Other exhibits included 250-watt metallized-filament lamps, 80-watt tantalum lamps, miniature tungsten and tantalum lamps, tungsten lamps operating on small dry-cell batteries and tungsten and old-type carbon lamps connected up with a wattmeter and a voltmeter to show the relative economies of the two lamps. Tungsten and Gem metallized lamps of 40 and 50-watt, respectively, connected in multiple circuits in series with a rheostat were shown. By operating this rheostat it is possible to observe the effect of the change of voltage on these two types of lamps. This was done to show that the resistance of all the later types of lamps increases with increase of temperature, whereas the resistance of the old-type carbon-filament lamp decreases with the increase of temperature, and vice versa. Tables were covered with bulletins issued by the engineering department of the National Electric Lamp Association. The attendant in charge took particular care to say that the National Electric Lamp Association is in no way connected with the Licensed Association. The members of the National individually are members of the Licensed also, but the former is distinct and separate and is maintained as is explained in bulletin No. 1, purely to enable a number of smaller manufacturers to reap the benefits to be derived from the large engineering department in competent hands.

The Westinghouse Companies' exhibit occupied spaces 11, 12, 30 and 31. The companies represented were the Westinghouse Machine Company, Westinghouse Electric and Manufacturing Company, Westinghouse Lamp Company and the Nernst Lamp Company. The direct-current, metallic-electrode, series arc lamps were shown to the public for the first time. Eight of the lamps were burning in series, each taking 50 volts and four amperes. This arc lamp requires one-half the electrical energy consumed by the ordinary carbon lamp and is particularly adapted to such lighting since the rays of light are emitted from the flame in a horizontal direction and the color values are the best possible for this purpose. A mercury rectifier and a regulated transformer of Westinghouse make were used in the operation of the lamps, and the system seemed to excite a great deal of interest among the delegates. The Westinghouse Lamp Company had burning in the exhibit a large number of its high-efficiency metallized-filament lamps ranging in candlepower from 20 to 50, all burning at a voltage of 110. The Westinghouse Electric and Manufacturing Company displayed a very complete line of instruments both for switchboard mountings and portable use, including its graphic recording ammeters, voltmeters and wattmeters, the new type CC carbon-break circuit-breaker, small-capacity type F circuit-breaker for motor services, and fan motors for alternating current and direct current. A handsome book describing them was given to interested persons. Many types of enclosed carbon arc lamps of Westinghouse manufacture were shown, including a new lamp for 250 volts direct-current multiple which is strictly fireproof and will not burn out under the most severe conditions of short-circuit. The Nernst Lamp Company showed the development of a new single-glower unit to provide a lamp to fill the gap that has heretofore existed between the one and two-glower units. This lamp takes 110 watts, emitting 115 candlepower in a downward direction and is equipped with a four-inch clear ball. In the Nernst Lamp Company's section of the Westinghouse booth were shown two three-glower ceiling fixtures of art glass, and also one three-glower ceiling fixture with nine-inch Holophane hemisphere, and various other single, three and six-glower lamps. The Westinghouse Machine Company had on exhibition various sizes of plates, showing the form and construction of those used on its improved storage batteries. The plates of the types shown are used in street-railway power plants for load regulation, lighting plants, railway train lighting, railway signaling, etc. Following is a list of the representatives of the Westinghouse Electric and Manufacturing Company present: W. M. McFarland, acting vice-president; G. M. Bates, J. W. Busch, Philip Clegg, A. M. Dudley, C. S. Gibbs, C. B. Humphrey, A. R. Laxton, S. L. Nicholson, E. T. Penrose, J. W. Schrantz, C. P. Billings, J. A. Brett, H. P. Davis, W. R. Dunbar, G. B. Griffin, R. B. Ingraham, George F. Leak, J. C. McQuiston, J. M. Nicholson, W. R. Pinckard, H. C. Stier, J. C. Warren, E. M. Bischoff, Samuel Chase, Mr De Lancey, W. B. Everest, G. W. Hill, W. D. Jend, Irwin Lehman, F. D. Newberry, W. S. Rugg, H. Van Stagen.

Exhibitors to Organize.

At a meeting of the associate members of the National Electric Light Association held in the parlors of the Westinghouse Companies on Thursday of last week the preliminary plans were laid for the formation of a manufacturers' organization for exhibition purposes at future conventions. A hearty vote of thanks was extended to the National Electric Light Association for the earnest efforts of the officers and various committees.

In an informal talk W. M. McFarland of Pittsburg opened the meeting. Mr. McFarland felt that the time was opportune for the manufacturers to perfect an organization for exhibition purposes at future conventions. F. H. Gale was chosen chairman of the meeting, and stated that he believed the time was ripe to effect an organization along the lines of the Street Railway Manufacturers' Association, with a permanent secretary and exhibition manager, the organization to work in harmony with the National Electric Light Association and to be able to take from the association's shoulders a vast amount of detail work.

James I. Ayer, who has been associated with convention work for a great many years, took up briefly the history of previous association exhibitions. He said that in former years the manufacturers had secured rooms at association headquarters and made small exhibits in their rooms. Later on the association arranged for these exhibits, and last year an exhibition committee was duly appointed to take charge of the exhibits in order to divorce the finances of the exhibition from the regular association. So far the exhibitions have been profitable, and he felt that the executive committee would gladly welcome a plan whereby exhibition details would be taken out of its hands, and that it would be desirable to have the management separate from the regular association but co-operating with it at all times. He felt that the proposed organization should be made permanent with a paid official in charge, but that the association should have partial control of the general plan.

The expression of the meeting was that the exhibitors needed more room and that the plans should be more definitely worked out by an effective organization.

Upon motion the chair was instructed to select a committee of seven on permanent organization, this committee to have authority to draw up plans. The expression of those present was practically unanimous for the perfecting of a manufacturers' organization, and the committee was instructed to meet with the officers of the National Electric Light Association and secure their ideas and co-operation in the work. This committee is composed of the following members: F. H. Gale, chairman; J. C. McQuiston, W. B. Heger, Charles P. Fry, Rodman Gilder, H. M. Post, C. W. Lee.

The following were present at the meeting: James I. Ayer, Simplex Heating Company; E. T. Pardee, J. R. Jeffrey, W. P. Heger, Allis-Chalmers Company; J. M. Mills, Oneida Community, Limited; Francis H. Ely, representing Harold P. Brown; Benjamin Wall, Metropolitan Engineering Company; H. M. Post, Western Electric Company; Rodman Gilder, Crocker-Wheeler Company; W. M. McFarland, Westinghouse Electric and Manufacturing Company; J. C. McQuiston, Westinghouse Companies; Henry Goodwin, Pope Motor Car Company; A. A. Serva, Fort Wayne Electric Works; Charles P. Fry, Weston Electrical Instrument Company; F. H. Gale, General Electric Company; Glenn Marston, M. O. Publishing Bureau; Max Harris, Nernst Lamp Company; H. B. Logan, president, Dossert & Co.; T. H. Whaling, Westinghouse Lamp Company; F. C. Sutter, Pittsburg Transformer Company; James V. Olsen.

Protection From Lightning.

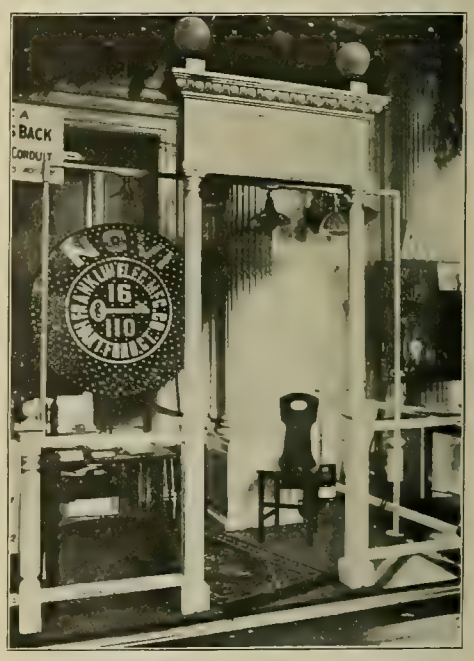
A valuable report of the results of a thorough investigation into the subject of protection from lightning was made at the Washington convention of the National Electric Light Association by the committee composed of Alex Dow (chairman), O. A. Honnald and Robert S. Stewart. The report is based on statements from members of the association, in reply to questions concerning the apparatus that had been damaged by lightning during 1906. Some valuable statistics are given in the report.

Following are the conclusions reached by the committee:

A certain percentage of loss due to lightning cannot be prevented. This unavoidable percentage, however, for the average company, is small.

The apparatus of the present day, except meters, is insulated so well that it will withstand very high potentials for short periods. The difference between the old transformers and the modern oil-insulated transformers is especially marked in this respect.

Lightning arresters are necessary on all circuits, and should be installed on distribution circuits wherever there is apparatus to be protected; be-



FRANKLIN ELECTRIC MFG. COMPANY'S EXHIBIT.

cause violent discharges prefer to jump large air-gaps rather than to travel 600 or 700 feet to the nearest arrester. The best practice calls for arresters at each transformer, and at ends of branch lines.

The multi-gap arrester still remains the standard arrester for alternating currents, but is now built with part of the gaps shunted by permanent resistance, or, in some cases, by a fuse wire.

The overhead ground wire, when tested thoroughly, has been proved to reduce losses due to lightning.

Choke coils have a definite value, but are not to be recommended for promiscuous use. Where experience or calculation indicates their use they should be installed. Used in the wrong place, they may do harm.

In the matter of recent theory of lightning protection, we would refer members to the Proceedings of the American Institute of Electrical Engineers, in which, since June, 1906, have been published a number of valuable papers bearing thereon.

Specifications for Street Lighting.[1]

In the year 1894 a committee of experts, appointed by the association to consider the rating of arc lamps, reported at the seventeenth convention, then in session at Washington, a preamble and resolution which was adopted as follows:

"Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy, the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligations of the producer of electricity for illuminating purposes to the consumer thereof, be it

"Resolved, That in the opinion of this convention what is ordinarily known as a 2,000-candlepower arc lamp is one requiring on the average 450 watts for its maintenance, the measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc. In case such resistance is used, it must be excluded in the measurement of the voltage."

The rating of arc lamps on the basis of energy consumed, as set forth in the resolution, was then and would now be satisfactory as an equitable means of determining either a proper rate of charge or illuminating value for street arc lighting furnished by a company to a municipality, under the same conditions, but at the time of the adoption of this resolution there was in use in the United States no type of arc lamp other than the open arc, which, although of many makes and designs, gave approximately the same illuminating power for a given amount of energy. Wherever the rating adopted by the committee in 1894 has been employed in connection with open-arc lamps of the general type then in use, little or no difficulty has been experienced in the adjustment of differences arising from interpretations of contracts.

During the very year in which this rating was adopted, however, the commercial introduction of enclosed arc lamps began, and within the last 10 or 12 years the gradual displacement of open-arc by enclosed-arc lamps has taken place. The manufacture of open-arc lamps has practically ceased as a result of their inability to compete with the enclosed type, and manufacturers have devoted themselves almost exclusively to the latter until quite recently. During the last four or five years there have been placed upon the market a number of distinct new types of lamps, which have been known by the general designation of "flaming carbon" or "luminous arc" lamps, some of which originated from American ideas, while others were imported.

The characteristics of the various lamps mentioned, taken either individually or grouped in classes, are so widely at variance in performance in the ratio between light produced and energy expended that the difficulties experienced by operating companies are greater now than they were in 1894, and the preamble then adopted is equally applicable today by reason of the introduction of these new devices. In addition to the new types of arc lamps, there have also been placed on the market and are now offered for sale certain kinds of mercury-vapor or vacuum-tube lamps, which can be used for street lighting, as well as a considerable number of new incandescent lamps constructed of some form of metallized filament. Quite a number of the latter are already in use, with every prospect of their general introduction within a reasonable time. Any attempt to compare the illuminating value of these latest forms of lamps, which are or may be used for street lighting, on the basis of energy consumed, is not only futile, but would be ruinous to the contracting company, for while the so-called high-efficiency lamps operate on a lesser expenditure of energy, they also give a larger volume of light. No reason can be given why a contractor should be penalized for giving more light than contracted for, after having made considerable investment for that purpose, simply because the number of watts consumed is less, notwithstanding that other items of expense and renewals may be considerably increased.

Your committee, after a most careful consideration of the difficulties to be met and for the purpose of establishing a definite basis, assumed: That, inasmuch as the lighting of streets by contract is a matter of illumination produced rather than of apparatus employed, the terms used in specifications should be in terms of illumination and not of energy consumed; that the individual lamp of each class should be the unit of number charged for; and that the average illuminating power of each unit should be comparable with and have a value equal to a known standard at proper relative distance. The following report is submitted as the best provisional solution of the problem of street-lamp specification that the unsatisfactory existing state of the science and art of outdoor photometry permits.

The committee considers that street-lighting lamps should not be rated in candlepower under contract specifications; because unless qualified as to the space distribution of the candlepower, such rating may be entirely misleading. The lamp may, by suitable reflectors, be made to possess a large candlepower in some particular direction or zone, and yet be very ineffective as a practical street illuminant. Consequently, the committee considers that the rating of street lamps in contract specifications should be in terms of the mean normal illumination cast at a considerable distance from the lamp, along the street which it illumines, i. e., the mean illumination thrown by the lamp upon a plane surface at a considerable distance from the lamp and supported perpendicularly to the rays.

The following specifications are drawn to cover the ordinary conditions of street lighting, and are recommended to replace previous specifications, such as those appearing in the Report of the Committee on Rating of Arc Lamps of the National Electric Light Association at the meeting of 1894, a copy of which is reported above:

(1) Under ordinary conditions of street arc lighting, with lamps spaced 200 to 600 feet apart, specifications for street lamps should define the mean illumination thrown by the individual lamp, in position in the street, as measured at the height of the observer's eye and perpendicular to the rays, at some point not less than 200 nor more than 300 feet distant, along a level street, from a position immediately below the lamp, with all extraneous light screened off and with no reflection from surrounding objects not forming part of the lamp equipment.[1]

(2) When using smaller units of light, such as series incandescent lamps spaced shorter distances apart, a correspondingly shorter distance from the lamp should be chosen in measuring the illumination.

(3) The lamp contracted for should give a mean normal illumination at the test point (selected as in Sections 1 and 2) not less than the illumination given by the stationary standard incandescent lamp of 16 candlepower at $\frac{1}{x}$ of the distance. The said standard incandescent lamp should be a standardized seasoned lamp, having a determined candlepower in a fixed direction.

(4) When the lamp tested fluctuates in intensity, a number of observations of the maximum normal illumination should be made at a distance of not less than 200 feet horizontally from beneath the lamp, and the average of these measurements should be taken as the average maximum illumination. A similar number of observations of the minimum normal illumination should be made, the average of which should be taken as the average minimum illumination. The arithmetical mean of the said average maximum and minimum illuminations should be taken as the mean normal illumination called for in Section 1[2].

(5) A reasonable number of lamps covered by the contract should be tested.

(6) For measuring the mean normal illumination of a lamp, comparison with the standard incandescent lamp may be made either with a suitable portable photometer or with a reading distance instrument, such as the so-called luminometer.

(7) The unobstructed mean normal illumination must not be less at shorter distances than at the point of test.

(8) An approximate list of the mean normal illuminations thrown by street lamps of standard manufacture, at horizontal distances within the 200-300-foot range, hung approximately 20 feet above the level of the observer's eye, is given in the following table: [Data from which table is to be prepared are not yet completed. Table will be furnished later.]

Your committee during the consideration of this subject invited to its meetings and sought the advice and assistance of a number of the most prominent illuminating engineers and arc-lamp experts, and in that connection hereby expresses its appreciation for services rendered by Dr. Clayton H. Sharp, Caryl D. Haskins, Frank Conrad, Carl Hering, Louis B. Marks and L. D. Howard Gilmour, and especially by W. D'A. Ryan for the quantity of data furnished to the committee for its use and the large mount of labor performed in the collection of additional data required in the preparation of the schedules.

Discussion.

C. P. Steinmetz, Schenectady: For nearly twenty years the electric-lighting industry has been almost in a dreamless sleep. Incandescent lamp and the carbon arc lamp held undisputed sway, and while a gradual slow advance was made no radical advance occurred except perhaps the replacement of the open arc by the enclosed arc, and of the direct current by the alternating current, and both, as regards efficiency, probably were rather negative; that is, efficiency was sacrificed to convenience and reliability and steadiness.

In the last few years we have experienced an enormously rapid advance. In the incandescent-lamp field we saw appear the Nernst lamp, the tantalum, the tungsten lamp, and gradually the efficiency of the incandescent lamp rose far beyond that of the arc lamp of old. In the field of arc lighting improvements have also taken place. In Europe the flaming carbon lamp was developed by impregnating the carbons with some chemicals; the amount of light for a given amount of power was increased manyfold, so that efficiencies unheard of before were realized. The only unfortunate feature in connection therewith was that the lamp necessarily was an open or short-burning arc lamp, which at that time had already disappeared practically from the American market. When the flaming carbon lamp made its first appearance, at least on paper, in this country, it appeared to me that there would be practically no hope in spite of its efficiency to reintroduce the open arc lamp here under American conditions. It appeared to me that the first condition required here would be a long-burning steady arc. That resulted in the investigation of other carriers of the arc flame, and a few days after the first news of the flaming carbon arc reached us here, we tried the first experience of magnetite and titanium arcs, and this led to the developments of the magnetite arc lamp as a luminous high-efficiency arc with long life.

Now, that, however, made necessary a readjustment of all our ideas, and especially of all our contracts, because these much higher efficiencies of illumination always mean a higher cost to the station in power. Four hundred and fifty watts spent by the station in a number of tungsten lamps of smaller candlepower, or a number of magnetite arc lamps, necessarily costs more than expending the same power in a single carbon arc lamp. So that, if we desire to give the public the benefit of these improvements in efficiencies, we must rearrange our contracts and sell light and not power, otherwise we discriminate against the high-efficiency illuminant. That was the purpose of the revised contract formed for street illuminants, as your committee has drafted it. Probably improvement will be made in future years, with increasing experience, but we had the experience of all the experts we could think of and did the best we could under the rather difficult conditions.

Now, when we deal with the sources of light there are really three questions of importance. The first is efficiency, the second is the size of unit, and the third is color. What we desire is the highest possible efficiency. The various lamps stand in groups by themselves. For efficiencies of a fraction of a watt per candlepower, we have the flaming carbon lamp, the magnetite lamp and the mercury lamp. The next lamp stands by itself, with an efficiency of a little less than one watt per candlepower, and that is the tungsten filament. Then, with a gradually decreasing scale of efficiency, we meet in succession the old carbon arc lamp, the tantalum lamp, the Gem filament lamp, the Moore tube, the Nernst lamp, and the old incandescent lamp.

High efficiency is not the only thing; we may get in a flaming carbon lamp an efficiency of a quarter of a watt per candlepower, but we get that only with a candlepower of thousands, which would not be available for many uses, where we need 16 candlepower or 50 candlepower. The size of the unit is of importance also. Arc lights are inherently at their best efficiency in units of many hundreds or thousands of candlepower. The incandescents are smaller units of light, and there is one curious feature; this higher efficiency incandescent lamp, of larger size, the tungsten lamp, as it appears to us, is a 70-candlepower lamp, while the old carbon filament was a 16-candlepower lamp. If we look into it, we will see that the power consumed per lamp has remained about the same. The 16-candlepower 50-watt incandescent lamp, like the metallized-filament lamp, still uses 50 watts, but gives 30 candlepower. The tantalum, with 50 watts, gives from 25 to 40 candlepower, with some 50 candlepower from the tungsten. What has been done has been the increase of light given for the same power. This seems to be the efficiency maximum of these illuminants.

The last point is the color, and here we find white in the magnetite and nearly white in the tungsten filament, a yellowish white in the tantalum, and a still more yellowish white in the Nernst lamp and the metallized-filament lamp, and ultimately in the old incandescent lamp and the flaming carbon. Then you get the reddish white of the carbon arc and Moore tube, and the bluish

1. Report of a committee composed of Dudley Farrand (chairman), A. E. Kennelly, Charles P. Steinmetz, Louis A. Ferguson and Paul Spencer appointed to consider specifications for street lighting, read at the convention of the National Electric Light Association, Washington, D. C., June 5, 1907.

1. The reason for leaving the horizontal distance flexible along the street within the range between 200 and 300 feet, is that a definitely specified distance such as 250 feet might be unsuitable for the purpose of the measurement. Within the horizontal distance in excess of 200 feet, the distance correction for the height of the lamp above the observer's eye is ordinarily unimportant.

2. (a) When a reading distance instrument is used for measuring the mean normal illumination at specified horizontal range, the average of a number of maximum distances at which a certain size of print can be distinguished may be called the average maximum distance, and the average of a similar number of minimum distances the average minimum distance. From these, the mean distance at which an illumination is cast normally, sufficient for distinguishing that size of print, can be determined. This mean distance must lie within the 200-300 feet horizontal range specified in Section 1. In most cases the arithmetical mean of the average maximum and average minimum distances may be taken as the said mean distance with an accuracy sufficient for practical purposes. The illumination needed for distinguishing the size of print may be determined for each particular observer from measurements of the reading distance with the standard incandescent lamp referred to in Section 3.

(b) When a portable photometer is used at a fixed horizontal distance, such as 250 feet, the mean normal illumination of a fluctuating lamp may be obtained by taking the average of not less than 50 observations at intervals of not less than one-half minute.

green of the mercury lamp. No one has yet produced a high-efficiency blue illuminant.

V. R. Lansingh, New York: It seems to me that we should take into account not only the redistribution of vertical light but also the horizontal. It is no doubt possible to build reflectors or globes which would throw practically double the amount of light up and down the street as would be given without such globes or reflectors, and therefore in specifying street lighting, if the lamps were not equipped with such globes or reflectors, we might need twice the amount of light that we would if they were so equipped. It seems to me, therefore, in specifying proper units for street lighting that we should take into account not only the redistribution of the vertical light but also the horizontal, and I think that is something which we are coming to, although little or no work has been done along these lines up to this time.

W. D'A. Ryan, Lynn, Mass.: I had the pleasure of being present at various meetings of the committee on standardization, and have endeavored to assist in drawing up a schedule of values to cover the specifications as outlined. I have gone over practically ten years' work in measurements of illumination and candlepower. For the last two months I have been working hard with a corps of men endeavoring to establish these standards in a way which will not get us into more difficulty than we are in at the present time in the methods of rating lamps. A number of peculiar features have developed. In the first place, we may take the candlepower surges and attempt to estimate the illumination at a distance of, say, 250 feet for the different illuminants. We obtain certain candle-foot values. We next test with luminometer at the distant point, or with the candle-foot photometer and obtain different values. That is to say, if you figure the illumination at a distant point from the candlepower you obtain one result, and if you reverse it you obtain another, due to the fact that when measuring on the photometer bar the eye is more sensitive to the light in the yellow rays. When working with faint illumination, such as one-thousandths or two-thousandths of a foot-candle, the sensitiveness of the eye shifts and the results are entirely dissimilar.

It is a well-known fact that the alternating enclosed arc for a given wattage is not as efficient as the direct-current arc for an equivalent wattage. It is also quite thoroughly established that, notwithstanding the difference in candlepower, the lighting distance is not so dissimilar, due no doubt to this very feature I have mentioned, the change of the sensitiveness of the eye. Relatively, there is more green in the alternating arc than in the direct-current arc, which would also assist in the same direction.

Other difficulties encountered are the natural changes which take place, the natural increase and decrease, due to the peculiarities of feeding the particular type of lamp tested. The open arc, we know, will travel up to something like 55 volts and feed down to 42 or 43 volts, if it is working well. If it is not in perfect condition, the variation is greater. So in establishing a figure to represent the average lighting of the lamp, you must take into consideration this time-element factor. I find 33⅓ per cent. should be deducted from the laboratory conditions to meet the conditions in the street for the open arc and 10 to 15 per cent. for the enclosed arc.

We also have the change in illumination due to deposits on the globe, and the different densities of the globe, and, taking all these variable conditions into consideration, you can appreciate it is a difficult thing to establish suitable illumination values. I can say that the results are most encouraging, and if we keep at the work there is no doubt we can establish something which will be sufficiently stable to standardize.

Paul Spencer, Philadelphia: The ideas that I have on this subject are embodied in the report, but it may be worth while to call attention to one or two points in connection with the report. The committee worked very faithfully. Every means of rating a lamp, and every means of measuring it after a rating had been determined, were carefully considered and the conclusions which were reached were practically the following: First, that the rating should be in terms of illumination; that is, of illumination actually received. That that illumination should be measured at the most useful point or at the point most needed, namely, at a distance approximately midway between lamps as suspended in street lighting. Again, that the measurements should be made in the street and not in the laboratory and that the means of making the measurements should be as simple as possible, so that a determination as to contract obligations could be made without the necessity of calling in experts, or with means that would be within the reach of the smaller companies. Therefore, the committee drew up this specification providing the measurement or determination at a distance between 200 and 300 feet, providing for outdoor measurement, either by means of the luminometer or by means of the photometer, and in order to provide for a determination on the street, that could be readily ascertained, referring the illumination as determined by the photometer to a standard 16-candlepower lamp. Based on that method of getting at it, a specification has been drawn up, and it seems to me to embody these ideas, in so far as possible to give a means of determining illumination with the means at present at hand.

F. W. Willcox, Harrison, N. J.: The latest development of the tungsten lamp gives an efficiency which, while not as high as the flaming or magnetite arc, in the form of an illuminating efficiency, is probably as good, because you can distribute the lamps more frequently and thereby secure a more satisfactory illumination for the same watts expended. The lamps will be supplied a little higher in candlepower than the old carbon lamps, and it is possible to give the increased candlepower values at about the same rates, if you have to, that were formerly given on the carbon lamp, and still provide a satisfactory profit on the transaction. The efficiency is something like three times as great, and you get 50 per cent. more candlepower —40 candlepower instead of 25, and still have, by means of the increased capacity of your apparatus, the benefit of additional returns to offset the increased cost of renewals. I think with that form of lighting there will be a great future for the incandescent tungsten lamp in street lighting.

Dr. E. P. Hyde, Washington, D. C.: There was one point that occurred to me as I listened to the reading of the report, which no doubt has been fully considered by your committee, but I would suggest it at least. I notice, according to the report, the illumination is to be measured at a distance of 200 or 300 feet from the source of a plane normal to the direction of the ray, but at the height of the observer's eye. This light really falls on the street between 50 and 100 feet further on. Moreover, it falls at an angle which is very small, so that the illumination which it produces in the street would be quite small. The question which is suggested here, is what do we really want in illuminating the streets? Do we want an illumination of the face of the pedestrians or an illumination of the surface of the street? If it is the latter we want, it seems to me in some ways this is not exactly what we are driving at.

Dr. A. E. Kennelly, Cambridge, Mass. (chairman of the meeting): In considering the specifications which are designed to take the place of the definition made in this city in 1894, it should not be forgotten that at the time when these early specifications were drafted these specifications of 1894 seemed to be admirably adapted to their purpose, and that fact is borne out in the circumstance that for 13 years the specifications have not been modified or overhauled.

Alex Dow, Detroit, gave an interesting account of the circumstances attending the adoption of the 450-watt definition in 1894, and concluded: The definition omitted the matter of angle of measurement, quality of carbons, etc., and exposed itself to criticism from the point of view of the nascent illuminating engineer. Nevertheless, it served its purpose and is entitled to credit. It has served its purpose for many years effectively, and if the new definition of specification which is proposed, and which I hope will be adopted, shall last as long it will do very well.

Dr. Edward Weston, Newark, N. J.: I have not been in the lighting field for so many years that I am somewhat rusty on the subject. I can remember what gave rise to the adoption of the former standard, but with that you are all familiar. Changed conditions undoubtedly necessitate the revision of the rules which were formerly in existence, but what your committee has recommended I really do not know and cannot say very much on the subject consequently. If I find I can say anything I shall be glad to communicate it to the members in writing in the proceedings.

A. J. De Camp, Philadelphia: While these papers and this discussion have shown, in my judgment, a wonderful progress in this thing, I do not think we have got into definite shape up to the present time, and therefore I make a motion that the report on specifications on street lighting be received and filed and the committee continued, to report at the next annual meeting, at which time I think they will be able to present in printed form a specification which this association will be in a position to adopt or reject.

L. A. Ferguson, Chicago: If I got the trend of the motion just made, it was that the report of the committee go over until the next annual meeting. The committee has worked hard on the report during the last six months; it has been unable in the time to complete it; but I can say for myself, and I think for the other members of the committee, that we are all very much interested in the subject and trying to do the best we can. I think it would be better, instead of letting this thing go over until the next annual meeting, to empower a committee to complete its report and, with the approval of the executive committee of the association, have the report sent to the members during the year.

There is a crying need all over the country for something definite in regard to contracts for street lighting. The larger companies can take care of these things because they are in a position to employ consulting and illuminating engineers to assist them, but there are many of the smaller companies not in that position. The object is to draw up something that could be used by the smaller companies, and I think it would be too bad to waste all the work that has been done in the last six months by letting the report go over until the next year. I offer the amendment that the committee be allowed to go forward with its report during the coming year and with the approval of the executive committee issue the report as a finality.

Mr. De Camp accepted the amendment.

Philip Torchio, New York: I think the title of the report for street lighting is a little misleading and will answer fully the objection of Mr. De Camp. The specifications, as far as I understand, are not specifications for street lighting but suggested specifications for street illuminations. It is intended to supplement the original 2,000-candlepower definition, and the committee has spent a lot of labor in determining what should be the proper way of determining the unit of illumination for street lighting, and I think that the title should be changed to "Specifications for street illumination," and I do not think there would be any objection to the report. The report does not cover the system of street lighting at all; it only determines the methods of illumination in the street. This organization should go on record to supplement the old-fashioned definition of a 2,000-candlepower arc lamp.

J. F. Gilchrist, Chicago: I most heartily endorse the sentiment which Mr. Ferguson expressed, that this matter should be determined as promptly as possible, and with his permission I will add a further amendment—that when it goes out it be written in words of one syllable. The average council committee consists of a saloonkeeper, a lawyer, a plumber and a couple of practical politicians. When this committee meets the representative of the central-station company the latter rarely has the ability or force to put the matter before the committee in the way it has been put before us this morning.

It would be desirable if in sending any information in regard to the price of electric light the members of this associaton could give definite information as to what is covered, and possibly something about the conditions which surround the contract, especially those who are selling light at what seems to some of us ridiculously low rates; it would be of the greatest assistance in convincing the municipalities that what we are offering to them is fair.

Mr. Engel: For some years all of my city contracts have been without reference to candlepower and without reference to wattage. They provide that we will use a certain manufacturer's lamp and get a guarantee from the manufacturer that it will produce a certain amount of efficiency in light which is standard to that company.

Preston S. Millar, New York: It seems to me there are some strong objections to the method of procedure outlined by the committee. Summing the thing up, it seems to me that the committee first condemns unidirectional rating and then recommends precisely that, changing the name of the unit a bit. It then recommends useful illumination and avoids it in its rating, and it then deplores the unsatisfactory state of photometry and describes conditions under which photometry cannot be carried out with very great precision. I recognize that academic considerations must give place in large measure to questions of practicability, but it seems to me we have not struck a true balance in these specifications. I think it would be a great mistake to rush this thing through hastily.

Dr. Steinmetz: I do not believe if the committee should work for another year it could do any better. The report does not claim to be a standard specification of street lighting. The conclusion of the committee was that while years ago it was possible to draft a standard specification for street lighting applicable everywhere, since we had only one street illuminant, perhaps two or even three different sizes of it, now we have such an enormous number of different illuminants that between the 40-candlepower series tungsten lamp and the flaming arc of thousands of candlepower it is impossible to draft a standard specification covering them all and merely requiring the signature of the parties interested.

The second conclusion the committee reached was that such a specification cannot be a specification of power consumed, but should be a specification of the light or illumination given, and then the committee concluded it should not be broadly or indiscriminately the light or candlepower in whichever direction it may be thrown, downward or hemispherically, but we want to specify, not broadly the candlepower, but to specify the candlepower in that direction in which it is desirable and necessary—that is, in the direction slightly below the horizontal beam. That was the misconception into which the last speaker fell in thinking the report contradicted itself.

The report states that we should not specify candlepower in general, but candlepower in the direction in which the light is mostly needed. The report further says: Instead of specifying current as candlepower it should be made as intelligible to the layman as possible. The specification should, in effect, read: "We offer you a street lamp which at 250 feet distance will give you just as good illumination as a 16-candlepower incandescent lamp, as we buy it from the National Bureau of Standards at 30 feet distance." The same

company may at half price offer a street lamp which at 125 feet distance gives an illumination that a 16-candlepower incandescent lamp gives at 30 feet distance. Another company may offer a street lamp which at 250 feet distance gives the same amount of light as a 16-candlepower incandescent lamp at 25 feet distance.

There is no possibility at the present time or in the future that we will be able to lay out a standard contract which only requires the signatures of the parties in interest. That time is over. We have an infinite variety of illuminants growing in number from day to day and we have to face the condition that we cannot draft a standard contract covering all cases, but can only lay out a form as to how the contract should be drafted and give such technichal data to the members of the association that they can draft a contract to suit their particular conditions.

H. Le Vaque Wills, Savannah, Ga.: I think we are facing a condition which is entirely dependent upon results. When people make a contract with the people for lighting they want results. If you put an illuminant in a certain place you will get a certain result, providing the reflecting substances which come within the range of your eye are such that they will give you the effect that you need. Now, the effect you need is an effect that will appeal to the eye and is reflected from the object upon which the illumination falls. If you have a street covered by black loam, very dark, and the color quality of your light does not fit those conditions, then you have an effect which will only lead to trouble. On the other hand, if you have a paved street with an illuminant which is adapted to the conditions you will be able to go ahead with your lighting and carry out your contract without much difficulty.

Dudley Farrand, Newark, N. J., chairman of the committee: There seems to be considerable misapprehension on the part of a number of gentlemen in discussing this matter. As a certain prominent gentleman who resided in Washington for some years said, it is a condition and not a theory which confronts us. If there is any fault to find with the title of the committee—"committee to consider specifications for street lighting"—you must blame the officers who bestowed that title upon the committee. The question of "specifications" for street lighting, in the engineering sense, was not taken up by the committee, as we did not consider that to be our province. That is a matter for the local authorities and the local company to decide. What we try to do is, when you agree to furnish certain illumination, to adopt a standard whereby it can be determined whether that illumination has been furnished in the case of any dispute. The matter of taking the measurement at the height of the observer's eye was simply a matter of convenience.

Chairman Kennelly put Mr. De Camp's motion, as amended by Mr. Ferguson, to vote, and the report was unanimously adopted.

Samuel Scovil, Cleveland: I want to offer a resolution in relation to the arc-lamp situation. It seems to me that the convention should put itself on record in one direction in regard to the development of the arc-lamp situation, and the meaning that I wish to convey is pretty well covered in the following resolution which I offer:

Resolved, That the energy test of 450 watts at the lamp terminal as adopted by this association in 1894 is a proper test for the old open type of arc lamp and the standard carbon type of enclosed arc lamps, but it is not a proper test for the flaming or luminous arcs or for the mercury vapor or vacuum tube lamps.

The motion was seconded by Mr. Farrand and adopted.

New Patent Bill for England.

Investments of American capital in factories in England may result from the passage of a bill framed by D. Lloyd-George, president of the British Board of Trade, and recently reported to the House of Commons.

Hitherto England, unlike France and other continental nations, has granted patents without requiring that the things patented should be made in the United Kingdom. For example, Americans are said to control all the best machinery in the shoe trade and manufacture none of the machines in England. In the future when England grants patents on such machinery the manufacturers will be compelled to do the manufacturing in that country.

An illustration of the way modern patent laws work is afforded by the case, says a cable dispatch, of the Oliver Manufacturing Company of Chicago, the senior partner in which, W. H. Oliver, has just completed arrangements to build a factory in France to turn out motor jacks. France granted a patent on these jacks on condition that they be made in France. Mr. Oliver has stated, it is said, that all his goods sent to England are made in America.

The London Times states that the Turkish government desires bids on telegraph material for the Haifa-Cadem-Medina line, 930 miles, and for 20 telegraph stations, and for the Medain-Salih-Medina line, 250 miles. The Minister of Commerce and Public Works, Constantinople, Turkey, can give particulars.

Radio-activity Discussed at the Cornell Branch.

The closing meeting for the current year of the Cornell branch of the American Institute of Electrical Engineers was held on the evening of June 4th. In accordance with the new constitution a delegate was elected to attend the annual convention of the Institute. The paper of the evening was delivered by Prof. Ernest Merritt upon the topic "Radio-activity." The address with the discussion proved of great interest and gave the members a view of the latest varieties of electric conduction and other advances which have followed from the discovery of the properties of radium and other radio-active metals. The speaker pointed out that while, in a commercial sense, radio-activity has not "made good" scientifically, it has proved of the utmost importance. This is particularly true as regards the indirect results, especially upon the theories of the construction of matter. A most interesting suggestion was that radium may result from the disorganization of uranium and that the metal itself may simply represent one stage in a series of such disorganizations.

Extensive Canadian Power Projects.

The West Kootenay Power Company has the distinction of being the largest concern but one of its kind in Canada. Its head offices are at Rossland, British Columbia. The company has three power houses, two of which are at Bonnington Falls and the third at Cascade Falls on the Kettle River.

Power house No. 1 is situated at the Lower Bonnington Falls and has a capacity of 4,000 horsepower. No. 2 is at the Upper Bonnington Falls and develops hydraulically 32,000 horsepower. Plant No. 3 has a capacity of 4,000 horsepower. The current is transmitted from No. 1 plant to Rossland and Trail at 20,000 volts; from No. 2 to Rossland, Grand Forks, Phœnix and Greenwood at 60,000 volts, and from No. 3 to Phœnix and Greenwood at 20,000 volts. These systems are all alternating-current, three-phase, 60-cycle.

The motor capacity of the three plants is 18,000 horsepower, all of which is being used by the mines and smelters in the vicinity of the plants. The 60,000-volt transmission line is 82 miles long, while the total length of single-pole lines is approximately 300 miles.

There is room for plenty of development work at all the plants and experts estimate that Upper Bonnington Falls is capable of development to the extent of 72,000 horsepower if necessary. As the country progresses more power will be developed from time to time at each of the company's plants.

BOOK TABLE.

Handbook of Mathematics. By J. Claudel. (Translated from the seventh French edition, and edited by Otis Allen Kenyon.) New York: McGraw Publishing Company. 1906. Pp. (6 by 9¼ inches), ix., 708, with 422 diagrams. Price, $3.50.

This is a condensed practical treatise on several of the most important branches of mathematics. It is a combined textbook and manual, being of value both to the student and to the engineer. Many tables not usually seen in such works appear in this book, such as a list of prime numbers, wage tables, a table of the expectancy of life, interest tables, etc. The treatment throughout is clear and concise; many new and short methods are given; and the arrangement of matter is calculated to make the book a valuable one.

These six branches of mathematics are represented—arithmetic, algebra, geometry, trigonometry, analytic geometry, elements of calculus.

Arithmetic is subdivided under these headings: Rules and Divisions, Fundamental Operations on Whole Numbers, Properties of Whole Divisors, Fractions and Decimals, Powers and Roots, Ratios, Proportions and Progressions, Diverse Rules, Logarithms.

Algebra is treated under Definitions and Principles, Fundamental Algebraic Operations, Equations of the First Degree, Powers and Roots of Algebraic Quantities, Equations of the Second Degree, Quadratics.

Geometry is divided into the following-named parts: Definitions, Plane Geometry, Solid Geometry, Problems in Geometry.

Plane Trigonometry and Spherical Trigonometry are both covered.

Under Analytic Geometry general methods are taken up first, then applied to specific examples. The circle, ellipse, hyberbola, parabola, lemniscate, cissoid, strophoid and limaçon are successively discussed, with appropriate diagrams.

The elements of calculus are taken up both for differential calculus and integral calculus, with some "Applications of Integral Calculus."

Altogether it is a valuable book for reference and study.

Great Western Power Company's Project.

The Great Western Power Company has about 1,000 men employed in Plumas County, Cal., on an extension of the Big Bend Tunnel, to supply power to its new 60,000-horsepower hydro-electric plant, and other work in connection with a project that may mean the ultimate development of 300,000 horsepower. Several additional plants will be installed at other points to obtain this aggregate.

Edwin Hawley of New York is said to be the head of the concern. Among the Californians who are interested are William G. Henshaw, Guy C. Earl, Edwin T. Earl and Henry E. Huntington.

The company is capitalized at $18,000,000, of which $7,000,000 is being spent in the Big Bend installation, including the construction of an artificial reservoir covering 20,000 acres at the headwaters of the Feather River. It is estimated that it will take 18 months to complete the initial installation. The transmission line to San Francisco will be about 185 miles long.

Mr. Henshaw in a recent interview is credited with saying: "The company intends to have a power station in East Oakland. This station will be for the purpose of supplying power to the bay cities. It will not be an auxiliary station, but will be an integral part of the whole scheme. The company may find it more advisable to use a plant for the supply of power locally than to transmit the electric current the entire distance from the Big Bend."

Asked if the Western Pacific Railway Company is interested in the power project, Mr. Henshaw said: "The Southern Pacific has figured that with electric motive power it could run 25 per cent. more freight over the mountains than it can by steam, and the Western Pacific may decide to use electricity on its mountain lines. We are not associated with the railroad, but of course we will sell power to the Western Pacific if it wants to buy."

It is learned that arrangements have been made so that the Great Western Power Company may erect its pole line on the Western Pacific right-of-way for the greater part of the distance from the Big Bend power plant to San Francisco. Although the Western Pacific line will be operated by steam locomotives at first, it is known that the management is favorable to the use of electricity, and would not hesitate to install electric power as soon as it may be advisable.

Unverified newspaper reports say that it is the Great Western Power Company's intention to run the transmission line across San Francisco Bay, a distance of six miles, by a submarine conduit, in order to avoid a detour of 100 miles in reaching San Francisco from Oakland. While there is no precedent for conducting a voltage of 100,000 volts under water, some engineers think that means might be devised to use a submarine conduit of special design after stepping down the voltage to, say, 20,000 volts.

The company has been taking contracts to supply electric power in the territory for about 100 miles north of San Francisco. The Henry Cowell Cement Company's new plant at Cordelia will be operated from this source. It is said that the Oakland steam plant will supply the power during construction of the waterpower plant.

Public Utilities Bill Signed.

The New York public utilities bill, reference to which was made in a recent issue of the Western Electrician, is now a law. As before stated, it puts under direct control every public-service corporation in the state of New York with the exception of the telephone and the telegraph.

Under the new law four of the most important state commissions will pass out of existence. The state gas and electric-light commissions, the railroad commission, and the rapid transit board of New York city will be replaced by two commissions of five members each, the one to have jurisdiction over Greater New York and the other over all the rest of the state.

The jurisdiction of the commission in the first district extends to any common carrier operating or doing business within the limits of the city, to the manufacture and sale of gas and electricity, and in addition the commission shall exercise all the powers conferred upon the rapid transit commission since the passage of the act in 1891 creating that body.

The salaries of each of the commissioners are fixed at $15,000 per annum, with the privilege of employing counsel at $10,000 and a secretary at $6,000 per annum.

The thirty-sixth commencement at the University of Illinois, Urbana, Ill., began on Sunday, June 9th, when Bishop Samuel Fallows delivered the baccalaureate address. On June 10th, Class day, the class of 1907 presented to the university a marble bust of Longfellow. The commencement address was delivered on June 12th by Hon. James Bryce, ambassador from Great Britain to the United States.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XX.—Auxiliary Apparatus.

Rheostats.

Rheostats, or resistance boxes, as they are sometimes called, comprise groups of resistances conveniently arranged for being varied, and the whole enclosed in a suitable case. Rheostats are always used in series with generator field windings so as to vary the resistance of the winding, and consequently the strength of the field between certain limits for the purpose of regulating the generator.

Another class of rheostats is used extensively for inserting in the main circuit of direct-current motors for the purpose of choking down the current on starting the motor or preventing a sudden rush of current through the armature, which would burn it out. Rheostats used in this service are frequently called starting boxes. In some cases it is necessary to use resistance continuously in the armature circuit for the purpose of speed regulation, and in this case the rheostat must be built with a large carrying capacity and have very ample radiating surface in order to prevent its attaining a dangerously high temperature.

In some kinds of experimental work where a large amount of energy is to be dissipated, water rheostats are used, which consist of casks filled with water in which two metal plates of large area are immersed. By varying the distance between the plates immersed a greater or less resistance is obtained. The addition of salt or a small amount of sulphuric acid will have the effect of greatly increasing the conductivity of the water. The use of such a rheostat is only advisable for temporary or experimental work; but such a device made with a cask of ordinary size is capable of absorbing from eight to 10 horsepower.

Another kind of rheostat often used in experimental work consists of a bank of incandescent lamps arranged so that they can be connected either in series or parallel as desired. The style of rheostat used for field resistance, or for starting boxes, consists usually of a high-resistance wire mounted in a suitable frame and so disposed that any part of the resistance may be thrown in or out of the circuit by the movement of a handle.

A very convenient style of rheostat is known as the enameled type, in which the resistance wire after being properly disposed and connected at its various terminals is entirely embedded in a hard enamel which very effectively protects it from any short-circuit or from mechanical injury. This style of rheostat, however, has the disadvantage that in case of any injury it is impossible to make any repairs without tearing the whole instrument down. It will usually be found to be more satisfactory to use an open type of rheostat, which is practically indestructible, except the resistance wire itself, and which can easily be repaired in case of damage. These conditions are met by rheostats in which the resistance is wound on spools or bars of enameled iron, or in which it consists of grids of suitable alloys. These unit sections of resistances are assembled so as to form a complete rheostat, and in case of damage to any of the units the same can be readily replaced without disturbing the balance of the units.

The two principal parts of the rheostat consist of the resistance, already described, and the face plate, by means of which the resistance is varied. The usual connections of the resistance are shown in the accompanying illustration, from which it will be seen that the connection between each unit resistance is brought out to a contact on the face plate. These contacts are arranged either in a complete circle or in the arc of a circle, so that the handle, pivoted at the center, makes a sliding contact with these connections, cutting in or out as much of the resistance as may be required for regulation.

Face plates, as just described, are suitable for wire-wound rheostats, but where grids are used such fine divisions of the resistance are not required, and in this case the face plate would be replaced by switches of large carrying capacity. The number of contacts on a face plate depends upon the closeness of the regulation desired, and for field rheostats from 20 to 60 or more steps are commonly used. For starting boxes it is evident that no such fine gradations are necessary, and the number of steps provided for this service is usually in the neighborhood of eight or 10, which permits the armature current of a motor to be increased gradually until it attains its normal speed.

In using a starting box the first step to which the handle is thrown puts all of the resistance in series with the armature, and each successive step cuts out part of the resistance, until, in its full-speed position, the resistance is cut out entirely. It should always be remembered that starting resistances are designed for momentary use only, and if the handle is allowed to stand on any of the intermediate steps for more than a few moments the rheostat will probably be overheated sufficiently to destroy some of the resistance wire. Field rheostats, on the other hand, are designed for continuous operation, and the resistance wires of which they are composed have sufficient capacity to carry their rated current continuously without dangerous overheating.

In case of very large rheostats, which are sometimes more conveniently operated from one central point of control, the contact arm is geared to a small electric motor. By this method any number of rheostats can be operated from one point of control. This method is only resorted to, however, where heavy currents are involved. In general, field rheostats are mounted upon the rear of central-station switchboards, and an operating handwheel is mounted on the shaft of the rheostat, which is carried through to the front of the switchboard, so that only the handwheel is visible from the front of the board.

Lightning Arresters.

Lightning arresters are devices designed to deflect lightning or atmospheric discharges from electrical circuits to the ground before they have an opportunity of passing through the generators, motors or other electrical devices. The characteristics of a lightning discharge are its small quantity of current or ampere capacity and its enormous high voltage. This very high voltage causes the lightning discharge to perform in a very erratic way, readily piercing all kinds of insulating materials and finding its way to earth by the shortest path. If lightning strikes a generator circuit it may travel as far as the generator, but it will not readily pass through the coils of the generator winding, but will rather pierce the insulation, arc over to the frame, thence to the ground. The very small current of the lightning discharge does no appreciable damage of itself, but having pierced the insulation and established an arc, this arc will be followed by the generator current, and if the generator current is not at once cut off the arc thus established may burn up the machine.

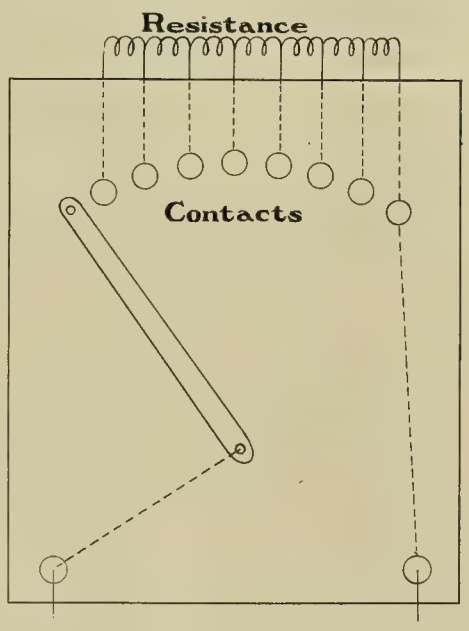


DIAGRAM OF RESISTANCE CONNECTIONS.

The real function of a lightning arrester is therefore not only to offer an easy path for the discharge to reach the earth, but also to prevent the dynamo current from following the path to the earth established by the lightning discharge. The fact that lightning will readily arc over a small air-gap or pierce insulating materials to get to the ground rather than follow the convolutions of a coil is the principle taken advantage of in the construction of numerous types of lightning arresters.

Owing to the erratic action of lightning it is found necessary to install lightning protective devices at numerous points along overhead out-door circuits and in central stations, each separate circuit entering the station building being also usually provided with station lightning arresters. Experience has shown that it is wise to install five or six lightning arresters per mile on low-tension overhead circuits in addition to the station arresters where these circuits enter the building.

The most effective lightning arrester is one having the lowest equivalent spark-gap. The equivalent spark-gap is such an air-gap, which, if placed in multiple with the lightning arrester, just fails to take the discharge. In many forms of lightning arresters a small air-gap is provided which offers too much resistance for the generator current to jump across, but which lightning will readily jump over on account of its high potential.

There are a number of different ways in which the generator current is prevented from following the arc established by the lightning. Sometimes a magnetic blow-out is used to extinguish the arc, this blow-out being operated by the current which flows through the lightning arrester. As soon as the current blows out the arc the circuit is open, leaving the lightning arrester ready for another discharge. In another form of lightning arrester one side of the air-gap consists of a movable plunger operated by a solenoid, and when the discharge takes place across the air-gap the current which follows energizes the solenoid and lifts the movable plunger, opening the air-gap sufficiently to break the arc.

In still another form of lightning arrester the lightning discharge is spread over a carborundum block along a number of minute paths. The voltage across each gap is therefore very small and the generator voltage cannot maintain an arc across them.

Another interesting type of lightning arrester is based upon the fact that certain alloys known as non-arcing metals will readily permit a discharge to arc across them when slightly separated. These non-arcing metals, however, will not maintain a continuous arc between them. Lightning arresters of this type are built of a number of cylinders of non-arcing metal, slightly separate from each other, across which the lightning discharges to the ground; but owing to the nature of the metal it will not maintain a continuous arc, due to the generator current.

It is often desirable to place a choke coil between the lightning arrester and the apparatus to be protected. The choke coil consists of a few turns of wire and is inserted in the circuit near where the lightning arrester is connected. This introduces self-induction in the circuit, so that the lightning has a tendency to pass off by way of the lightning arrester rather than to follow the circuit through to the generator.

As the object of all lightning arresters is to divert the charge to the ground, it is evident that a very thorough and effective ground connection should be established. The ground wires leading from the lightning arrester to the ground should be of ample size and of good conductivity and should be run as directly to the ground as possible without bends or coils. In order to establish a good ground connection it is necessary to reach damp ground. The best method of making this connection is to dig a hole in the ground of ample size and continue it down until permanently damp earth is reached. A ground plate of copper is then buried in this damp earth and the connection from the lightning arrester securely soldered to the ground plate. Unless a thoroughly good ground connection is established, the lightning arrester will be practically useless.

Lightning arresters are sometimes made with fuses, which are inserted in the ground connection, so that when the generator current follows the lightning discharge the fuse is burned and opens the circuit. This has the disadvantage that after the lightning arrester operates once it is not effective again until a new fuse has been inserted. All lightning arresters should be mounted in incombustible cases or compartments and should preferably be without moving parts.

[*To be continued.*]

The Cardiff Light and Water Company of Glenwood Springs, Colo., has been incorporated with a capital stock of $25,000.

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

The Gyroscopic Principle.

Old Subscriber, Cotton Plant, Ark.: What is the principle of the gyroscope, and how is it applied to the Brennan monorail cars?

ANSWER.

A gyroscope is a rotating wheel mounted in a ring or rings. It was devised by Prof. W. R. Johnson in 1832, and was called by him the rotascope. Its use is to illustrate the dynamics of rotating bodies, the composition of rotations, etc. Further information concerning its various applications may be obtained by consulting an encyclopedia.

In the Western Electrician of May 18th last appeared a short description of the Brennan monorailway, which consists of cars having only one line of wheels and the center of gravity considerably above the rail on which the car runs, equilibrium being maintained by gyroscopes driven electrically at high speed. The principle of the gyroscope may be better explained by aid of the accompanying illustrations. Fig. 1 represents a revolving gyroscope wheel. If it is intended to give the axis a rotational movement by applying a couple in a direction such as is indicated by B, B′, a couple at right angles to this direction will be set up as indicated by C, C′, or D, D′, governed by the direction in which the wheel rotates.

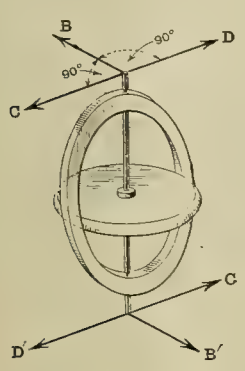
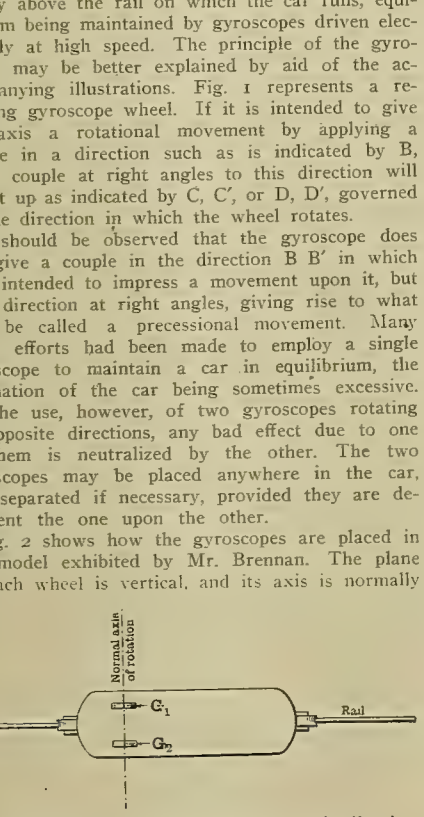


FIG. 1. DIAGRAM ILLUSTRATING GYROSCOPIC ACTION.

It should be observed that the gyroscope does not give a couple in the direction B B′ in which it is intended to impress a movement upon it, but in a direction at right angles, giving rise to what may be called a precessional movement. Many futile efforts had been made to employ a single gyroscope to maintain a car in equilibrium, the inclination of the car being sometimes excessive. By the use, however, of two gyroscopes rotating in opposite directions, any bad effect due to one of them is neutralized by the other. The two gyroscopes may be placed anywhere in the car, and separated if necessary, provided they are dependent the one upon the other.

Fig. 2 shows how the gyroscopes are placed in the model exhibited by Mr. Brennan. The plane of each wheel is vertical, and its axis is normally at right angles to the track upon which the car runs. The arrangement used is shown by Fig. 3. The two gyroscopes, G_1, G_2, have the frames carrying them pivoted on trunnions, the upper ones of which are shown at T_1, T_2. The spindles of the gyroscope wheels are perpendicular to these frames. W represents one of the gyroscope wheels surrounded by its circular frame. The two gyroscopes are together carried by a third trunnioned frame, partly indicated at FF, so that the whole arrangement is free to turn on the horizontal axis XY. If either gyroscope is turned about the vertical axis through T_1 or T_2, it will exert a couple about a horizontal axis. When the car tends to turn over, the frame F, which carries the whole mechanism, remains horizontal, but in doing so changes its position with respect to the car body. The frame can be arranged to open a valve or close a circuit, so that the gyroscope frames G_1, G_2, are acted upon mechanically. For instance, a motor might be started up in this way to rotate the gyroscopes G_1, G_2, about the vertical axes through T_1, T_2, and this rotation at once creates a couple about a horizontal axis, tending to restore the car to its normal position. The gyroscopes G_1, G_2, are connected together by toothed sectors, so that if one turns the other must turn also, but in the opposite direction, as is required, owing to the rotation of the wheels being in opposite directions. In Mr. Brennan's model the turning of these sectors is accomplished by friction.



G_1 G_2 represent two gyroscopes rotating in opposite directions.

FIG. 2. DIAGRAMMATIC PLAN OF MONORAIL CAR.

If the gyroscopes turn so far as to be at right angles to the track they become useless. It is, therefore, necessary to make such provision that the gyroscopes will return to their normal position parallel to the track after the required couple has been exerted. The method of accomplishing this, however, is kept a secret by the inventor. The accompanying illustrations are taken from the Electrician, London.

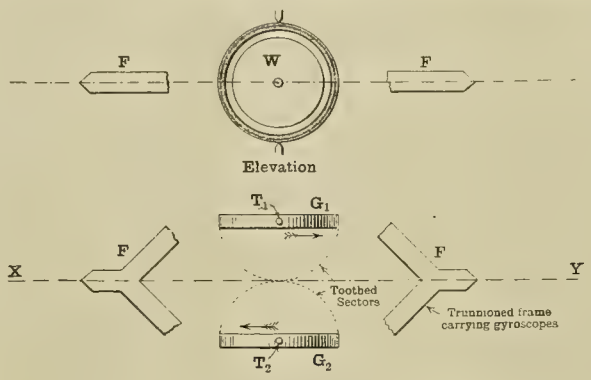


FIG. 3. PLAN AND ELEVATION OF THE GYROSCOPIC ARRANGEMENT.

Points for the New-business Department.

Some good points in the organization and conduct of a new-business department for central stations in cities of 50,000 population and under are brought out in a paper by Mr. Clare N. Stannard, secretary of the Denver Gas and Electric Company of Denver, Colo. The paper was entered in the Co-operative Electrical Development Association's prize contest. Following are a few extracts from the paper:

The first step in establishing a new-business department should be a careful selection of a manager. Assuming the city to have a population as stated in the title, I would divide it into 10 territories containing an average of 5,000 people, or 1,250 families. It would then be advisable to subdivide each territory into two districts—one a residence and the other a business. Thus the representatives would have an opportunity of working both classes of trade.

I do not favor paying representatives on a commission basis for appliances sold, nor a straight salary basis, but favor the plan of basing compensation upon a combination basis, viz., a certain fixed salary plus a commission, said commission based upon the revenue secured and the value of said revenue.

The engineering department can render great assistance to the commercial department by the engineer or those working with him giving material aid on all large installations of light and power. The salesroom should be planned to show all electrical devices and appliances with the proper display of the various kinds of reflectors and glassware designed to properly reflect the light. The effect of decorative lighting should be incorporated; a full supply of staple and fancy electric fixtures should be shown, also different forms of display, window and sign lighting. Electric domestic and industrial appliances should form a permanent part of the office display.

A new-business-plans committee should be formed consisting of the active officers of the company, including the general manager, secretary-treasurer, superintendent, chief engineer, commercial manager, heads of departments and one or two representatives. This committee should meet at regular stated intervals for the purpose of discussing all new-business matters. Suggestions for improvement or work of the department should be taken up and discussed.

Daily morning meetings should be presided over by the new-business manager, at which time orders should be given and discussed, reports received from the representatives, giving a record of the previous day's work, preliminary reports presented showing the nature of the proposed day's work, and matters of mutual interest discussed.

Weekly educational meetings should be held. An organization should be formed having permanent officers, and meetings should be conducted along the lines of parliamentary law. Educational matters should be taken up and discussed. Papers of interest should be presented and discussed. A stenographer should be present at both of these meetings, taking minutes of same, afterward typewriting them so that they may be placed on file for future reference.

The giving of practical demonstrations are of great value and should not be underestimated. They might be classified as office, home and church.

Big Swiss Electric Enterprise

The hydro-electric enterprise of the Lake of Brusio, in the canton of the Grisons, Switzerland, the machines of which were first set in motion on March 10th, is without doubt the most important upon the Continent. The water of the River Poschiavo is caught at the base of Lake Poschiavo, which is used as a controller or regulator for the reservoir and conducted by a three-mile conduit into the reservoir 1,378 feet above the central station. From this reservoir the water is brought into the hydraulic station by means of five conduits fastened in the rocks to a wall nearly vertical.

The station now contains six groups of dynamos with, respectively, a force of 3,000 horsepower each. During this year there will be added four new groups, and in 1908 the two last, which will complete the installation and thereby enable the station to produce an energy of 36,000 horsepower. A portion of this will serve to the needs of the valley of Poschiavo and for the future electric railway of the Bernina. The contractors will reserve for themselves 16,000 kilowatts, and this power will be distributed in the industrial region south of the lakes of Como and Majeur by the means of a cable 100 miles in length. The undertaking is the property of a Swiss company, and its installations are due entirely to Swiss industry.

Electric Table Fountain.

An electric fountain is now being put on the market by the New York Electric Fountain Company, 114 West Thirty-ninth Street, New York city, designed to be used on a dining or banquet table as an attractive decoration. It does not require any water connection and is driven by electric current of no more power than a 16-candlepower lamp requires.

The accompanying illustration represents one type of fountain composed of a small electric motor and a centrifugal pump, the latter being placed in the interior of a basin and direct connected to the motor shaft. The pump gets the water directly from the basin and conveys it through the pipes and a multiplicity of small nozzles, thus producing cascades. The water, falling upon the dome, returns to the basin and thence again to the pump.

Once filled it is not necessary to refill until the water diminishes by evaporation. In the basin may be placed with the water scented or colored water or any disinfectant. The fountain being not more than 22 inches high and about 12 inches at the base, may be placed in any private living room. It may also be used for hygienic cooling and moistening of the air in a room.

To produce the play of the fountain it is only necessary to attach the wire to any circuit and turn on the switch. The dome is illuminated by an incandescent lamp and revolves by means of a jet of water driven against flanges on the under side of the rim of the dome. Alternating or direct-current motors are furnished with the outfit.

ELECTRIC TABLE FOUNTAIN.

The Forest Power Company of Silver City, N. M., has been incorporated with a capital stock of $750,000.

The Manufacture of Ice in Connection with Electric Light, Heat and Power Plants.[1]

By Rufus E. Lee.

Early attempts at the manufacture of artificial or mechanically made ice date back to an earlier period than most people are aware, but it is only in recent years that the art has been fully developed through practical improvement, so that today ice factories and mechanical refrigerating plants are being installed in practically every town south of the Mason and Dixon line which lays claim to a population of 5,000 or over. While this in a measure is due to the fact that natural ice cannot be harvested in the South or brought from the northern states, owing to the prohibitive freight rates, it is also true that the great improvements in the apparatus used in the manufacture of ice have been the chief factor which has made it possible for mechanically made ice to compete successfully with the natural ice, not only in the South, which has a natural advantage over the northern states, due to the added cost of transportation of ice, but also in the North; so that today we see artificial-ice factories being installed as far north as St. Paul and Minneapolis.

There are practically only two systems used today in the manufacture of artificial ice, viz., ammonia-compression system and ammonia-absorption system, and of the two, the former is more generally used. As we are using the ammonia-compression system in our factory, our remarks will be based on our experience with it.

To operate an artificial-ice factory successfully there must be a market for the ice as well as the ability to manufacture at a price that will show good returns, but as ice is now no longer considered a luxury but a necessity, the question of a market may be quickly passed over, for any town which can support an electric-light, heat and power plant will afford a market for a reasonable sized ice factory. Therefore, the question of "cost to produce" is equally as vital to the successful operating of an ice factory as is the question of a market.

But to answer the question, "What does it cost to manufacture a ton of ice for a given output or capacity?" requires no little investigation, and the manager who is always on the lookout for opportunities to reduce his costs to the lowest possible point is the one who will, as a rule, meet with the largest measure of success.

"What does it cost to manufacture a ton of ice?" By referring to catalogues sent out by the different manufacturers of ice-making machinery we find that they have compiled tables showing the cost and what it is made up of for factories of different sizes, but the writer's experience of one year in the business shows that in some respects the manufacturers' estimates are misleading. For example, we find for a plant having a capacity of 15 tons each 24 hours, the manufacturer estimates that the ice can be produced for $1.12 per ton. This is made up of the following items:

Two engineers	$ 3.75
Two tankmen	2.00
6,700 lbs. of coal at $3 per ton	10.05
Oil, lights, waste and sundries	1.00
	$16.80

This shows a total of $16.80 for the manufacture of 15 tons of ice. Referring to the first item, that of engineers' wages, we find an allowance of only $3.75, whereas two engineers capable of handling this class of machinery will cost at least $4.50, if the company investing its money is to have the best returns from the investment, for it all depends on the engineers—what shall be the quality as well as the quantity of ice turned out each day. Then, again, it is impossible to hire engineers and tankmen by the hour or day unless the work is reasonably steady the year round, which would be impossible for an independently operated factory. It must also be remembered that there has nothing been allowed for firemen, and that this work would have to be performed by the engineers.

The second item of expense, for tankmen, is rather low, for these men must be clean men, and there is no class of work today which requires a man to give 12 hours of his time out of every 24 that does not pay more than $30 a month.

As to the item of fuel, we believe that the estimate of 67 cents per ton of ice is about correct for an independent factory, providing the factory is operated continually. The estimates for coal are usually based on the evaporizing of about five pounds of water per pound of coal, but this could be improved on if operated in connection with an electric-light and heat plant.

As to the last-mentioned items of expense, we believe that this should be increased to $1.25 per day, so as to include with the sundry items small items of repairs, such as are not ordinarily taken into consideration when figuring depreciation charge on a plant.

And this brings us to the one item which has been entirely left out in any estimates which we have ever seen, namely, a charge for depreciation, for be it remembered this item is sure to demand attention sooner or later, and the wise manager will set aside a proper amount to take care of this item each month or at least each year. As to what is the proper amount to be figured per ton of ice manufactured will depend on the total annual output of factory and what the depreciation charges amount to.

In our case, we have a 15-ton plant (based on ice-making, and not refrigerating capacity), and the cost of this plant, including additional real estate purchased, but not including boilers, is about $1,000 per ton, or a total of $15,000. We have estimated the life of the plant at 15 years, which means that approximately $1,000 per annum must be set aside to replace equipment. We may find a little later that this is insufficient, but, assuming that this is about right, it is self-evident that the more tons of ice manufactured per annum, the less per ton will have to be added for depreciation in making up one's cost per ton manufactured.

Under ordinarily favorable conditions, the ice season does not last over six months, which means that a 15-ton plant would only turn out 2,700 tons of ice running full capacity. But, assuming that 300 tons could be manufactured during the other six months, would make 3,000 tons for the year, which means that the sum of 33⅓ cents must be set aside for depreciation charges for each ton of ice turned out.

If these changes in this estimate are to be accepted as being more nearly correct for the average small ice factory in actual operation, and our experience leads us to believe that they should, the actual cost per ton for an independently operated ice factory having a capacity of 15 tons would be about as follows:

Two engineers	$ 4.50
Two tankmen	3.00
6,700 lbs. coal	10.05
Oil, lights, waste, ammonia and chloride	1.25
Depreciation charges, based on 3,000 tons annual output	5.00
	$23.80

This makes a total of $23.80 for the manufacture of 15 tons of ice, or an average of approximately $1.586 per ton.

The question which now suggests itself to us is: "How does this price compare with the cost of harvesting natural ice?" and, never having had any experience with that part of the ice business, we are only able to make comparisons from what our local natural-ice men have claimed that it cost them. Our local natural-ice dealer claims that it cost $1.10 per ton to put the ice in the house. To this must be added the shrinkage, which we estimate is 50 per cent. for all ice put in storage, so that this cost is really $2.20 per ton.

There is no doubt that the natural ice can be put up for less than this amount in some localities, especially where the lake or pond from which ice is taken is owned by the person putting up the ice, and the ice does not have to be hauled but run into icehouse direct from lake or pond. We did have a little experience with the delivery of some natural ice last season, and we found that it cost fully 50 cents per ton more to deliver than did our artificial ice. This was due to distance it had to be hauled, difficulty in getting out of icehouse, and trouble in cleaning.

We do not believe that anyone will claim that natural ice can be put into house, taken out again and delivered to center of distribution, and make proper allowance for shrinkage, for less than $1.586 per ton, and if our estimate of cost to produce artificial ice as above stated is correct, then we have both kinds of ice on an equality as far as first cost is concerned. We, therefore, believe we are justified in the statement that mechanically made ice can be placed in consumer's box in competing with natural ice and make the same percentage of profit as could be made on the natural ice.

Now if an independently operated ice plant can operate in competition with natural ice and be able to show good returns for the investment, could not the combining of an artificial ice factory with an electric-light, heat and power plant be made to show still better returns? By reason of such a combination, not only in the ice factory but also in the electric plant as well, we believe such a combination would prove a good thing, if properly handled and managed, in any town which boasts of an electric-light and heat plant if such a plant is already operating 24 hours daily, and it might prove to be the saving of some small plant from going to sheriff's sale because of inability to even pay daily operating expense. A few suggestions at this time of some of the advantages and savings that might be effected by the combining of an electric-light, heat and power plant, together with an ice factory, might be of interest to some of the members of this association, and the following are some that have come to the writer's notice:

First—Saving effected in boiler room by reason of operating boilers nearer their rated capacity for an increased length of time out of each 24 hours, and the boiler losses remaining the same with the ice-factory load on as when only electric and heating plant was operated.

Second—Can afford to employ more competent engineers for both ice and electric plant, and in small plant would really not require any additional engineers over those already employed. This is also true of firemen, for a fireman that can keep up steam on the peak of electrical load can easily keep up the normal load with the ice factory added.

Third—Ice plant can be shut down during the "peak-load" period each evening. And, by the way, the ice-factory load comes at a time in the year which is just exactly opposite the winter "peak" period of electrical load and "fills up the valleys on the gross-return chart" which in most small plants is very marked for the months of June, July, August and September.

Fourth—Saving of water run over steam condenser usually run to sewer, but which is the best of water for boiler-feed purposes, as it usually has a temperature of at least 150 degrees Fahrenheit when it comes off of steam condenser. This is a net saving of 95 degrees over the normal temperature of ordinary well water, and means a saving in fuel.

Fifth—In the spring and fall seasons, if electric plant is operating a heating plant in connection, the regular steam condenser used in distilling water may be dispensed with entirely, as a sufficient quantity of condensation can be secured from return heating mains for the filling of ice cans, and while this might have been used again for boiler-feed purposes, yet the ice factory has furnished the heating plant with additional exhaust steam, and that at a time when the heating plant was very much in need of exhaust steam, and had electric and heating plant been operating independently of ice factory it would have been necessary to have resorted to the live-steam valve in order to maintain pressure in heating mains. In our particular case we are even fortunate enough to dispose of all water run through double-pipe ammonia condenser, and at a good price per thousand gallons for pumping same.

Our company has for the last two years required each employe to turn in a daily report on a time card for all work performed by him, and from these time cards we are able to get all labor properly chargeable to the ice factory, and as we also carry a storeroom account, and all material is charged to this account as soon as received, and when used in any department of the business, that particular department is charged and storeroom receives credit for such material used. We are, therefore, able to show exactly what material and labor has been used in the manufactue of ice from the first day we started ice factory. The only exception to this is in the case of coal used in the manufacture of ice, and in this we have assumed that the amount of coal used was the same as if ice factory were operated as an independent ice factory, namely one-fourth ton coal per ton of ice made.

We started to turning out ice for sale May 30, 1906, which means that we had been in operation only seven months on January 1, 1907, and during this time we made 2,800 tons of ice, or an average of 13 tons per day, at a total cost of $2,958.33, or $1.056 per ton, which is a net saving of 53 cents per ton over our estimate for an independently operated plant. This includes a $583 depreciation charge. As there were times during the months of November and December that we were compelled to use some live steam for heating, in addition to that furnished by the electric and ice-factory load, we would be justified in claiming that part of the coal charged to manufacture of ice should have been charged to heating account, which would have reduced the figure of cost somewhat. As a matter of fact, during November and December we only operated ice factory when we needed additional exhaust, so that we might have charged all coal during these months to heating.

And now, just a few words as to what it costs to deliver ice to the consumer after it is made. We carry an account for ice-delivery expense, and we found that our cost for delivery of ice to consumer and on board the cars averaged 0.593 cent per ton, but as our ice shipped out of town was delivered by teamsters on board cars for 25 cents per ton, it means that the ice sold to the small user cost considerably more to deliver.

Deducting the ice shipped from the total made, and figuring this amount at 25 cents per ton, we find that ice delivered to small consumer was 1,000 tons and cost approximately $1.211 per ton. And right here we wish to state that the prices which we received for this ice ranged from $4 to $10 per ton until October 1st, when in car lots we reduced the price to $3, which was the lowest price made up to January 1, 1907.

Our company had not intended to undertake the sale of ice to the regular trade, but simply to wholesale the ice, but, owing to the fact that the men who expected to retail the ice decided at the last moment not to undertake the job, we were forced to retail the ice ourselves, and we had not been in the business 30 days until we were fully convinced that it could never have been otherwise and proven satisfactory to all concerned, any more than a small electric-light plant could undertake the manufacture of electric current and wholesale the product to a middleman to retail. We used coupon books in the sale of all ice to local consumers and positively refused to allow any icemen to sell any ice for cash from the wagon, and each driver was made to account for all ice taken from factory each day, and the coupons turned in each

[1] A paper read before the Iowa Electrical Association at Clinton, Iowa, on April 18, 1907. The author is manager of the Lee Electric Light Company of Clarinda, Iowa.

day had to compare favorably with ice taken out.

In conclusion, I will say that, as this is the first paper to our knowledge of this nature to be read before this association, we feel that we should not take up more of the valuable time of the association at this time, but if we have said anything that will prove beneficial to any member of this association, and if this paper will be the means of starting central-station managers after this new line of business, then we will feel that our effort has not been in vain.

Light.[1]

By Willis R. Whitney.

It is the writer's intention briefly to review the present schemes for the production of light by electrical means and to consider the possible future limitations; to look into present efficiency compared with what we may hope to obtain. In other words, to follow along the lines of thought which the experimenter in this subject naturally follows.

A definition of light might at this point be desirable, but the attempt at best would only result in jumbling a few words together which might satisfy the present knowledge of it, and even then would not give as good a conception of light as we all have. We know it as that agency by which we see. It is a something which affects the retina of the eye possibly somewhat as it effects a photographic plate. In modern times it has been recognized as a form of radiant energy, derived from a source such as the sun, and carried in waves or periodic vibrations through space with a velocity of 190,000 miles per second. In scientific parlance, it is the result of waves of electromagnetic induction in the ether by transverse oscillatory movements of electric charges. But until the luminiferous ether is defined and an electric charge understood, we cannot expect to see it in this way. Accepting this statement, we may simplify it by saying that light is due to energy in space, the energy being in wave form through space. The velocity of propagation of this energy is the same no matter what the size of the wave, so that we may have all wave lengths passing with equal velocity through space and produced by the same general means. The energy will differ only in wave length and frequency. That part of such energy which has wave lengths varying from 16 to 24 one-hundred-thousandths of an inch constitutes light. This is merely because within these limits our eyes are sensitive to the energy. Millions of times greater and smaller waves also exist. The longest ones, such as those of several feet, or even much longer, are the ones which, so to speak, are the light to the wireless-telegraph receiver, i. e., they are the wireless waves. The very small ones are only detected by photographic plates, by phosphorescent phenomena, etc.

By causing a motion of electric charges within a circuit of visible dimensions, Hertz, the real father of wireless telegraphy, found that he could produce ether waves with lengths of several feet. It was later shown that they could also be similarly produced with lengths less than an inch. The short waves which give us the sense of light are so small that they could only be produced by the motion of electric charges in ultra-microscopic circuits, or in those of the magnitude of atoms or molecules. Thus our methods of producing light are all apparently connected with intramolecular or atomic electrical phenomena.

The radiated energy from the sun is, generally speaking, mostly heat waves, i. e., mostly of longer wave length than the light waves. One might imagine a sun giving off relatively the same light, but much less heat than does our sun. It is this relationship between the heat and the light emitted by any source that determines its light value or light efficiency. A solid body at a temperature of dull redness produces the waves which we call heat without giving much light. The waves are a little too long. As its temperature is raised the light becomes more intense, but more heat is also emitted. As we thus continue raising the temperature, however, the fraction of energy sent off as light increases and the light economy improves. The average wave length is shortening. We would expect that, by still further raising the temperature, the body might give neither heat nor light, as it might then emit only such short waves as are beyond our perception except by photography or some other external means. In practice, however, this point is not reached, because the heated body is first destroyed or vaporized. Evidently, in attempting to get artificial light, we must aim at producing as nearly as possible only the waves of the prescribed length, 16 one-hundred-thousandths to 24 one-hundred-thousands of an inch. This has not been done to any great extent as yet; that is, all practical sources of light still send out much more than half the energy as useless heat. In other words, there is plenty of room for improvement in light sources.

To those who are interested, but have not given the point much thought, it may be worth while to show how a knowledge is gained of the actual fraction of applied energy which in any luminous source is obtained as light. One method which seems quite simple, consists in immersing the light in a known quantity of water in a vessel the walls of which may be made transparent or opaque at will. When opaque, the entire energy sent to the lamp ultimately enters the water and raises its temperature at a definite rate. This rate is less when the walls are transparent, by that quantity of energy which escapes as light. The relationship between the loss through the transparent walls and the total input is the "efficiency." An incandescent carbon lamp so tested would show that not over five per cent. of the energy used is emitted in visible form.

The energy of the light which falls upon a black body is all used in heating the body, so that such a body interposed in the path of the light waves after these had been separated from other waves into a spectrum, would form a calorimeter, informing us at what rate light energy was being sent to it from the light source. Knowing the total heat value of the light process, for example, the combustion of the oil, we can thus also readily determine its light efficiency. In this way an oil lamp may give about three per cent. of the energy of the combustion as light. An electric arc light may be as high as 40 per cent.; consequently there is here a wide margin which permits of oil engines being used to generate mechanical energy, which in turn is transformed by electric generators and used for lighting purposes instead of simply burning the oil in lamps for the same purpose. And this is true in spite of the fact that each such transformation turns a part of the energy into heat.

The various ways of producing light by electrical means may be divided into three classes: Solids heated to incandescence by the passage of the current; vapors so heated, and a combination of both.

The first type is best illustrated by the various kinds of incandescent lamp. The most common are the well-known carbon-filament lamp, the Nernst lamp, in which a filament of metallic oxides incandesces, and the newer vacuum lamps having osmium, tantalum or tungsten filaments.

In this type of lamp it is of the greatest importance to operate it in such a way as to compromise between its practical length of life and its efficiency. This can best be illustrated by a rough experiment, which consists in operating an ordinary carbon lamp at very much higher than its rated voltage. Under these conditions its efficiency is very greatly increased, but the so-called useful life is less the higher the efficiency. In practice, carbon incandescent lamps are operated at an efficiency of about three watts per candlepower, and at that efficiency they fall in luminosity to 80 per cent. of their original value within 500 hours. This 80 per cent. point is considered the death of the lamp—that is, the end of its useful life. It might last much longer, but would be continually giving out less and less light. If the same lamp is run at an efficiency one-third greater, in other words, at two watts per candlepower, its useful life will be only about 50 hours. The efficiency, then, that is to be practically preferred is determined by the relationship between the cost of energy and the cost and trouble of installing fresh lamps. This is what has determined the present running rate of the carbon incandescent lamp. The general principles in this case also apply to other filament lamps, so that they are all operated at such voltage as shall make the final cost for the light the least possible.

The mercury arc lamp and such vapor lamps as Geissler or Crookes tubes are representatives of the second class; here there is no consumption of material, and the luminosity is due to the incandescent vapors. Another type of incandescent vapor lamp is the magnetic arc lamp, in which the vapors of iron or its oxide are heated to incandescence between electrodes, one of which contains the iron or other luminous material, which is gradually fed into the arc by the current.

The ordinary carbon arc and the flaming carbon arc are combinations of the two previous types. In the former the light almost entirely emanates from the so-called crater or tip of the positive-carbon electrode, the actual arc or path of the current between the electrodes being almost non-luminous. The flaming arcs, which are made most familiar to us by the brilliant, reddish and powerful lamp occasionally seen on the streets, owe most of their lighting power to the vapors of salts, such as calcium fluoride, which are contained in the carbon pencils. A large part of the light in this case also comes from the heated surface of the carbon electrodes.

As there are more incandescent carbon-filament lamps made than any other kind, it may be interesting to briefly consider the present process of manufacture. The history of Mr. Edison's experiments, in which all possible sources of filaments or fibers of carbon were tested, are probably well known. In the past carbonized silk, bamboo, paper, cotton and various fibers have been used. The present filaments are usually made from some soluble modification of cotton. The solution is squirted through a die, much as a spider spins a web. The fiber is then hardened by water or alcohol. This is also the common practice in the manufacture of artificial silk. The fibers, made as described, are wound on metal forms to shape them, and finally slowly baked until only carbon is left. This is finally heated to a very high temperature in a gas furnace. Such a filament, however, when mounted in an evacuated globe in the usual manner, lasts only about 175 hours at three watts per candle. The lamps of today, however, last 500 hours. This considerable difference is due to a coating of graphite, which is put upon the carbon filament before it is mounted in the lamp. This coating is an exceedingly delicate process, and consists in heating the filament to a very high temperature while in a vapor of benzine or other hydrocarbon. Here the filament not only cannot burn, but it decomposes the benzine vapor and causes carbon as graphite to deposit upon its surface.

In general, the light efficiency of a heated solid increases rapidly with the temperature. For example, an isolated body at a temperature below 500° C. is radiating all its energy in non-visible form. At a dull red heat only a small fraction of one per cent. of the applied energy is in the form of light. At about 1,000 degrees perhaps one per cent. or two per cent. is as light. At 2,000 degrees it amounts to about 10 per cent.

In all electric lamps, then, the great need is for a substance which shall operate at very high temperature. The temperature which the material will withstand is the limiting feature of all electric lamps, both arc and incandescent. Where carbon is used the temperature is limited by the vaporizing of the carbon. In the case of metal filaments the limit is determined by the melting or softening point of the metal used. It is natural to speculate on the future possibilities of incandescent lamps under these conditions. There is really no reason for supposing that the most stable substance possible has yet been discovered. It is evident that, through still higher temperature ranges, the light efficiency will continue to rapidly increase, although it will be later shown that this does not continue indefinitely.

The carbon filament may be run for a few moments at so high a temperature that its light efficiency corresponds to about 0.4 of a watt per candlepower. This is eight times as efficient as its normal operation, and possibly corresponds to about 50 per cent. light efficiency. On this basis a hundred per cent. efficiency would correspond to about 0.2 of a watt per candle. This value includes so many errors that it is not to be looked at as more than a limiting upper value. It also involves the exclusion of what is called selective radiation. In other words, it is based on the so-called black-body luminosity.

The carbon lamp at 0.4 watt per candle is running at a temperature approximating 3,500° C. This is above the melting point of any other known substance, although experiments are continually being carried on along the lines of discovering more stable bodies. The carbon filament at ordinary operating efficiencies—about three watts per candle, is at a temperature not far from 1,700° C., while the metal filaments, such as osmium and tantalum, probably run between 2,000 and 2,200 degrees. It is interesting to know that if the carbon filament could be made to withstand for 500 hours the temperature which it bears for a few moments at 0.4 of a watt per candle, then the cost of operating incandescent lamps would be reduced to nearly one-tenth of the present rate.

In the case of the tungsten lamp, this difference is still more marked. The lamp will burn at 1¼ watts per candle for over 500 hours, and is, therefore, three times as efficient as the ordinary carbon; but it will also last a few moments at about 0.2 watt per candle. If it could only be permanent at this point our lighting would be about five per cent. of the present cost.

Naturally, the number of elements or compounds which will be stable at temperatures above 3,000 degrees is small, but the chemist recognizes that little is known about the chemistry of substances at these temperatures, and, therefore, this field must be gone over carefully. Reasoning purely from analogies in nature, it would perhaps seem now more normal to experiment with arcs and vapors than with incandescent solids, for astrophysics teaches us that the materials which are withstanding high temperatures are in gaseous state. There seems to be no theoretical difficulty in introducing any desired quantity of electric energy into a given space. Therefore, it ought to be possible to finally produce nearly 100 per cent. light efficiency by a suitable discovery of material.

It is very interesting to note that the work of Sir Norman Lockyer discloses the existence of temperatures in the stellar space which are much higher than that which would probably correspond to 100 per cent. light efficiency—that is, in producing light by temperature rise we may go too far. Light efficiency does not continually rise with temperature, and as the average wave length of radiated energy gets continually shorter with rise of temperature, it may become so short as to be in invisible form. The 100 per cent. illuminant would send all of its energy into the visible spectrum, and this is not true of any known illuminant. In all practical cases much energy is radiated in waves too long to be in a visible spectrum; that is, the body sends out infra-red waves. Spectra photographs of many of the stars have shown that

1. From the Sibley Journal of Engineering for January, 1907. The author is director of the Research Laboratory of the General Electric Company at Schenectady.

most of their energy is in the ultra-violet end of the spectrum. Over measurable-temperature intervals relationships have been discovered between the total energy radiated and the temperature of the body, and also between the wave length corresponding to the maximum energy in the spectrum and the temperature of the body. As these regularities are practically laws within our known range of temperatures, it is natural that attempts to measure the temperature of the stars should have been based on them. In this way Lockyer has determined the temperature of the stars ranging all the way from 6,000° C. to over 25,000° C.

Government Telephones in Manitoba.

A number of Manitoba municipalities have already decided to install their own telephone systems, which will be connected with other parts of the province by the long-distance lines to be built by the Manitoba government. The municipalities which have decided to install their own systems are: Woodsworth, where there will be three exchanges throughout the municipality to handle the work; Brenda, with three exchanges; Victoria, with one exchange; Wallace, with three, and Hamiota and Blanchard with one each. The rural systems, where built by the municipality, will be under municipal control.

The provincial government will furnish all material for the work so that the systems will be in working order by November 1st of this year. The rural systems which have already been decided upon involve the building of over 3,000 miles of pole line.

So far nothing definite has been decided regarding the route of the long-distance lines to be built by the government, but it is known that one line will run to the extreme southwest portion of the province, while another will run to the northwestern corner. The long-distance system will include three trunk lines involving the construction of some 2,500 miles of pole line.

Indiana Telephone Items.

The Home Telephone Company of Bedford has increased its capital stock from $75,000 to $250,000. The additional capital is necessary to make required extensions and improvements in the plant. E. B. Thornton is president and Charles W. Lanz, secretary.

A. C. Lindemuth of Richmond, president of the Indiana Independent Telephone Association, has given out a statement in regard to the status of affairs in the efforts of the Bell company and the Independents to reach an agreement whereby they would come to an understanding on the business for which both are now competing. Mr. Lindemuth said that the two concerns are now farther apart in their negotiations than ever, and that for the present all efforts to get together have been dropped. He does not think that the Independents will take over the Bell local business in Indiana for some time to come.

There is a strong sentiment among the Indiana Independent telephone men to have the United States government rescind an order forbidding postmasters to put telephones in their offices unless the instruments have direct connection with Washington. The rule is declared to be unfair treatment of the $350,000,000 invested in Independent telephone property and to be an injustice to 3,000,000 telephone subscribers and patrons of the 7,000 Independent companies and held to be a discriminating aid to the Bell monopoly.

Purdue University, Lafayette, reports the usual scramble among telephone companies to secure for telephone work the more promising young men now graduating from the electric engineering department. It is said agents of these companies visit this college weeks before commencement and learn of the acquirements and ability of the young electricians and study each candidate for a position so as to get accurate estimates as to whether or not the graduate will be able to fill the somewhat exacting requirements of the business of their systems.

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GENERAL TELEPHONE NEWS.

A 25-year franchise has been granted at Rockwell, Iowa, to the Rockwell Farmers' Telephone Company.

R. A. Matteson of Geneva, Neb., and others have organized the Citizens' Mutual Telephone Company with a capitalization of $100,000.

A. A. White of St. Paul proposes to build a telephone line north from Blackduck, Minn., to International Falls on the Canadian border.

The Lanyon (Iowa) Mutual Telephone Company has filed articles of incorporation with a capital of $5,000. G. T. Peterson heads the list of stockholders.

The following telephone companies have recently been incorporated: Wanti (Utah) Telephone Company, capital stock, $10,000; Springtown (Texas) Telephone Company, $5,000; Iowa (La.) Telephone Company; Independent Telephone Company, Cestos, Okla., capital stock, $25,000; Campbell (Neb.) Telephone Company, $7,000.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

The International Independent Telephone Association closed its annual convention in Chicago last week after the most harmonious and enthusiastic meeting in the history of the Independent telephone movement. The sessions extended over three days, June 4th to 6th. A report of the first half of the meeting was given in the Western Electrician last week. Following is a continuation of the report to the close:

Roll Call of States.

The roll call of states was continued Wednesday afternoon, all the states, through their various representatives, reporting progress and a healthy condition of business.

Ohio proved itself the banner Independent telephone state. President Frank L. Beam, of the state association, stated that on March 28, 1907, there were 290,400 Independent telephones in service, with 845 exchanges, 1,723 toll stations and 25,311 stockholders.

Charles S. Norton, speaking for Indiana, said that in 40 out of 92 counties in the state the Independents now have little or no opposition and that it is now possible for any Independent company to have commercial toll service with every other Independent company in the state.

James S. Brailey, Jr., of Toledo, Ohio, spoke eloquently on the "Strength of the Chain." He urged the members of the association to act together as a unit and not permit themselves to be detached individually from the movement.

The Annual Banquet.

The annual banquet, which was held Wednesday evening, was attended by 250 ladies and gentlemen. Senator C. W. Kline of Hazleton, Pa., acted as toastmaster. The first speaker was Mr. Luke Lee of Nashville, Tenn., who referred to the passage of the Talbert bill as a great victory, because under its provisions it is possible for a company incorporated in Tennessee to construct plants in every city and town without securing a municipal franchise.

T. Harvey Ferris of Utica, N. Y., responding to the toast, "The Empire State," said, among other good things, that "There is nothing in the Independent business which will warrant watering of stock. The Independents must be honest with the public to succeed. Aim to pay only legitimate dividends on actual capitalization." He also urged his hearers to plan standardization of equipment, accounting and methods of operation.

Other good talks were made by Helm Bruce of Louisville, Ky., and A. A. Goddard of Topeka, Kan.

The Closing Session.

The last session of the convention was opened by a paper on "Toll-line Clearing Houses," by J. M. Plaister of Fort Dodge, Iowa, who urged the discontinuance of the issue of coupons as a practice unfair to the general public and detrimental to the business at large.

E. E. Clement of Washington, D. C., presented the report of the committee on physical standards, which was printed in full in last week's issue of the Western Electrician. On motion the report was approved and referred to the executive committee for action.

A. C. Davis of Parkersburg, W. Va., chairman of the special committee on incorporation, reported that it was the sense of the committee that the association be incorporated under the laws of some state favorable to such organizations. The report was approved and the executive committee instructed to take the necessary steps to perfect the incorporation.

W. B. Woodbury of Detroit, Mich., reported for the finance committee. He stated that enough money had been secured to liquidate all the obligations of the association and to leave a handsome surplus in the treasury. A rising vote of thanks was given to the committee for the splendid work done by its members.

Telephone Securities as an Investment.

The subject of "Telephone Securities as an Investment" was handled by W. L. Moellering of Fort Wayne, Ind., in a manner that called forth general approval. Among other suggestions presented in the paper were the following:

"The regular dividend distribution, ranging from three per cent. to 10 per cent., now being paid by most Independent companies, and the creating of a surplus fund after having made proper deductions for depreciations, have made the investor take notice, and former prejudice, fostered by the opposition, has given way to impartial investigation, with most encouraging results.

"It must be patent to every observer that Independent telephone companies are more carefully and economically conducted than the Bell; local men of broad business experience constitute their boards of directors and they are in constant close touch with the company's affairs. Another great element of strength consists in the sentiment of the local community, which is, as a rule, outspokenly and actively favorable to Independent interests.

"Viewed from the standpoint of failures, Independent telephone securities are noticeably strong, the per cent. of failures as compared with other industries being strikingly small. There are in the United States over 700 Independent telephone companies, with a capitalization of $350,000,000. Dun and Bradstreet's weekly reports of bank, trust company and commercial failures very rarely include an Independent telephone company.

"The Independents of the United States own today several hundred thousand miles of toll lines, and have over 3,000,000 telephones in service. They have during the last eight years averaged daily approximately 200 miles of new toll lines, with a daily addition of over 1,000 new subscribers to their local exchanges, requiring daily more than $100,000 of new capital, and their future increase can be measured not only by the growth of this growing land, but by the fact that not a single operating company has its present territory fully covered, to say nothing of the numberless cities and towns yet to be built. Over 7,000 Independent telephone companies are now operating in 12,000 cities and villages.

"Investors will view with strong approval the present close organization, district, state and national, throughout the United States. The element of security such organization brings is of immense value, and capital is thereby assured of the systematic protection of all Independent interests. A continuation of systematic organization means not only increased security and prosperity to individual companies, but increased confidence by the investing public."

Telephone History in the Canadian Northwest.

Francis Dagger of Winnipeg, Man., telephone expert of the Manitoba government, spoke on "Making History in the Canadian Northwest." He referred to the campaign of last year, which closed with an election whereby the provincial government was authorized to construct long-distance telephone lines, and over fifty municipalities voted to establish municipal exchanges. Fifteen hundred miles of standard toll lines will be constructed at once under the direction of the government and the personal supervision of O. F. French, deputy minister of railways, telephones and telegraphs.

Closing Business.

Charles E. Sumner of Portland, Ore., stated that Congress, at its next session, would be asked for a second time to grant a franchise to an Independent company in the District of Columbia, and said that he had been advised that the claims of the Independents would receive a full and fair hearing. He urged the delegates to request their senators and representatives to vote for the granting of an Independent franchise in the national capital.

The committee on amendments to the constitution reported several changes, which were made by unanimous vote. The changes are of minor importance, the principal one being the enlargement of the executive committee from five to seven members.

The last business was the election of officers, which resulted as printed in last week's issue.

President-elect Theodore Gary of Macon, Mo., acknowledged the honor conferred upon him in an eloquent impromptu speech. "I appreciate this honor," he said, "more than I would being elected governor of any state in the Union."

On motion, the convention adjourned sine die at one o'clock, everybody being pleased with the gathering, which certainly was the most harmonious and enthusiastic in the history of the Independent movement.

Plans for the Future.

President Gary has decided to remove the headquarters of the association from Cleveland, Ohio, to Chicago, and within the next two months the records will be removed to the new location. John A. Harney, assistant secretary, who won the golden opinion of every delegate to the convention, all the details of which had been arranged under his personal supervision, has been reappointed and will have charge of the Chicago office.

The publicity work of the association will be made a prominent factor during the coming year. No detailed plans have as yet been worked out, but in the judgment of President Gary the publicity department should be granted a liberal appropriation. The department will be managed by G. W. Weippiert, a newspaper man and writer on economic subjects, who has been a resident of Chicago for over twenty years.

Telephone Convention Notes.

The Electric Appliance Company was on hand, as usual.

Nungesser Electric Battery Company of Cleveland was on hand.

Of course the Vote-Berger Company of La Crosse was on hand.

The Fibre Conduit Company of Orangeburg, N. Y., was represented by W. W. Smythe, Jr., western manager. A full line of socket-joint, sleeve-joint and screw-joint fiber conduit was exhibited, together with a sample section of subway, which

showed fiber conduit as installed embedded in concrete.

The Indiana Steel and Wire Company had its usual exhibit.

Dean Electric Company of Elyria, Ohio, made an interesting exhibit.

George L. Lindsley looked after the interests of the Lindsley Bros. Company.

American Electric Fuse Company's exhibit was in charge of Manager Kenny.

Homer Roberts Telephone Company of Chicago displayed a new party-line lockout system.

Chance Manufacturing Company of Centralia, Mo., exhibited its skyrocket lightning arrester.

W. G. Nagel Electric Company of Toledo, Ohio, was represented by W. G. Nagel and H. E. Adams.

Belden Manufacturing Company showed its line of products used in many of the telephone exchanges.

Select Telephone Manufacturing Company of Springfield, Ohio, showed its telephones and lockout system.

National Carbon Company of Cleveland, maker of batteries and carbon specialties, made its usual tasteful exhibit.

F. R. Bryant, general salesman for the Central Electric Company, looked after the interests of his company.

"Kirk" and McRoy clay conduit never fail to appear at a telephone convention, and this one was no exception.

North Electric Company of Cleveland exhibited its new synchromonic system, besides its standard telephone apparatus.

The Sterling Electric Company's exhibit—the writing room on the main floor—was placed at the disposal of the guests.

Gary Powell explained the merits of the United States coin register made by the United States Coin Register Company of Toledo.

Much interest was shown in the exhibit of the Duplex Metals Company of New York, which was in charge of B. E. Eldred.

The exhibit of the Western Telephone Manufacturing Company of Chicago attracted the attention of many of the delegates.

Universal Pole and Post Preserving Company of Circleville, Ohio, explained its system of preserving poles to hundreds of delegates.

President E. L. Clark of the Valentine-Clark Company of Chicago mingled with his many customers and friends at the convention.

W. R. Adams, manager of the conduit department of the American Sewer Pipe Company, Pittsburg, did the honors for his company.

Durant Electric Supplies Company, the new telephone and electrical supply house of Chicago, booked many new customers at the convention.

Monarch Telephone Manufacturing Company of Chicago was well represented at the convention. President E. E. Yaxley and associates were constantly in attendance.

President Overshiner of the Swedish-American Telephone Company of Chicago was one of the busiest men at the convention. The company made a very interesting exhibit.

American Steel and Wire Company's exhibit was in charge of C. S. Knight, Jr., manager of the electrical department, F. J. Conklin, George Quigley and A. T. Merriman assisting.

American Electric Telephone Company of Chicago made an interesting exhibit. President P. C. Burns and Manager J. G. Ihmsen were on hand and also a large staff of representatives.

Everstick Anchor Company of St. Louis was represented by President Jasper Blackburn. Mr. Blackburn secured orders from telephone managers in seven different states during the meeting.

President Fred Bissell of the F. Bissell Company, Toledo, attended the convention with the following representatives: Walter Bissell, J. Alexander Navarre, M. E. Townsend and C. M. Hamilton.

The Bulldog steel gain made by the Steel Gain Manufacturing Company of Chicago attracted the attention of a large number of delegates. Many new customers were added to the company's list.

The Wire and Telephone Company of America, Rome, N. Y., made a neat exhibit, consisting of easophones and various kinds of wire. F. N. Potter, A. J. Kennedy and A. H. Hamilton represented the company.

H. W. Reade, vice-president and treasurer of the National Pole Company, Escanaba, Mich., took the opportunity to get personally acquainted with many users of National cedar poles. The National company is a successor to the pole department of the Pittsburg and Lake Superior Iron Company, the business having grown to such an extent that a separate company was necessary.

James S. Cuming, C. H. Wallis and L. G. Le Bourvau represented the Central Telephone and Electric Company of St. Louis. Mr. Cuming stated that he sold more goods at this convention than at any previous meeting.

Among the largest and most complete exhibits was that of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., and Chicago. A large force of representatives looked after the interests of this company.

This was the first International Independent telephone convention at which the Long Distance Telephone Manufacturing Company of South Bend, Ind., exhibited. A full line of apparatus was shown, and the exhibit was in charge of R. E. Willard and J. W. Culp.

Following is a list of the Standard Underground Cable Company's representatives at the convention: J. R. Wiley, J. E. O'Neill, W. M. Rogers of Chicago; E. J. Pietzcker and Richard Houck of St. Louis, and A. A. Anderson and L. L. Parkinson of Pittsburg.

L. M. Ericsson Telephone Manufacturing Company of Buffalo displayed its telephone instruments and specialties. Its harmonic system attracted attention. The Durant Electric Supplies Company of Chicago will represent the Ericsson company in four western states.

H. E. Cobb of Chicago, the well-known western agent for several companies, made an interesting exhibit. Chapman lightning arresters made by the Minnesota Electric Company of Minneapolis received a great deal of attention. The Crawfordsville Wire and Nail Company's galvanized wire and galvanized strand were shown, also the Acme Rubber Company's rubber-covered wire, Alfred F. Moore's receiver and switchboard cords, as well as Scranton button receiver shells and mouthpieces.

Frank B. Cook of Chicago exhibited a complete line of pole cable terminals, also subscriber-station and exchange protectors. As usual, Mr. Cook showed new apparatus for the improvement of service. A porcelain cable terminal with copper can top for multiple top work and a wireless heat cartridge giving protection against both strong and sneak currents attracted considerable attention. Mr. Cook was assisted by F. A. Rader, S. C. Harvey, J. A. Mohr, F. R. Parker, E. E. Dewey, J. F. Tompkins, H. Roy Cook.

The Automatic Electric Company exhibited a 100-line unit of common-battery automatic switchboard type with 12 telephones connected. The company also showed a combination wire chief and trouble clerk's desk recently built for the Home Telephone Company of Champaign and Urbana, Ill.; also a duplicate set four-frequency harmonic converter built for the Montana Independent Telephone Company, Butte, Mont. All of these pieces were working exhibits. The company was represented by C. L. Fisher, sales manager; F. L. Middleton, assistant sales manager; H. H. Woodworth, advertising manager; J. A. Russell, P. J. Eubanks and J. E. Fisher of the sales department, and William Hannan and J. S. Engh of the engineering department. As usual the Automatic exhibit attracted much attention.

One of the most interesting exhibits at the Telephone Convention was the "loud-speaking telephone" of the International Telephone Manufacturing Company of Chicago. The International company besides showing a full line of multiple and trunking central-energy and generator-call switchboard equipment and telephones exhibited a telephone with a transmitter of such power that it caused the diaphragm of a distant-connected receiver to vibrate so strongly that the sound was heard through a megaphone over a large area. The International Telephone Manufacturing Company was represented at the convention by Henry Shafer, president; John C. Burmeister, secretary and treasurer; Fred E. Freers, manager; H. M. Coulter, T. Crozier, B. Carliss, John Hoffenkemp, P. J. Shepard, Charles Reynolds and William Shaw.

The exhibit of W. N. Matthews & Bro. of St. Louis was in charge of Claude L. Matthews. The company showed its Hargis cable-splicing joint, Stombaugh guy anchor and other telephone specialties. A feature of the exhibit was the demonstrations given by O. R. Johann, an expert cable splicer. The Matthews company will send Mr. Johann to various parts of the country to teach the art of cable splicing to users of Matthews specialties.

Another Telephone Relay.

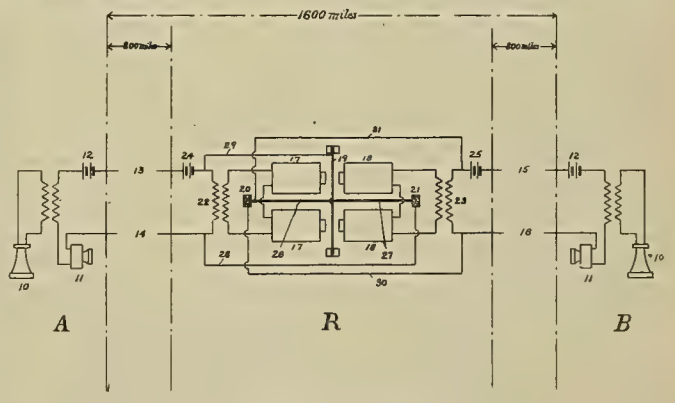
A practicable telephone relay has been long sought, and although many inventors have wrestled with the problem, none has yet accomplished, apparently, the end aimed at—that is, the production of a relay that will do for telephonic transmission what the ordinary telegraph relay does for telegraphic communication. However, the various attempts are interesting and praiseworthy; perhaps some one of them will be successful. One of the latest efforts is that of Dilpert S. Dickert of Salt Lake City, who on March 19th was granted a patent for a "telephone relay," for which application was made about a year ago. Mr. Dickert says that the object of his invention is a telephone relay "which when into the telephone circuit will enable sound waves to be transmitted much greater distances than is at present possible without a relay." For this purpose he uses two sets of magnets, a diaphragm controlled by these magnets and means in connection with the diaphragm to transmit and strengthen weak incoming vibrations.

Referring to the diagram (A) and (B) indicate two telephone stations, for example, 1,600 miles apart and each 800 miles from the transmitting relay (R), 800 miles being, the inventor says, about the present limit of direct transmission.

The usual telephone receiver is shown at (10) and the transmitter at (11); (12) is a local battery located either at the instrument or at a central station; (13) and (14) are the line wires from station (A), and (15) and (16) the line wires from station (B).

The relay transmitter comprises the two sets of receiving magnets (17) and (18), one for each station, a common diaphragm (19), placed between the magnets, transmitters (20) and (21) and the induction coils (22) and (23) and batteries (24) and (25). The line wires terminate, respectively, in the primary coils of the induction coils, whose secondary coils are in a closed circuit, including, respectively, the magnets. The relay battery (24) is located in series in one of the line wires from station (A) and the relay battery (25) in one of the line wires from station (B). The transmitting devices (20) and (21) are preferably of the carbon type with contact point operated by the diaphragm. The transmitter (20) is connected by wire (30) with line wire (16), and the contact rod (26), insulated from the diaphragm (19), is electrically connected by wire (31) with the line wire (15). The transmitter (21) is connected to the line wire (14) by wire (28), and the contact rod (27) is electrically connected with the diaphragm itself, which is in connection with line wire (13) through wire (29).

In operation weak telephonic impulse on the line (13) (14) enters the relay and completes the circuit through the primary of induction coil (22). A current is thus set up in the secondary of this coil, thereby energizing the magnets (17), which in turn move the diaphragm. The movement of the diaphragm varies the resistance of the transmitter (20) through varying the degree of contact, and thereby varies the current through the circuit (20) (30) (16), station (B), (15) (25) (31) (20) reproducing the received telephonic impulses, but considerably strengthening them through the local battery (25). A telephonic impulse coming from the station (B) operates similarly by energizing the magnets (18) and operating the transmitter (21), which sends a corresponding strengthened impulse to the



ANOTHER TELEPHONE RELAY.

line wires (13) (14) through local battery (24).

In providing a common diaphragm between the two sets of magnets the inventor avoids the objectionable effect of repeating back into the sending line, causing a consequent confusion of vibrations. "It might be supposed," says Mr. Dickert, "that the pulsations from one transmitter would affect the opposite primary and secondary and thereby the corresponding magnets, thus causing a repeating back into the sending line. This does not occur, however, as the primary coil becomes partly short-circuited by the transmitter circuit, thus weakening the magnets and releasing the diaphragm, and

thereby the attached contact rod, and increasing the contact resistance of the transmitter. Also since both contact rods are attached to a common diaphragm, as the one is drawn toward its carbon block the other is drawn away, tending to increase the resistance of the transmitter circuit. The one transmitter in operating thus automatically increases the contact resistance of the other by means of the common controlling diaphragm and the part short-circuiting of the opposite primary."

Steinmetz's Integrating Photometer.

In order to determine exactly the total flux or spherical intensity of light issuing from a luminous source it would be necessary to determine the intensity at each point on the surface of a sphere having the source of light at its center; but as most commercial sources of light have a distribution which is practically symmetrical about an axis it is sufficient for practical purposes to take photometric readings about a great circle passing through the poles of the axis of symmetry and thus determine the intensity.

To take individual readings all around the circle is a laborious process, and, moreover, not reliable, since during the time of taking the readings the intensity of the light may change, and, in fact, does change in some forms of lamps, as, for instance, the electric arc lamp.

In order to determine the intensity about a great circle at one reading Dr. C. P. Steinmetz has devised an integrating photometer in which one or more series of mirrors are arranged about the light in a great circle which passes through the axis of symmetry of the light. The mirrors are set so that each reflects the image of the source to be measured on a photometric screen placed in the axis of the circle at some distance from the source. Each mirror, or in case the mirrors are arranged in pairs with respect to the symmetrical axis, each pair of mirrors may be considered as measuring the intensity of light of the zone which lies between planes passing perpendicular to the axis of symmetry midway between successive mirrors. This invention is patented in the United States and assigned to the General Electric Company. The patent was issued April 2, 1907, but the application dates back to October 13, 1902.

As the result which it is desired to obtain is the product of the intensity of light into the area over which that intensity exists, or rather the average of such a product, it is necessary that the intensity of the light which is obtained by the reflection in the mirror be multiplied by some factor which will give this desired result. As is well known, the spherical areas of zones formed by planes taken perpendicular to an axis of the sphere are proportional to the distance between such planes measured along the axis. Hence the area of zones marked out by successive planes separated from each other by equal distances are equal. The inventor has therefore so placed the mirrors that they lie midway between planes which mark out zones of equal areas. As a result the average of the intensities given by the mirrors will give the desired result, since each mirror or each pair of mirrors gives the average intensity which exists over one of a series of equal areas.

Fig. 1 of the accompanying drawing is a perspective view showing the general arrangement of a photometer embodying the invention. Fig. 2 is a diagram showing one arrangement of the mirrors. Fig. 3 is a diagram showing a modified arrangement. Fig. 4 is an elevation showing the support for the mirror, and Fig. 5 is a sectional view taken on the line (5) (5) of Fig. 1, giving a different view of the mirror-supporting means.

A large circular or ring-shaped body (1) is provided as a support for the mirrors. A lamp (3) is the source of light which it is desired to measure. A series of plane mirrors (4) are carried by the ring.

In Figs. (4) and (5) is illustrated one means by which these mirrors may be supported. A pair of small uprights (5) are bolted or screwed to the inner surface of the ring (1). These uprights have cup-shaped recesses formed near their outer end, in which a ball (6) is placed. To one side of the ball the mirror is secured in any suitable manner. A locking screw (7) is provided, by means of which the standards can be drawn together to clamp the ball in any desired position. By means of this construction a universal joint is obtained, and hence the mirrors can be adjusted in any desired manner.

In Fig. 1, (8) represents a photometric screen which may be of any desired form. In the present instance it is shown provided with the conventional grease spot (9). A standard light is shown back of the screen, slidingly mounted on a table (11).

The mirrors are set at such an angle that the image of the lamp (3) will be reflected on the grease spot of the photometric screen. The mirrors will all be set so that they will be tangent to a cone, the axis of which coincides with the line connecting the grease spot with the center of the circle (1). An opaque screen (12) is supported between the lamp (3) and the screen (8) so as to cut out the direct light from the lamp to the screen, but is of such proportion and is so placed as not to cut out the reflected light passing from any of the mirrors to the screen.

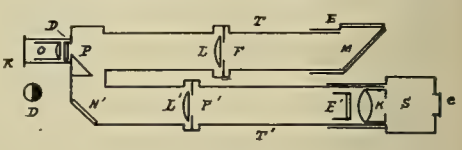
In Fig. 2 the circle shown represents the outline of a sphere, at the center (O) of which is placed the luminous body to be measured. The line (A) (B) represents the axis of symmetry of this luminous body. In the present case it corresponds to the vertical diameter of the circle (1). The lines (C) (D) represent successive planes perpendicular to the line (A) (B), separated each from its neighbor by equal distances (a). Then the area of the zones of the sphere lying between successive planes represented by the lines (C) (D) will be equal. Midway between successive lines (C) (D) and between apexes (A) and (B) and the adjacent lines (C) (D), lines (C′) (D′) are drawn, and at the intersection of the lines (C′) (D′) with the circle the mirrors are placed. With this construction it will be understood that the pair of mirrors at the ends of each line (C′) (D′) reflect the average intensity existing over the zone marked out by the adjacent planes (C) (D).

In Fig. 3 is shown a diagram which in general is similar to that shown in Fig. 2, the right half being identical therewith and the left half different, in that the zones are different in number.

In practice the proper position of the mirrors may be obtained by covering all but one and then so adjusting that one that the reflection on the lamp (3) will fall squarely on the spot of the photometric screen. In order to obtain quantitative measurements it will of course be necessary to determine accurately the distance between the lamp and the screen as well as the distance from the lamp to the mirror. It will also be necessary to take into account the amount of light which is not reflected by the mirror, but is lost by absorption, diffusion or otherwise.

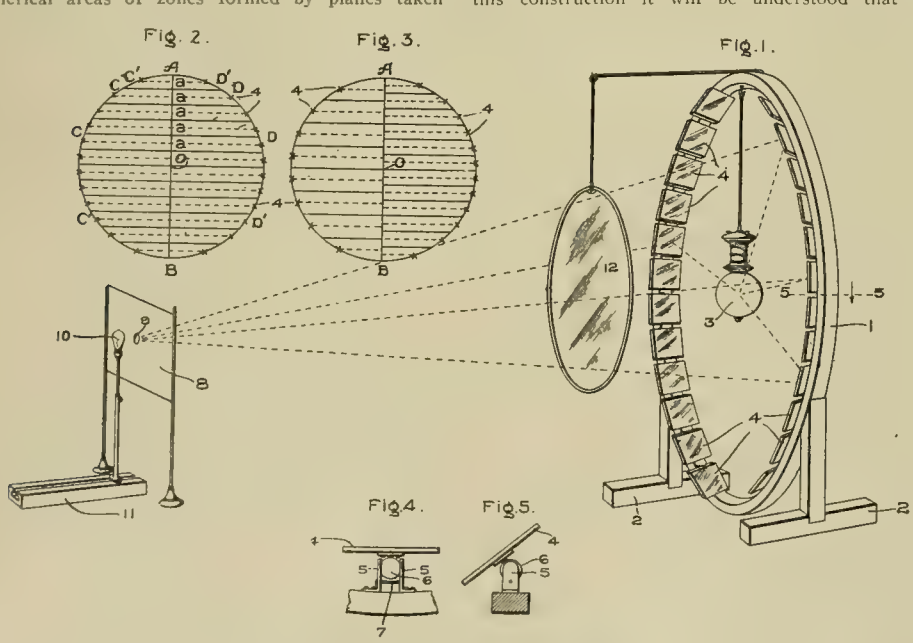
The mirrors should be sufficiently large so that the entire image of the lamp (3) can be seen in each mirror from the spot. The intensity of light reflected in any one mirror can be readily determined by covering up the remaining mirrors, and the hemispherical intensity for the lower hemisphere can be readily obtained by apparatus employing only the lower half of the mirrors. Other modifications may be employed.

While the results which can be obtained by the use of this arrangement will only be highly accurate in those cases in which the light distribution is substantially symmetrical about an axis, useful results can be obtained by its use in measuring the luminosity of sources which do not give a symmetrical distribution of light. In such cases the source of light may be rotated with respect to the axis of the mirror circle.



PHOTOMETER FOR MAKING TRAIN-LIGHTING MEASUREMENTS.

In place of the simple photometric screen shown other forms of photometric screens may be employed or other devices used, such as a spectroscope, bolometer, thermal couple or the like, as the object upon which the reflections from the source of light or other radiation are directed by the various reflecting surfaces, the invention may be employed where it is desired to determine properties other than that of luminosity.



STEINMETZ'S INTEGRATING PHOTOMETER.

Photometric Measurements of Train Lighting.

The Eastern Railway Company, which controls one of the leading systems of railroad in France has been carrying on a series of experiments with regard to train lighting. In the standard cars of the company, the lamps are suspended from the ceiling of each compartment and thus have but a limited area to cover. In general there is one lamp per compartment, which is found sufficient. While the tests have been made up to the present mainly with incandescent gas-mantle lamps, the method of making the photometric measurements which is now used by the engineers of the company is very well adapted for any source of light, including carbon or other filaments. When making the tests upon the lighting of the compartments it was found necessary to design a special form of photometer, seeing that the usual forms of instrument could hardly be used in the kind of tests which were required. What was wanted was an instrument which is of light construction and also portable, which is the first desideratum. Then it must allow of finding the value of the light which is received at a determined point, without having to measure the angles, regardless of the inclination of the rays. A modified form of Mascart photometer, described below, was found satisfactory.

Referring to the diagram, the photometer consists in general of two parallel tubes which hold the rest of the apparatus. At (E) is placed a thin paper screen which is used to receive the light which is to be measured. Mounted together with it is a reflecting mirror (M) placed at an angle of 45 degrees. The piece which carries the screen and mirror is adapted to turn about the end of the upper tube (T) so that the screen can be made to take any desired direction in the plane perpendicular to the axis of the tube. Placed at a point near the middle of the tube is a lens (L), which is used to send the image of the screen (E) upon a second screen or diaphragm (D) at the other end of the tube.

As regards the second tube (T′), it is mounted parallel to the former, and contains an adjustable chamber (S) at one end. In the chamber is placed the standard source of light, which is a gasoline lamp having a flat flame. The height of the flame is regulated by observing its projection upon the ground-glass screen (e). A lens (K) is used to produce a beam of parallel rays from the lamp, which falls upon a screen (E′). The latter is formed in the same way as the upper screen (E). The image of the screen is thrown by the lens (L′), in the middle of the tube, upon the mirror (N′) placed at the other end and mounted at 45 degrees. Thence it passes the total-reflection prism (P) and falls upon the diaphragm (D), but only upon the lower half of it, as the upper half receives at the same time the image of the upper screen (E). In this way the two beams, the standard and the test beam, are thrown side by side upon the diaphragm, where it is easy to make the

comparison by observing through the opening (R), using preferably a lens (O) for the purpose.

It now remains to equalize the light upon both halves of the diaphragm so as to find the photometer reading. This is done in practice by using an adjustable diaphragm shutter (F), (F') with the lenses (L), (L'), so as to modify the quantity of light received from the screens (E) or (E'). On the shutters are graduated scales in which the divisions are regulated so as to give the units of comparison. The instrument is standardized by placing a Carcel lamp at a determined distance, say, three feet, from the upper screen (E), and then making a series of readings by adjusting the shutters, whose figures represent the diameters or areas of the openings. In order to make color tests upon different kinds of light, the instrument carries a set of revolving color screens which are placed before the eyepiece (R), so that they can be made to equalize the shade of the light on the two halves of the photometer screen.

HAULING MACHINERY IN THE SIERRAS.

Automatic Motor Starters.

The Ward Leonard Electric Company of Bronxville, N. Y., points out many unique features in its latest type automatic motor starter. The accompanying picture of the panel shows the latest improvements in the art. The Ward Leonard Company has gone carefully into the subject of motor starters and has written a set of exacting specifications, a few extracts from which are given:

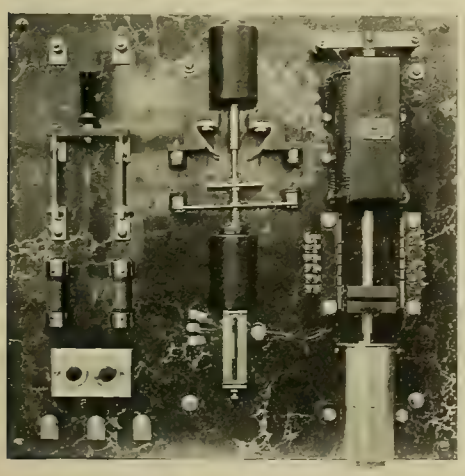
"The panel shall start the motor on the making of a circuit by means of a push button, the push button not to carry over three amperes. This circuit shall become de-energized as soon as the automatic switch closes, so that the push button, when released, does not have to break the circuit.

"The motor shall stop when a push button is pushed, breaking a circuit of not over one-tenth of an ampere.

"When the motor is not running there shall be absolutely no power absorbed by the self-starting panel or by the motor."

"The knife switch and fuses shall be of the National Electrical Code standard and shall be rugged and strong in construction. The automatic switch shall be of the laminated double-break type. There shall be an auxiliary metal-to-metal break for shunting the laminæ and final carbon-on-carbon break. * * * The self-closing switch shall have * * * a lifting magnet and a holding magnet, the lifting magnet being automatically short-circuited when the switch closes."

"The holding magnet and its resistance shall not absorb more than 10 watts after the motor has been started and is operating normally. The lifting magnet shall have such a capacity that it will be possible to start the motor at least once each minute for an hour, taking 10 seconds each time for starting the motor, without in any way injuring or materially altering the operation of the magnet."



AUTOMATIC MOTOR STARTER.

"The resistance material, when cold, shall stand without injury or alteration a current of .50 per cent. in excess of the full-load motor current for one minute, or 100 per cent. in excess of the full-load motor current for 20 seconds."

"The resistance material shall be arranged so that in case of burnout it shall be impossible for flames to be developed or for molten metal to be ejected from the casing. The overload device shall operate by breaking the circuit of the holding magnet of the main line solenoid switch, thereby positively causing the switch to open. Overload devices which operate by short-circuiting the no-voltage magnet will not be accepted."

Incidents in Power-plant Construction in the Sierras.

The question is often asked, "What becomes of the thousands of car signs being sent out daily by manufacturers all over the United States? This can practically be accounted for by a trip to the head waters of the many streams rising on the Pacific slope of the Sierra Nevada range and flowing westward to furnish irrigation to the fertile valleys of California. To secure waterpower in this region and leave the volume of water unimpaired and at an elevation sufficient to let it flow to the ranches so badly in need of it means long-distance transmission in every sense of the word. A few years ago half a hundred miles was the limit set; now several hundred miles is considered no barrier.

To turn the water over to the irrigating ditch at a height sufficient for it to reach the valley by gravity means that the location of the power plant, as a rule, is far from towns, railroads and supplies. The transportation of the heavy machinery becomes a feat often deemed impossible by the erecting man from the factory, but it is solved by the man on the spot accustomed to using the forces and equipment around him.

One of the accompanying pictures shows the hauling of some heavy pieces by primitive means.

A CAMP IN THE SIERRAS.

Once at its destination everything is treasured for future use; in the bolts, nails, wire, sawed timbers and boards the station attendants see possibilities in case of breakdown or to build habitations for themselves.

A casual glance at the sides or roof of many a bunkhouse or superintendent's house discloses the fact that the timber came from the shipping department of some manufacturing concern supplying the machinery for the plant. Even the car signs do not go into the scrap heap, but they often serve to give a name to a temporary home or permanent locality.

The second picture is from a photograph taken on the slopes of Mount Whitney, California, the highest mountain in the United States, where the Edison company of Los Angeles is just completing its new power plant for which the Allis-Chalmers Company is furnishing the complete hydraulic turbine equipment, while the General Electric Company is furnishing the electrical apparatus.

Chicago Electrical Baseball League.

The Electrical League, a baseball association organized among the employes of the various Chicago electrical supply houses, is attracting considerable local attention and doing much to stimulate interest among the various employes in outdoor sport and exercise. Each of the Chicago electrical supply houses has put a rival team in the field, the companies represented being as follows: Central Electric Company, Western Electric Company, Automatic Electric Company, Stromberg-Carlson Telephone Manufacturing Company, Electric Appliance Company, Manhattan Electrical Supply Company, Illinois Electric Company.

The most of these teams are named after some specialty or trade-mark which is prominently identified with the house. The Central Electric Company team, for instance, is known as the "Okonite" Club. The plan is for each team to play three games with each rival team. The season was opened on June 1st by the game between the Okonite Club and the Manhattan Electrical Supply Company's "Red Seal" Club, the former winning. Arrangements are under way for securing a permanent baseball park.

CORRESPONDENCE.

Continental Europe.

Paris, May 27.—At the last meeting of the Société Internationale des Electriciens at Paris, M. de Traz read an interesting paper on different methods of operating controllers for electric traction. It was devoted for the most part to bringing out the differences between the two leading controller systems operated by the pneumatic or electric system, first the drum controller and second the separate contact system with a different motive device for each apparatus. After dwelling at some length upon the merits of each he concluded that the system of separate contact devices is to be preferred in the case of two motors of 150 horsepower. Where there is as low as 75 horsepower used, or where there is but one motor per car, the drum controller system appears to be the better.

There is a project on foot in Switzerland for an electric railroad in the region of Lake Leman which is to run between Les Avants and Moleson, passing by the Sonloup Pass, with a tunnel under the Cape au Moine and the Saletta Pass. The length of the new line will be nearly 15 miles. Along the route there will be many constructions in the way of viaducts, tunnels and bridges. The line will mount up to a high point and the difference of level is about 3,000 feet, with a maximum grade of 63 per cent. It will connect at Les Avants with the Montreux-Oberland Bernois road and will be able to use the same rolling stock. It will take about four hours to make the total distance. The cost of the line is estimated at $720,000.

According to the annual report of the Unioni Italiana Tramways Elettrici of Genoa the profits for the last year were in round numbers $1,500,000, and the company decided to pay a dividend of 7½ per cent. upon its capital stock of $3,000,000, besides making other payments. The company is one of the largest in Italy.

A new hydraulic plant is to be erected in Sweden by the Holmia Electric Company of Stockholm, and this firm has lately acquired the rights for the fall of Dingersjo. About 1,500 horsepower will be used at first. In the turbine house will be mounted three turbines to operate the machines. The latter may be built in Sweden, but the measuring instruments at least will need to be imported.

An example of the use of the high-tension direct-current system is found in a hydraulic plant erected in the Apennines in the north of Italy. Thury dynamos coupled in series give a total of 16,000 volts, which is sent into the overhead line. The new plant is located at Chiappa and uses water from two lakes, Lagolungo and Lavezze, which lie at a high point in the mountain. The water head, 1,100 feet, is one of the highest in the country. Four turbine groups are installed here, each composed of a Piccard & Pictet wheel running at 500 revolutions per minute and giving 300 horsepower. Contrary to the ordinary practice, the dynamos are excited in series and the current on the line is kept constant by varying the speed, so that there are no flywheels on the shaft. A solenoid device acts upon the hydraulic piston motor which controls the turbine feed. The Italian station also has an outfit of alternators consisting of five turbine sets of from 1,000 horsepower down, working on a line of 23,000 volts and some other lines of lower voltage.

A DE C.

Great Britain.

London, June 1.—The London County Council electric power bill has been read a second time in the House of Commons. But this does not mean much, for the one condition upon which the present stage was allowed to pass unopposed was that the terms of any lease or contract entered into by the council with a private company shall be submitted for the consideration of Parliament either in the present bill or in a subsequent measure. This clearly contemplates that the County Council, even if it succeeds in establishing the principle that electric supply in London shall be under municipal control may have to come to Parliament next year in order to secure the ratification of an agreement with a private body to whom the actual administration of the scheme is to be entrusted. The general opinion is that the council has decided not to work any electric supply undertaking itself, therefore no scheme with engineering details can, presumably, be placed before the committee which will deal with the bill this year.

The draft charter of the Imperial Technical College at South Kensington has now been published.

An interesting tramway by-law in connection with tramway working has been sanctioned by the Board of Trade. It is that in wet weather passengers may stand inside the car instead of being forced to sit on top. Up to the present ordinary open-deck cars have been prevented from carrying standing passengers, although it is true that the rule is frequently broken. The increasing use of covered-in top decks is getting over the difficulty.

Some difficulty is being experienced in various parts of the country where it is becoming the practice to exclude miners from making use of the

inside of tram cars in the evening, owing to damage to other passengers' clothes. In fine weather, even when the insides are empty, they are forced to go on top and stand. The obvious remedy seems to be special cars, which ought to be possible in mining districts, as the traffic would be considerable.

That old-established firm, the Brush Electrical Engineering Company, is just now passing through what may be termed a bad time. In similar circumstances most of our other companies have turned to the colonies and abroad for relief. The Brush company, curiously enough, was one of the pioneers in Australia, and has, as a matter of fact, been compelled to shut down its own branch office there and deal through agents. This is due, it is said, to severe competition from American and German houses, made possible by subsidies to the shipping companies by their respective governments.

During the discussion upon a paper at the Institution of Electrical Engineers last week dealing with the influence of interpoles upon direct-current design, the opinion was very generally expressed that there appeared to be a general application of interpoles to all types and sizes of machines indiscriminately. Interpoles, it was argued, had a definite and legitimate field of application, but their use in cases where a good design could be obtained on ordinary lines was not justifiable.

The annual report of the council of the Institution of Electrical Engineers makes record of the fact that in connection with the opening of the new Engineering Societies' Building in New York at the invitation of the committee in charge of the arrangements Sir William Preece, K. C. B., F. R. S., was appointed to act as the representative of the Institution. G.

New York.

New York City, June 8.—At a recent meeting of the Board of Estimates Bridge Commissioner Stevenson revealed another plan to increase the traffic facilities of the Brooklyn Bridge, when he applied for an appropriation of $45,000 for making improvements in the structure. Of this amount $10,000 is to be devoted to the installation of a local trolley service across the bridge to replace the local train service now in use and to allow the through operation of trains as during the non-rush hours. It is the plan of the commissioner to use the ground floor of the present terminal on the Brooklyn side for the installation of trolley loops similar to those now in operation in Manhattan. Part of the appropriation is to be used to make the operation of the trains safer by the installation of block signals to keep the trains at safer distances from each other.

Throughout the week there have been persistent accounts in the daily press of serious faults which were being brought to light in the construction of the tunnel which is being built to Brooklyn from Battery Place, New York. It was also reported that the tubes were sinking. A letter was sent to the mayor by one of Brooklyn's leading civic organizations requesting that the mayor appoint an engineer to make an investigation of the conditions and report the results. Nelson P. Lewis, chief engineer of the Board of Estimates, has been appointed and will shortly hand in his report. Chief Engineer Rice says that the tubes are perfectly safe and that the settling is only normal.

Corporation Counsel Ellison has just rendered an opinion to the effect that the city of New York cannot grant a monopoly franchise to a telephone company. In the same opinion, which was sent to the Board of Estimates, he recites the fact that the city has in past years granted franchises to a number of telephone companies, and the fact that such rights have not been exercised is in no way conclusive that these old franchises are void. The opinion was in response to a request from the Board of Estimates as to the right of the city to grant the application of the Atlantic Telephone Company for a franchise to lay conduits and wires in the streets of the city for a new telephone service. Back of this request was the question whether or not the city should by franchise grants assist in maintaining a telephone monopoly. E. H. S.

New England.

Boston, Mass., June 8.—The New York, New Haven and Hartford Railroad Company is planning an extensive development of freight business on its electric railways in Rhode Island and Connecticut, including the distribution of heavy freight and coal to factories. The company will eventually consolidate its Rhode Island railways.

The Providence and Burrillville and the Columbian and Woonsocket street railway companies are to be merged with the Rhode Island company.

The Pawcatuck Valley Street Railway Company has been reorganized by a committee of the bondholders. The company operates an electric railway between Westerly and Watch Hill, R. I., and has a large summer patronage.

A bill allowing interurban electric-railway companies to build an elevated structure longitudinally in the public streets for sections where such construction might be required by the local authorities and the State Railroad Commissioners has been killed by the Massachusetts Legislature. This will affect the Boston, Lowell and Lawrence Electric Railroad Company which wishes to build such structures in Boston and Lowell.

The Universal Electric Pull Socket Company of New York city has filed an infringement suit against Harvey Hubbell of Bridgeport, Conn., in the United States Circuit Court in Hartford, Conn. The complainant charges an infringement of a patented improvement in incandescent lamp sockets and asks for an injunction. B.

Dominion of Canada.

Winnipeg, Man., June 8.—The Manitoba government has purchased a site at the corner of McDermot and Charlotte streets, Winnipeg, for $56,000 and will shortly call for tenders for the erection of a central telephone exchange for the government system to be erected in that city. Work will be commenced immediately on the construction of government systems in both Winnipeg and Brandon.

Magnus Peterson, secretary of the Winnipeg Civic Board of Control, will receive sealed tenders until noon, June 26th, for the supply of 100 arc lights and two regulators for the street-lighting system.

At a special meeting of the Fort William City Council it was decided to spend $36,000 for the extension of the municipal telephone system and $26,000 for electric-light improvements. Mayor Whalen can give particulars.

The Uxbridge & Scott Independent Telephone Company, recently organized, expects to serve the following villages in Ontario: Mount Albert, Sunderland, Stouffville, Markham and Claremont.

Capitalists of Port Maitland, Ont., are arranging for the construction of an electric railway across the Niagara peninsula to Beamsville.

The ratepayers of Regina, Sask., have voted to spend $60,000 for electric-light purposes. Mayor Smith can give particulars. R.

Indiana.

Indianapolis, June 8.—More than a hundred miles of interurban road will be opened for traffic in Indiana during the coming week. The lines to be put in operation are those connecting Indianapolis and Green Castle by the Terre Haute, Indianapolis and Eastern; Henryville and Scottsburgh by the Louisville, New Albany and Southern; Evansville and Rockport by the Evansville and Eastern; Logansport and Lafayette by the Fort Wayne and Wabash Valley; Indianapolis and Crawfordsville by the Indianapolis and Crawfordsville and Western Traction Compny, and the first section out of Laporte by the Chicago-New York Air Line.

The announcement is made that the United States Express Company has signed a contract with the Murdock interests whereby the express company will handle all express packages over the lines of the Murdock company in Northern Indiana. It is said that it will make a bid for all the interurban business of the state.

At Laporte on June 15th the running of the first cars on the first section of the track of the Chicago-New York Air Line will take place.

Because he thinks it is dangerous for city linemen to work so near wires that are highly charged, City Lineman Benjamin F. Hull has notified the owners of the Indianapolis, Columbus and Southern Traction line that a 10-foot extension will have to be made to the new poles which they have been placing in the streets of Columbus.

Ballasting is expected to commence on the Indianapolis, Newcastle and Toledo Traction line in the next few days and will be rushed as rapidly as possible.

The terminal station at Terre Haute of the Terre Haute, Indianapolis and Eastern Railway is promised within three years. It is said that $850,000 will be expended for permanent improvements and in the building of interurban lines, the terminal station and new equipment.

Through a schedule agreement between the Chicago, South Bend and Northern Indiana Railway Company, the Southern Michigan Railway Company of South Bend, and the Winona Electric Company of Warsaw, the interurbans will compete with steam lines for freight between St. Joseph, Mich., and Warsaw, Ind. A through service between the points will be established.

The new plant of the Maxwell-Briscoe Company at Newcastle will be one of the largest in the country. It will have a capacity of 5,000 automobiles annually, and will combine three plants now owned by the company in Chicago, Pawtucket, R. I., and Tarrytown, N. Y. The building, testing tracks, etc., will cover 60 acres and 2,000 men will be employed.

John and Hays Birch, foundrymen of Crawfordsville, have been granted letters patent on a gas engine. It is very simple, doing away with the cams, gears and shaft now in use, and can be made at less expense. A three-horsepower working model is on exhibition at their machine shop. S. S.

Ohio.

Toledo, June 15.—Preliminary survey work on the Toledo, Wabash and St. Louis electric road was started at Defiance last week and will be made west to Fort Wayne. The company is considering two routes, one via Hicksville and the other by way of Paulding.

The Everett-Moore syndicate is making plans for a fast trolley schedule between Cleveland and Detroit. Ten new cars have been ordered and will be run on a six-hour schedule when the line is completed. This will be one of the longest continuous trolley lines and one of the fastest in the world. The distance is 180 miles.

Many improvements will be made in the power plant of the Lake Shore Electric line in a short time. The company has received 25 cars of electric machinery and will distribute it at the various power stations on its line.

The telegraph office of the Erie Railroad at Mansfield was struck by lightning last week. Every fuse on the switchboard was burned out and the operator was badly shaken up.

Steps were taken last week toward the organization of a Toledo branch of the American Institute of Electrical Engineers. It is the aim of the organization to bring electrical engineers of this vicinity together at least once a month. W. C. Nagel was named as chairman and G. E. Kirk, secretary.

The Case Electric Company of Columbus is almost ready to ship two 75-ton electric cranes to Schenectady, N. Y., for the General Electric Company.

Lorain is having trouble with the old problem of electrolysis. Representatives of the Black River Telephone Company have gone before the Board of Service with rods, cables and guy posts, showing the effect of the grounded circuits of the two interurbans. It is understood that an effort is to be made to have the trolleys use return wires instead of grounded circuits. In the meantime an examination of the water pipes is being made.

Youngstown is still in the throes of a bitter telephone fight. So pronounced have the citizens become in their attitude against both companies, because of alleged poor service, that the matter has gone to the attorney-general of the state. The retail grocers have proposed to throw out both telephones in all the stores.

Rumors are current throughout the northern part of the state that the United States Express Company has about closed arrangements whereby it will handle all the express work on the trolleys in this section of the state.

The Toledo, Wabash and St. Louis Railway Company has begun the grading of the new Toledo-Defiance electric line between Neapolis and Maumee. The work will probably be finished by October. The company has only been incorporated about two months, but has made much progress. It is designed eventually to connect Toledo with St. Louis. S.

Illinois.

Peoria, June 8.—While the franchise of the Havana Electric Company does not expire until 1909, the city has gone on record as favoring municipal ownership.

The Northern Gas and Electric Company has been incorporated, with principal office in Chicago, to operate light, heat and power plants. The capital is $250,000. The incorporators are Leander D. Condee, Edward J. Kloss and Bertha G. Kuehn.

Attorney-general Stead has expressed an opinion that the Western Gas and Electric Company, a combination to take over the gas plants of Joliet, Aurora and some others in Northern Illinois, is a violator of the anti-trust laws of the state. In accordance with this advice, the state's attorney is preparing to bring suit to have the incorporation dissolved.

The Postal Telegraph Company is building a new line along the Alton's right-of-way from St. Louis to this city.

The Centralia and Sandoval Railway Company has been incorporated to build an electric railway from Centralia to Sandoval, parallel to the Illinois Central. The office is to be in Centralia. W. M. Warnock, George D. Burroughs of Edwardsville and others are the incorporators.

Work of constructing the electric railway from Hillsboro to Rochester will be commenced this week. When completed the line will be 53 miles long.

The Springfield, Beardstown and Quincy Railway Company has been incorporated with a capital of $25,000, the object being to build an interurban line from Springfield to Quincy, through Petersburgh, Chandlerville and Beardstown. The incorporators are Henry H. Colby, Robert B. Bone and Charles W. Houghton of Petersburgh.

At the meeting of the Citizens' Telephone Company of Pekin, Ill., steps were taken to merge the company with the Pekin Telephone Company. The directors of the Pekin Telephone Company have agreed to take $100,000 worth of stock of the Citizens' company. The companies now maintain exchanges in Havana and Manito, and have over 150 miles of toll line, most of which is copper. V. N.

Southeastern States.

Charlotte, N. C., June 8.—A suit involving the development of possibly 8,000 horsepower at Mountain Island, on the Catawba River, in North Carolina, has been decided in favor of the plaintiff, the Four C's Company of Charlotte, which purchased certain river rights on the Catawba River which the Catawba Power Company, controlled by the Southern Power Company, claimed as its property in part.

The Greensboro (N. C.) Electric Company has asked for an extension of franchise for 60 years in order to carry out extensive interurban developments, including systems in High Point and a line connecting Greensboro, High Point and Thomasville, these latter projects being practically controlled by the Greensboro company, which is completing the details of a sale of their interests to the Van Brunt Allen interests.

The stockholders of the Williamston (N. C.) Light and Power Company have completed the placing of orders for the lighting system to be installed shortly in that town.

The South Carolina Public Service Corporation, which has been seeking franchises in many towns in its scheme to cover the state with an electric-railway system, has reached Greenwood, S. C., in its requests for perpetual franchises for an interurban line and for a limited franchise for a local system. The matter has not been determined by the Town Council.

The Bradshaw Electrical Company has been chartered at Charlotte, N. C., with $50,000 capital to do a general supply business.

The new interurban line of the Anderson (S. C.) Traction Company to Belton, S. C., will be in operation by the 1st of July, it is stated.

F. S. Birtwhistle, formerly president of the Raleigh (N. C.) Construction Company, has opened an office as consulting electrical engineer in Raleigh. L.

Northwestern States.

Minneapolis, June 8.—Under a decision filed by the Minnesota Supreme Court reecntly the interurban lines of the Twin City Rapid Transit Company are defined as common carriers, having the right of eminent domain and not subject to the franchise powers of incorporated cities and villages. The case came from the District Court of Hennepin County, where the case was decided otherwise. The Minneapolis and St. Paul Suburban Railway Company will be thus enabled to extend its line from Excelsior, Minn., to Tonka Bay at once.

A. C. Volk of Duluth, Minn., has announced his intention of building a street-railway line from that city to West Duluth.

It has been announced that C. C. Goodrich, vice-president of the Twin City Rapid Transit Company, is interested in the Mesaba Traction Company, which proposes to construct an electric line connecting the various towns on the iron range in Northern Minnesota. R.

The Omaha and Council Bluffs Street Railway Company has purchased a site for its new car barns. The building will be 150 by 450 feet and will cost $70,000.

Judge Lochren of the Federal District Court has appointed E. L. Hospes receiver of the Stillwater Gas and Electric Light Company. The property will not be sold, but the receiver will continue the business. The company on January 1st defaulted in the payment of the interest due on $150,000 of its bonds.

The Menominee (Mich.) Insulated Electric Wire Company has been incorporated with a capital of $100,000. Henry Tideman is president.

The Sioux Falls Light and Power Company of Sioux Falls, S. D., has been organized with a capital of $750,000. E. W. Coughren is president and Fred Reed, secretary.

The Biwabik Mining Company has made a proposition to the council of Biwabik, Minn., to furnish electric lighting for that city.

Bids have been taken at Spring Grove, Minn., for extensive improvements on the municipal lighting plant and for additional machinery.

The Chicago and Northwestern Railway Company is said to be investigating the possibility of developing waterpower at Glendale, Wis., for use as auxiliary power in hauling trains over the heavy grades between Kendall and Sparta.

The new interurban line between Des Moines and Boone, Iowa, has been placed in operation.

C. C. Cokefair of Duluth, Minn., president of the Mississippi River Electric Power Company, has disposed of his large holdings in that concern to Archibald S. White of New York. The plans, as outlined by Mr. Cokefair, provided for the development of about 60,000 horsepower between Elk River and St. Cloud, Minn. It is not announced what Mr. White's plans in the matter are.

Contracts for the construction of a two-story brick transformation plant for the Omaha (Neb.) Electric Light and Power Company have been let. R.

Mexico.

Mexico City, May 22.—The Mexican government has granted the application of the Batopilas Mining Company of Batopilas, state of Chihuahua, for a concession to install a hydro-electric plant at Los Algodones, on the Batopilas River. A transmission line will be built from the plant to the mines and smelter of the company at Batopilas.

The Compania Hidro-Electrica San Agustin, which was recently organized at Puebla, Mexico, with a capital stock of $1,000,000, will install a hydro-electric plant and furnish the city of Puebla with light and power. Fernando Pimentel y Fagoaga is president of the company.

It is announced that the Compania de Tranvias, luz y Fuerza of Guadalajara will build a transmission line from Guadalajara to Aguascalientes, a distance of about 125 miles. It will dispose of about 5,000 horsepower in that city. The company has a capital stock of $11,000,000. Andres Bermejillo of Mexico City has been elected president of the company. W. D. H.

Pacific Slope.

San Francisco, June 5.—The strike situation this week has been enlivened by the walkout of the members of the Outside Electrical Workers' Union No. 151, in sympathy with the striking telephone operators, several hundred of whom have been on strike for the last month. In striking, the union violated its agreement with the Pacific Telephone and Telegraph Company, for which about 500 of its members were working.

The United Railroads is gradually improving its service in San Francisco and is now running about 240 cars from 6 a. m. till 9 p. m., without very serious trouble.

The supervisors of San Francisco have amended the budget in order to block any attempt at stopping the appropriation of $720,000 of next year's revenue for the reconstruction of the Geary Street railroad into a municipal electric line.

The Nevada Transit Company and the Harris-Gignoux Railway Company are battling over a right-of-way on Sierra Street, Reno, Nev. The directors of the latter company assert that they will force the Nevada Transit Company to allow it to run cars on the portion of Sierra Street in question. The Nevada Transit Company already had a franchise on Sierra Street and refuses to permit the holders of the newer franchise to build along the street.

Sealed bids will be received by the Board of Trustees of St. Helena, Cal., up to July 9, 1907, for the sale of a franchise that has been applied for by Henry Brown to erect and maintain for a period of 50 years an electric transmission system for light, heat and power purposes along the streets of St. Helena.

An ordinance has been passed by the Board of Trustees of St. Helena, Cal., granting Harry W. Pittman of Calistoga, Cal., a franchise to construct and operate an electric-light and power line. Mr. Pittman is given four months in which to begin work and 24 months in which to complete the system.

The Mono Power Company will erect a power plant on the Owens River, whence an electric transmission line, about 100 miles long, will extend into the Nevada mining camps. Edson F. Adams of Oakland, Cal., and his associates in the company have already expended about $25,000 in the preliminary work.

W. J. Ludlow has applied for a franchise for an electric transmission system along the streets of Napa, Cal.

It is announced that arrangements have been completed for the extension of an electric transmission line from the Fremont (Ore.) power plant to the Greenhorn district. Work will be commenced this summer, after the line is completed to Borne, Ore.

The Eagle River Electric Power Company will this summer install a power plant at the Sanger mine, near Baker City, Ore., with a capacity of 1,200 horsepower.

The Washington State Board of Control has called for bids for an 85-horsepower electric motor and a 3,000-gallon pump for the Eastern Washington Hospital for the Insane at Medical Lake, Wash.

The Cascade Reservoir, Irrigation and Power Company has been incorporated by A. C. Woodcock, A. R. Black and Dr. T. W. Harris of Eugene, Ore., with a capital stock of $150,000 for the purpose of constructing and operating reservoirs, canals, power plants, electric transmission lines, etc.

I. N. Smith of Lewiston, Idaho, attorney for the Chicago, Milwaukee and St. Paul Railroad Company, has made application for water rights in the St. Joe River and its tributaries. The plans contemplate the construction of 16 dams. The power to be developed is supposedly to be used by the railroad company in operating its trains over the Bitter Root Mountains. The dams, exclusive of the necessary power plants, will cost $923,000. Five years will be required for the completion of the work, it is estimated.

B. F. Howard, owner of the Junction City (Ore.) electric-lighting plant, has filed a notice of appropriation of the waters of Bear Creek for generating power for the operation of an electric plant, the site being about eight miles from Junction City. A.

PERSONAL.

William B. Jackson, the well-known electrical engineer of Madison, Wis., was in Chicago this week.

Arthur D. Mackie, who is in charge of the new-business and advertising department of the Peoria Gas and Electric Company, was recently married to Miss Savilla Holmes of St. Louis.

W. W. Street succeeds Thomas Woods as superintendent of transportation of the Illinois Traction Company. Mr. Street, who was superintendent of the Tri-City lines and East St. Louis terminals, will be succeeded by C. W. Cain.

Fred S. Hunting, sales manager of the Fort Wayne Electric Works, Fort Wayne, Ind., was married on June 10th to Miss Elma Pearl Balthis, daughter of Mr. and Mrs. William Balthis of Chicago. On account of illness in the family of the bride the wedding was quietly conducted, only the family being present.

At a special meeting of the directors of the Joseph Dixon Crucible Company, Jersey City, N. J., held on May 31st, to take action on the death of Vice-president and Treasurer John A. Walker, George T. Smith was elected vice-president, and George E. Long treasurer. Harry Dailey was elected director and secretary of the company.

The French Academy of Sciences has elected M. Le Chatelier, an electrician and physicist of note, to the place left vacant by the death of M. Henri Moissan in the chemical section. M. Le Chatelier is best known by his work in the field of pyrometry and he has invented certain instruments for the measurement of high temperatures. The academy has also named M. Darboux, an eminent physicist, as the candidate it will present for the place left vacant in the Institute by M. Berthelot.

ELECTRIC LIGHTING.

E. B. Hillman has asked the town of Sidney, Iowa, for a franchise for an electric-lighting plant.

The Home Light, Water and Ice Company of Blooming Grove, Tex., has been capitalized at $30,000.

The San Francisco Gas and Electric Company has ordered a 5,000-kilowatt three-phase generating unit for its main power station in the Potrero district. It consists of a Curtis steam turbine and a General Electric 11,000-volt generator. It is understood that one of the present 1,500-kilowatt units will be removed from the station and rebuilt for use in the Pacific Gas and Electric Company's new 3,000-horsepower steam relay plant at Petaluma. An additional 500-horsepower exciter will be installed in the Potrero station, making the net gain in generating capacity by the changes about 3,000 kilowatts.

A mortgage deed of trust for $7,500,000 from the Baltimore Electric Company to the Northern Trust Company of Philadelphia has been filed. It conveys all the land and property, including plants and all equipment, franchises and all the income and profits of the Baltimore concern to the Philadelphia corporation in trust. The deed also includes the bonds of the Maryland Telephone and Telegraph Company. This transaction completes the plan of consolidation and capitalization of the Baltimore Electric Company, which recently was formed by the merging of the Baltimore Electric Power Company and the Maryland Telephone and Telegraph Company.

ELECTRIC RAILWAYS.

The Ithaca-Owego Traction Company of Ithaca, N. Y., has been incorporated for $400,000 to operate a 40-mile electric railway between these cities. The incorporators include George R. Peck, H. S. Finch and S. E. Banks.

Dodge & Day, engineers and constructors, Philadelphia, Pa., have commenced work on an extension of the York (Pa.) street-railway system from York to Hanover. They have a large force of men working and rapid progress is being made.

Federal Judge Kohlsaat on June 10th dismissed the bill of complaint against the Chicago and New York Electric Air Line Company. This disposes of the receivership proceedings and allows the affairs of the company to remain in the hands of officers who have been managing the road up to the present time.

A petition opposing the confirmation of the sale of the Toledo (Ohio) Railways and Terminal Company was filed in the United States Circuit Court at Toledo on June 5th. It alleges that J. Pierpont Morgan and his allies in banking and railroad circles entered into a conspiracy at the time the terminal road was sold and that a committee representing the bondholders bought the road at the set price of $2,000,000. It further charges that the

creditors were prevented from holding on the road by a prearranged plan of Morgan and his allies.

The Supreme Court of Illinois has refused a petition for a rehearing of the Mueller certificate case. The ordinance providing for the issuing of $75,000,000 of certificates under the Mueller law, which certificates were to have furnished the money with which the city of Chicago could purchase the street railways, had previously been declared invalid. This ends the Mueller certificate case.

Charles N. Wilson, president American Engineering Company, Indianapolis, Ind., is the author of a series of articles on the building and development of electric railways in the Central West, now being sent out in booklet form. "Electric Railroads as a Factor in Twentieth Century Transportation" and "Why Forty-nine Projected Electric Roads Fail and the Fiftieth Succeeds" are the titles of two of them.

PUBLICATIONS.

R. G. Dun & Co., 290 Broadway, New York city, have issued a special Cuban number for June of Dun's International Review. All of the articles contained therein have been prepared by prominent Cuban business men, and as a whole it gives a good idea of the present commercial situation of the island from the Cuban viewpoint.

The J. R. Almond Manufacturing Company, 83 Washington Street, Brooklyn, N. Y., is sending out a catalogue in which are illustrated and described drill chucks, right-angle transmission, turret heads, flexible arms for electric lights and flexible steel tubing, all of "Almond" design and manufacture. The right-angle transmission is a self-contained device designed for use wherever it is desirable to transmit power at right angles. The "Almond" Flexo desk lamp is also described.

The Rockwell Engineering Company, 26 Cortland Street, New York city, is sending to the trade bulletins Nos. 10 and 11, describing Rockwell rod-heating and bolt-heating furnaces, respectively, for oil or gas fuel. The Rockwell rod-heating furnace is for making long heats on stock from three-eighths inch to four inches in diameter for cutting off, and is used in the manufacture of rivets, nuts, spikes, etc. The bolt-heating furnace is used for making short heats on round or square stock for upsetting, cutting off, etc.

The Nernst Lamp Company, Pittsburg, is sending to the trade, besides its regular monthly publication, "The Glower," two interesting booklets entitled "Electric Lighting in the Department Store" and "A Departure in Office Buildings." In the booklet on department-store lighting it is stated that "for the sake of appearance and economy a system should be selected that comes in units of various sizes, so that the light in all the different departments, including the display windows, may be uniform. Color, quality, quantity, arrangement, distribution and diffusion, all in turn claim attention." The merits of the Nernst lamp for department-store illumination are treated at length, several illustrations being given of the lighting of various stores by these lamps. In the booklet entitled "A Departure in Office Buildings" details are given of the lighting and other equipment of the new administration building of the Larkin Company in Buffalo, a building of which it is said scarcely any other in America shows more careful thought upon the part of the builders. The standard lighting arrangement of the building consists of 88 three-glower lamps in ceiling, fixtures for each floor, Holophane spheres being employed.

Bulletin No. 1513, issued by Allis-Chalmers Company, describes the Christensen portable air compressor. The equipment consists of the following parts: Motor-driven compressor, automatic governor, switch and fuse, reservoir, air gauge and short connection pipe, hose and fittings. The entire apparatus is mounted on an ordinary four-wheel platform truck. The motor operating the compressor is of the series type and is designed for any standard voltage required. It is so constructed that the armature and fields may be removed, if necessary, without disturbing any other parts of the machine. The motor can be put in operation or stopped without the use of resistance, simply by closing or breaking the circuit in the same manner as with a knife switch. The compressors are furnished for capacities of 11, 16, 20 and 50 cubic feet of free air per minute. Each compressor will withstand a working pressure of 100 pounds to the square inch.

SOCIETIES AND SCHOOLS.

Bion J. Arnold delivered the annual college address at the eleventh annual commencement of the College of Engineering, Armour Institute of Technology, Chicago, on June 13th.

The April bulletin of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., contains the calendar for 1907-1908. The four-year courses in engineering afford preparation for those who intend to engage in the professions of electrical, mechanical, chemical or civil engineering.

Last week was commencement week at the Massachusetts Institute of Technology, and 225 seniors received their degrees. Of these, 33 were electrical engineers. Among the theses read was one on "A Plan for the Electrification of the Newton Circuit of the Boston and Albany Railroad," by James Mason Gaylord, B. S.

At the annual meeting of the New York Electrical Society, held in the Engineering Societies Building, on the evening of June 10th, the following-named officers were elected: President, Albert F. Ganz; vice-presidents, Augustus Post, Theodore Beran and W. L. Conwell; secretary, George H. Guy; treasurer, H. A. Sinclair. The society now has a membership list of 831. After the election Dr. William H. Tolman, director of the American Museum of Safety Devices and Industrial Hygiene, delivered a most interesting lecture on "Safety and Security for American Life and Labor," illustrated with lantern slides.

The investigating committee of the municipal ownership commission appointed by the National Civic Federation in October, 1905, completed its report at a meeting in New York on June 10th. Before it is given to the public the report will be submitted to the full commission, probably by July 1st. The report will cover the four leading public utilities—gas, water, electric lighting, and power and street railways. Twenty-nine private and public plants were visited in cities of the United States and 24 in Great Britain and Ireland. Both the popular and technical sides of the question will be reported on in detail.

TRADE NEWS.

The Addison W. Brown Electric Company of Brooklyn, N. Y., has been incorporated for $10,000.

Dodge & Day, engineers and constructors, whose main offices are in the Drexel Building, Philadelphia, have extended their business by opening an office in the United States Realty Building, 115 Broadway, New York, which has been placed in charge of Mr. Robert T. Lozier, who has for some years past been prominently connected with electrical industries. The new office has already closed contracts for several industrial and public utility plants.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 p. m. on the 15th day of July for an extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, to the United States postoffice and custom house at Sheboygan, Wis., in accordance with drawings and specification, copies of which may be had at the office named or at the office of the custodian at Sheboygan.

Harry H. Gerhard, manager of the C. A. Manufacturing Company of Austin, Tex., maker of the C. A. wood preserver, was in Chicago this week. Mr. Gerhard made arrangements with George H. Erich, 358 Dearborn Street, Chicago, to represent the company in Chicago and vicinity. The C. A. Manufacturing Company's product is used by many of the electric-light, telephone and telegraph companies in the West, and the company's list of customers is constantly on the increase. The appointment of Mr. Erich, it is predicted, will result in a substantial list of new customers in his territory.

BUSINESS.

The Electric Machinery Company, Minneapolis, Minn., has just closed a contract with the Valdez Electric Light and Power Company of Valdez, Alaska, for one of its 150-kilowatt revolving-field alternators. The company has also closed a contract with the Cavite Electric Light and Power Company, Cavite, Philippine Islands, for a 150-kilowatt equipment, consisting of a three-phase revolving-field alternator of that capacity, together with engine, transformers, switchboard equipment, etc. The Electric Machinery Company has just established an agency in Japan and China.

A number of 20 and 30-horsepower 60-cycle three-phase 440-volt Allis-Chalmers induction motors have recently been purchased by Deer & Co., Moline, Ill., for use in its grinding shop, where mold boards, shares and other plow parts are ground. Each motor installed is arranged for a pulley on either end of the shaft, but the pulleys are left off and the shaft extended by coupling to it a piece of shaft about six feet long carrying pulley and having extra bearings. From each pulley is belted a grinding machine, each machine having two emery or carborundum wheels, as desired, for the special type of steel to be ground, making a total of four grinding wheels to each motor, allowing four men the service of one motor, which gives a group-drive effect.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 4, 1907.

855,440. Electrical Safety Device. Richard Apt, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 17, 1906.

Combined with a spark gap having electrodes is radioactive material in proximity thereto to ionize the space between the electrodes and to decrease the breakdown potential of the gap.

855,441. Cooling Jacket for Electric Furnace Electrodes. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company, a corporation of West Virginia. Application filed January 30, 1906.

In an electric furnace are an electrode, a support therefor, and a separate sectional cooling jacket surrounding the electrode, the jacket being longitudinally and independently adjustable upon the electrode and within the furnace.

855,449. Process of Ameliorating Wines and Spirits and of Sterilizing Liquids. Victor Dorn, Wilmersdorf, near Berlin, Germany. Application filed April 25, 1904.

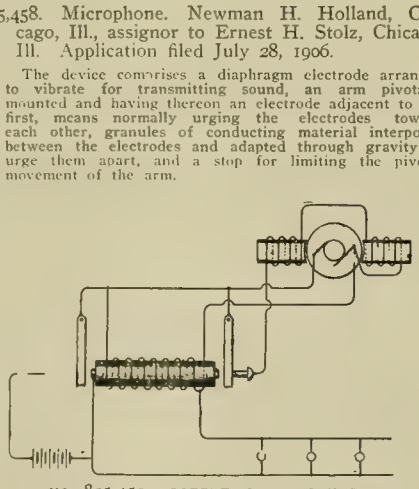
The process of sterilizing and aging liquids consists in saturating the liquid with oxygen and simultaneously passing an electric spark through the liquid.

855,450. Potential Regulator. James H. Duncan, St. Louis, Mo., assignor of one-half to James W. Kaye, St. Louis, Mo. Application filed March 22, 1906.

In combination with a generator armature and a field circuit for an armature circuit, a translating device adapted to be connected with the armature, means actuated by a current of lower potential in the armature circuit for governing the supply of current to the translating devices, and means actuated by a current of higher potential in the armature circuit for governing the current in the field circuit. (See cut.)

855,458. Microphone. Newman H. Holland, Chicago, Ill., assignor to Ernest H. Stolz, Chicago, Ill. Application filed July 28, 1906.

The device comprises a diaphragm electrode arranged to vibrate for transmitting sound, an arm pivotally mounted and having thereon an electrode adjacent to the first, means normally urging the electrodes toward each other, granules of conducting material interposed between the electrodes and adapted through gravity to urge them apart, and a stop for limiting the pivotal movement of the arm.



NO. 855,450.—POTENTIAL REGULATOR.

855,470. Motor-controlling Device. Carl Mittelstrass, Hermsdorf, and Albrecht Frank, Berlin, Germany, assignors to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1906.

Combined with an electric motor circuit are means for controlling the same, comprising an impedance, an auxiliary motor for varying the same, and electrically controlled means for automatically changing the connections of the motor upon the failure of voltage so as to reverse the same upon the return of voltage.

855,471. Insulated Stud and Method of Making the Same. Edgar W. Mix, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1906.

A two-part metal insulating stud and the method of making it are described.

855,476. Process of Producing Calcium Carbide. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed November 14, 1905.

The process consists in smelting the charge by an electrically heated resistance-conductor, accumulating a body of carbide, a portion of the body lying within a movable receptacle and a portion within the smelting chamber, and shifting the receptacle and thereby withdrawing its contents from the portion remaining in the furnace.

855,477. Process of Producing Calcium Carbide. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed November 14, 1905.

A method is described which consists in smelting the charge by an electric arc, and continuing the process described in patent 855,476.

855,478. Process of Smelting Refractory Ores and Producing Ferro Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

The process is similar to that mentioned in patent 855,476.

855,479. Process of Smelting Refractory Ores and Producing Ferro Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

The method employed is similar to that described in patent 855,476. In producing ferrosilicon a charge of silica, carbon and a source of iron is smelted according to that method.

855,480. Electric-resistance Furnace. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

The furnace described comprises a smelting chamber having a discharge opening, means for heating the chamber by passing an electric current through the charge, serving as a resistance-conductor, and a number of abutting receptacles movable across the discharge opening and arranged to retain a molten body within the chamber.

855,484. Constant-current Generator. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 7, 1905.

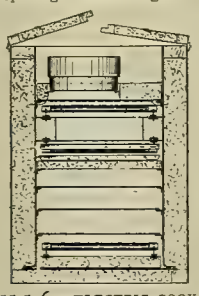
In a constant-current generator are field and armature structures arranged with a small air-gap, distributed field and armature windings carried in slots in the structures, a commutator connected to the armature winding, and brushes arranged on the commutator on a line making an angle of less than forty-five electrical degrees with the line of field magnetization and connected to the load circuit, the generator being arranged to be saturated at normal load.

855,485. Constant-current Generator. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 7, 1905.

In a constant-current generator are a number of armature windings of the open-coil type, a number of sets of series transformers revolving with the armature, each of the armature coils being connected in closed circuit through the primaries of one transformer of each set, and a number of rectifying commutators revolving with the armature and connected respectively to the secondaries of the several sets of transformers.

855,492. Conduit for Electric Railways. John S. Alexander, New York, N. Y. Application filed March 14, 1904.

Combined are a conductor conduit or carrier composed of upper and lower members detachably connected together, a conductor contained within the conduit, and an interposed insulator also comprising upper and lower members, the lower member being so formed as to provide drainage openings therethrough.



NO.—855,536.—ELECTRIC COOK STOVE.

855,494. Electrical Switch. James P. Appleby, Hopkins, Minn. Application filed April 3, 1905.

Combined with leads having terminal contacts are a switch-lever and a sliding-contact plate and having engaging parts co-operatively arranged to close and break the circuit between the contacts, and a key-operated lock having a tumbler arranged to move the sliding plate into an inoperative or circuit-breaking position, and to lock the same in such position, and which contact-plate, in turn, operates on the switch-lever, to force the same into an inoperative position and to lock the same.

855,513. Reciprocating Electric Motor. Ronald P. Irving, Quincy, Mass. Application filed November 21, 1906.

In combination are a solenoid comprising a number of helices, a core adapted to reciprocate therethrough, a source of electrical-current means interposed between the source of electrical current and the helices adapted to limit the magnetic field of the solenoid to a predetermined number of the helices, and mechanism to actuate the means to move the magnetic field longitudinally of the solenoid.

855,531. Gas-lighter Attachment. William Roche, Jersey City, N. J. Application filed September 21, 1906.

In a gas-lighter attachment for use with dry-cell batteries are a lighting device, a circuit therefor and means for detachably connecting the terminals thereof with the electrodes of the battery comprising a split band or ring for one terminal adapted to encircle the battery cell and provided with manually operable circuit-closing means.

855,536. Electric Cooking Stove. David C. Smith, Kalgoorlie, Western Australia, Australia. Application filed August 11, 1906.

The stove comprises inner and outer walls, wooden frames covered with insulating material located between the walls and heat non-conducting material between the walls. (See cut.)

855,545. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed December 16, 1904.

In the system described, combined with a metallic telephone line extending from a substation to the exchange are a central source of current, a connection terminal having contact-pieces associated with the limbs of the line, and a third contact-piece adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with the terminal, a differentially-wound electromagnet having a winding associated with the line, switching mechanism controlled thereby adapted to connect the third contact-piece with a limb of the line, and testing means whereby the operator may determine such connected condition, and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

855,546. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed December 16, 1904.

Combined with a metallic telephone line are a talking contact forming a part of a connection terminal for the line, the contact being normally connected to earth, a central source of current associated with the line and adapted to be included in the metallic circuit of the line when a connection exists to furnish current to the substation transmitters for talking purposes, means for establishing a direct earth connection intermediate the contact and its associate line limb when the line is not in use, means operated by current from the source to connect the contact directly with the line when the line is in use and testing apparatus to co-operate with the contact to indicate the condition of the line.

855,550. Electric Switch Box. William R. Atkinson, New York, N. Y. Application filed July 16, 1906.

The box described has the opposite side portions formed separately and detachably connected therewith, the portions being provided at their inner ends with recesses or openings.

855,601. Electric-railway Switch. Edward F. Winfield, Los Angeles, Cal., assignor to Jacob Baum, Los Angeles, Cal., trustee. Application filed July 7, 1903.

In the switch described are electromagnetic means for closing the switch, means for causing the electromagnetic means to close the switch when the car is at a definite point from the switch, and means intermediate of the point and the switch for causing the switch to open when the car takes more than a definite amount of the electric current.

855,623. Motor Control. Henry B. Emerson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1906.

In combination with a load to be driven are two variable-speed electric motors, a differential gear having two of its members connected to the motors respectively and its third member to the load and arranged to give a load-speed of zero when one motor is operating at its maximum and the other at its minimum speed, and an electrically controlled brake for one of the gear members.

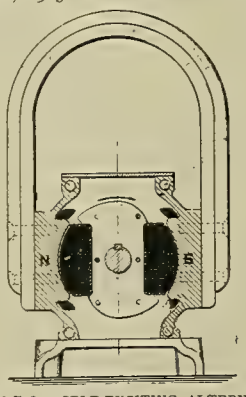
855,667. Process of Electrolytically Removing Scale and Producing Iron Sulphate. Charles J. Reed, Philadelphia, Pa. Application filed June 18, 1906.

The process of electrolytically dissolving iron-oxide scale from the surface of metal, consists in passing an electric current to the metal, as cathode, in an electrolyte consisting of a strong aqueous solution of sulphuric acid and containing a substance capable of yielding sulphuric acid by oxidation.

855,711. Automatic Stop for Automobiles. Charles O. Lambert, Bridgeport, Conn., assignor to the Electric Vehicle Company, Hartford, Conn. Application filed February 27, 1900.

In an automobile are a contact through which electric energy passes for the propulsion of the vehicle, a movable-switch member co-operating with the contact, a movable seat on the vehicle operated by the weight of the occupant normally holding the movable contact member in position to close the electrical circuit, and means co-operating with the movable part to automatically move the contact member and apply the brake.

855,713. Self-exciting Alternator. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company, a corporation of New York. Application filed December 11, 1905.



NO. 855,713.—SELF-EXCITING ALTERNATOR.

A partially self-exciting alternator has a permanent magnetic field, polar projections of soft iron adjacent to the magnetic poles developed by the field, a rotor having dissymmetric polar faces adapted to rotate in close proximity to the poles, a winding on the rotor, auxiliary coils wound around the soft iron polar projections, the coils being connected in series with each other and in shunt with the rotor winding, whereby the waves of the alternating current generated which have a magnetizing effect on the permanent magnetic field reach a higher value than those which have a de-magnetizing effect on the field and the magnetizing effect being increased by the location of the auxiliary windings in the magnetic circuit. (See cut.)

855,723. Electric Regulating Device. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed July 10, 1905.

In a potential regulator are combined a regulating device, a constant-potential circuit, a motor on the circuit having contacts in series therewith and operating the regulating device at a voltage lower than that of the circuit by an amount compensating for contact resistance, and a magnet on the circuit responding to the potential thereof and operating the contacts.

855,727. Electric Signaling System. Edward L. Orcutt and Richard Sheldon, New York, N. Y., assignors to the Railway Electric Signal Company, a corporation of New Jersey. Application filed September 1, 1906.

Combined are a signal, an operating circuit therefor, a controlling circuit therefor, including a controller for the operating circuit, a controller for the controlling circuit, a circuit-breaking train contact and a controller circuit-closer in the controlling circuit.

855,729. Electric Bell. Marcus Plato, London, England, assignor of one-half to Arthur William Macleod, London, England. Application filed October 6, 1904.

The device comprises a supporting frame, a trembling mechanism attached thereto and including among its members an electromaguet and a movable armature therefor, a bell supported by the frame, a counter-balanced hammer pivotally supported by the frame adjacent to the edge of the bell and a link connecting the hammer with the movable armature of the trembling mechanism.

855,738. Electrode for Arc Lamps. Samuel P. Wilbur, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 6, 1902.

In an arc lamp are a pair of electrodes, one of which is adapted to make contact with the other, both electrodes being composed of carbon mixed with a substance adapted to produce a slag during the operation of the lamp, in combination with projections of carbon, the projections being in line with each other on adjacent faces of the electrodes.

855,805. Governor for Electric Motors. Alphonse F. Pieper, Rochester, N. Y. Application filed September 16, 1904.

In combination with an electric motor comprising a field, an armature, an armature shaft and a supply circuit leading to the motor, are two insulated plates arranged on the shaft, contact brushes engaging the separate plates and arranged in the supply circuit, a movable member supported on one of the plates and a contact point carried by the member and normally engaging the other plate.

855,877. Commutator Grinder. Ellsworth S. Bryant and Henry J. Bery, Detroit, Mich. Application filed April 7, 1906.

Combined are a number of parallel rods rigidly connected together, means for securing the same to an electric machine, guide rods mounted at right angles to the first, frames movably mounted on the guide rods, bearing rollers mounted on the frames, a sleeve longitudinally movable on the rollers, and grinding means mounted in the sleeve.

855,880. Battery. Bertram B. Downs, St. Paul, Minn. Application filed April 2, 1906.

The battery is formed of dry cells suitably connected and having their outer electrodes separated from each other. A suitable inclosure is common to all of the cells. There is a layer of solid insulating compound in the inclosure on which the cells rest. A solid insulating compound adapted to melt at a lower temperature than the layer covers the cells and their connections.

855,881. Apparatus for Doubling Cloth, etc. John Fish, Manchester, England. Application filed March 16, 1906.

Apparatus for accurately guiding and controlling the passage of cloth for the purpose of doubling it comprises a triangular frame over which the cloth passes and is folded, and electromagnetic means controlled by the cloth.

855,892. Means for Operating the Valves of Motive-power Engines. Ramsey Kendal, Darlington, England, assignor of one-half to J. Stone & Co., Limited, Deptford, England. Application filed September 18, 1905.

A valve gear for motive power engines comprises in part a number of inlet valves, a number of exhaust valves, a number of electromagnets each operatively connected with its respective inlet valve, a number of electromagnets each operatively connected with its respective exhaust valve, sliding-contact breakers for engaging contact devices for the inlet valves, non-sliding contact breakers for engaging various other contact devices, and means for alternately connecting supply devices with a source of electric energy.

855,895. Method of Separating Minerals. Adolphe F. Kirschner, Pittsburg, Pa. Application filed January 17, 1907.

The process described for separating minerals from their ores consists in charging an air-tight chamber with a gaseous medium having a lower permeability than atmospheric air, suspending the ore within the charged chamber, and subjecting the ore while in suspension to electromagnetic action.

855,897. Controller for Electric Motors and Similar Devices. Harry W. Leonard, Bronxville, N. Y. Application filed July 11, 1903.

In combination are a motor having a field winding energized independently of its armature current, controlling means for varying the effective electromotive force on the motor armature, independently movable correlated means for varying the effective electromotive force on the field winding, and means for protecting the motor armature against no-voltage and against overload-current.

855,911. Telephone Receiver. Kelley M. Turner, New York, N. Y., assignor to the General Acoustic Company, a corporation of New York. Application filed February 5, 1907.

In a telephone receiver having two bobbins each sectionally wound with corresponding leads extending from the respective bobbins are a circuit controller having two rows of contacts respectively connected with the leads, a pair of spring blades adapted to make contact simultaneously with a pair of corresponding contacts of the respective rows, and means projecting through the casing of the receiver for angularly moving the blades to make connection with different pairs of contacts, whereby the number of turns in the telephone circuit of the two bobbins is simultaneously varied, and the sensitiveness of the receiver also varied.

855,926. Globe Closure for Electric Arc Lamps. Ernest Bonnet, St. Croix, Switzerland, assignor to Mermod Frères, St. Croix, Switzerland. Application filed December 18, 1906.

The globe has a single opening, the edges of which are adapted to engage the lamp body. Outwardly ex-

tending projections are carried adjacent to the opening and are adapted to be engaged by the central portions of a number of spiral springs having both ends connected with the body of the lamp.

855,930. Safety Device for Gas Burners. Arthur A. Churchill, Portland, Ore. Application filed July 18, 1906.

A combined thermostat and smoke bell comprises a conical plate adapted to be flattened by an increase in temperature, and electrical contacts adapted to be separated as the cone flatten.

855,966. Electric Signaling Device. Edward L. Orcutt, New York, N. Y., assignor to the Railway Safety Signal Company, a corporation of New Jersey. Application filed September 1, 1906.

In an electric signaling system for railways are combined a track circuit, including both rails of the track, a transformer and a magnet arranged to be shunted by a passing train, a supply circuit including the transformer, a generator on a train arranged to be connected with the supply circuit to energize the transformer, a number of track signals controlled by the magnet of the track circuit, a train signal, and means operated by the track circuit for controlling the train signal.

855,967. Electric Signaling Device. Edward L. Orcutt, New York, N. Y., assignor to the Railway Safety Signal Company, a corporation of New Jersey. Application filed September 1, 1906.

The device is similar to that described in patent 855,966.

855,968. Electric Signaling Device. Edward L. Orcutt, New York, N. Y., assignor to the Railway Safety Signal Company, a corporation of New Jersey. Application filed September 1, 1906.

Details are similar to those enumerated under patent 855,966.

855,071. Railway Signal. Charles C. Phillips, Owensboro, Ky. Application filed August 6, 1906.

A signaling system comprises a pair of normally open circuits, a pair of independently movable signaling blades included respectively in the circuits, magnet-controlled means for holding the members in normal position, track devices for closing the circuits to energize separately the magnets and release the blades, a normally open duplex lamp circuit adapted to be closed through the medium of either of the blades when released, a third open circuit including magnets for resetting the blades, and track devices for closing the third circuit.

855,972. Controller for Electric Motors. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed December 1, 1903. Renewed November 26, 1906.

Combined with a multiple-voltage system are a motor, a controller arranged to connect the armature of the motor across different sets of the mains of the system, a resistance in the circuit of the armature, and a switch separate from the controller but controlled thereby and in shunt to said resistance.

855,973. Mechanical Movement. Joseph Y. Porter, Detroit, Mich. Application filed May 21, 1906.

In a safety appliance for electrically actuated solenoids, in combination with a member adapted to be actuated, are an electric motor for actuating the same, a safety switch adapted to be brought into action by the actuated part at the close of its stroke, and means for retaining the actuated member at its assumed position.

855,985. Conduit. George Russell, McKeesport, Pa. Application filed August 22, 1906.

A conduit for electric wires comprises a metal pipe having a thin, flexible, sheet-metal lining secured within the same and a flexible enamel coating on the inner surface of the lining.

855,991. Process of Making Storage-battery Plates. William L. Silvey, Dayton, Ohio. Application filed April 2, 1906.

The process consists in providing a battery grid and a perforated sheet, putting them in contact in parallel relation, and pressing the sheet by a platen of rubber or equivalent material into the openings of the grid and thereby fixing the grid and perforated sheet in contact and operative situation.

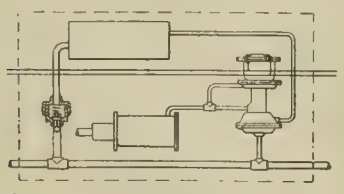
855,996. Spark-producing Mechanism for Explosive Engines. Lorenzo D. Stamps, Anahuac, Tex., assignor to himself and John W. Hamilton, Anahuac, Tex. Application filed March 6, 1906.

Combined with a dynamo provided with an armature are a sparking circuit connected with the dynamo and with an engine, a revoluble member also connected with the engine for turning the armature of the dynamo, clutch mechanism controllable at will for disconnecting the armature from the revoluble member, auxiliary means for turning the armature, gearing connecting the auxiliary means with the armature, and means controllable at will for disconnecting the gearing.

856,007. Jeweled Bearing for Electrical and Other Instruments. John Wennstrom, Suffern, N. Y. Application filed February 7, 1907.

The bearing comprises a hollow screw with a jewel stub removably held in the mouth of the screw, and a supporting spring, the screw having means for frictionally holding the stub in place.

856,010. Electro-pneumatic Braking Device for Railway Cars. Ragnar Wikander, Westeras, Sweden. Application filed December 26, 1906.



NO. 856,010.—ELECTRO-PNEUMATIC BRAKE FOR RAILWAY CARS.

An air-brake-apparatus for electric railway-cars, and the like, in which the brakes are applied or released by means of the variable air pressure in a train-pipe or by means of an electric controlling-current is characterized by the fact that the valve-body, which controls the communication between an auxiliary reservoir and the braking-cylinder and between the latter and the atmosphere, is controlled both by the train-pipe and by the electric circuit in such a manner that the displacing of the valve-body into desired positions may be accomplished by changing either the pressure in the train-pipe or the strength of current in the controlling circuit or both simultaneously. (See cut.)

856,012. Means of Testing Insulated Wires. Newton A. Wolcott, Warren, Ohio, assignor to the Packard Electric Company, Warren, Ohio. Application filed May 5, 1906.

An insulated cable-tester has two dielectric contacts and means for supplying an electric current to the contacts of such potentiality that the contacts in series are quiescent, either being thrown in circuit with the other through the core of a cable when an insufficiently insulated portion thereof engages such other contact.

856,054. Electrically Heated Stove. Fritz Gutjahr, Berlin, Germany. Application filed June 13, 1906.

Details are given of a heating device adapted to be electrically energized.

856,061. Electric Furnace. Aldus C. Higgins, Worcester, Mass. Application filed April 6, 1906.

The furnace comprises a chamber having exterior and interior walls, the walls being exposed on one side to the charge and on the other side to the atmosphere, electrodes oppositely disposed with respect to the interior walls, and means for cooling the interior walls.

856,071. Electric Signal. George Langlumé, New Orleans, La., assignor of one-half to Hyman Hirsch, New Orleans, La. Application filed October 6, 1906.

A signal is described in which a cup containing mercury is employed.

856,085. Electrical Cut-out. Philip T. McNally, Mandan, N. D. Application filed May 25, 1906.

The cut-out comprises solenoid with circuit contacts arranged in a main-line lead, a rack-bar attached to the plunger of the solenoid, a cut-in electromagnet operating the contacts of the solenoid, a local battery circuit for the cut-in magnet with circuit closer therein and a control electromagnet arranged to adjust the last-named circuit closer and having an individual circuit extending to the control station.

856,094. Electrical Signaling Device for Railroads. Edward L. Orcutt, New York, N. Y., assignor to the Railway Safety Signal Company, a corporation of New Jersey. Application filed October 13, 1905. Renewed September 1, 1906.

In an electric-signaling system are a track circuit, including a transformer, both rails of the track, a magnet and a track contact, the magnet and track contact being arranged in series, a supply circuit for the transformer, a generator on a train for the supply circuit, a number of track signals controlled by the magnet of the track circuit, a signal on the train, a magnet on the train controlling the train signal and contacts on the train connected with the magnet on the train and arranged to make connection with the track contact and one rail of the track.

856,095. Electric Semaphore. Edward L. Orcutt, New York, N. Y., assignor to the Railway Safety Signal Company, a corporation of New Jersey. Application filed September 1, 1906.

The semaphore described includes a number of permanently fixed arms mounted thereon and extending at different signaling positions, lamps giving different signaling colors on the arms corresponding in color to the signaling positions of the arms, an independent electric signal circuit entering each arm and containing the lamps on the arm it enters, a source of supply of electricity, and a switching device to switch the supply of electricity into any one of the signal circuits to light the lamps contained therein.

856,127. Rail Bond. James J. Brennan, Fort Wayne, Ind. Application filed September 24, 1906.

Details are described.

856,129. Machine for Basing Incandescent Lamps. William R. Burrows, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 11, 1906.

Means are provided for pressing the base of the machine to the bulb and there are devices for delivering cementing material.

856,132. Electric Burglar Alarm. Bert J. Cizkovsky, Chicago, Ill. Application filed August 22, 1906.

A circuit closer comprises a support, a binding post arranged upon the support, a shaft mounted for rocking movement upon the support, fixed arms carried by the support and designed for attachment to a fixed element, an arm carried by the shaft and designed for engagement with a movable element whereby the shaft will be rocked when the element is moved, and a contact finger carried by the shaft and designed to contact with the binding post.

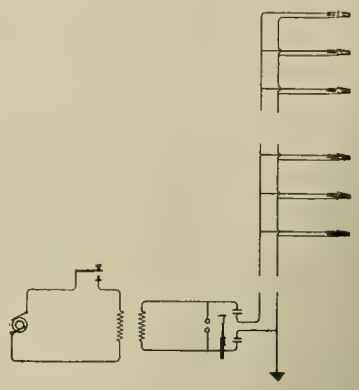
856,146. Lock-out Device for Telephones. Ruben C. M. Hastings and Thurston Matheny, Athens, Ohio. Application filed May 7, 1906.

In party-line telephone systems are a receiver hook at each station, a receiver hook locking device, an electromagnet for operating the same, a normally closed de-energized circuit in which all of the electromagnets are connected, a local battery at each station, a manually operable means for connecting the battery in the circuit, and means under the control of each receiver hook for retaining the line closed and energized.

856,149. Aerial Radiating Circuit. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed January 20, 1904. Divided and this application filed March 7, 1904.

In a system for transmitting electromagnetic waves are coils having a common axis, and means for causing therein electric currents alternating in proper phase to produce synchronously alternating similar magnetic fields.

856,150. Method of Radiating Electromagnetic Waves. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed January 20, 1904. Renewed February 21, 1907.



NO. 856,150.—METHOD OF RADIATING ELECTROMAGNETIC WAVES.

The method described of transmitting energy by means of electromagnetic waves consists in causing electric currents to traverse circular or spiral paths having a common axis and causing the currents to alternate in proper phase to produce synchronously alternating, similar, magnetic fields. (See cut.)

856,162. Fire-alarm Circuit. Isidor Kitsee, Philadelphia, Pa. Application filed October 31, 1902.

The apparatus embraces an annunciating device in the circuit, a series of devices in multiple arc at different points of the circuit, each of the devices normally non-conducting to the flow of a straight or voltaic current, but conductive in the presence of high temperature, the devices also acting as generators of electricity.

856,163. Electric Relay. Isidor Kitsee, Philadelphia, Pa. Application filed June 8, 1905.

In combination with a receiving device inserted in a telegraph-receiving circuit are a siphon and liquid therefor, a localized circuit embracing an electromagnet and air-gap, and means integral with the receiving device to cause the liquid to overbridge the air-gap or cause the liquid to flow out of the region of the air-gap.

856,165. Floor Box for Electric Wiring. Hubert Krantz, New York, N. Y. Application filed September 22, 1905.

An outlet box is described.

856,179. Electric Signal. Robert Pfeil, Grunewald, Berlin, Germany, assignor to the Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed January 19, 1906.

In an electric signal apparatus are a motor for operating the signal, manually operated means for controlling the setting of the signal, and means dependent upon the condition to be indicated by the signal for causing the motor to return the signal to corresponding position.

REISSUE.

12,658. Electric Furnace and Process. Paul L. T. Héroult, La Praz, France, assignor to Sté. Electro Metallurgique, Francaise, Froges, Isère, France. Application filed September 16, 1905. Original No. 721,703, dated March 3, 1903.

An apparatus for the manufacture of metals having a strong affinity for carbon, such as chromium, manganese, iron or the like, consists of an electric furnace with carbon electrodes arranged to form arcs in series by passing the current from one electrode through an arc into and through the metal and then through another arc to another electrode, a voltmeter in shunt between each electrode and the metal in the furnace for indicating the length of each arc separately, and means for regulating the position of each electrode separately so as to avoid contact thereof with the metal.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on June 10, 1907:

429,596. Galvanic Battery. J. Beattie, Jr., Fall River, Mass.
429,599. Electric Annunciator. J. D. Bishop, Chicago, Ill.
429,608. Manufacture of Incandescent Electric Lamps. R. N. Dyer, New York, N. Y.
429,687. Electric Railway. R. M. Hunter, Philadelphia, Pa.
429,703. Galvanic Battery. J. Siliceo, Jr., Mexico City, Mexico.
429,729. Generator for Electrically Reciprocating Tools. H. N. Marvin, Syracuse, N. Y.
429,730 and 429,731. Electric Drill System. H. N. Marvin, Syracuse, N. Y.
429,729. Generator for Electrically Reciprocated Tools. H. N. Marvin, Syracuse, N. Y.
429,736. Dynamo-electric Machine. R. Pfund, Brooklyn, N. Y.
429,745. Electric Connection. C. J. Van Depoele, Lynn, Mass.
429,746. Electric-railway-motor Truck. C. J. Van Depoele, Lynn, Mass.
429,751. Electric Meter. J. H. Barnard, Asheville, N. C.
429,787. Electric Arc Lamp. C. Coerper, Ehrenfeld, Germany.
429,801. Telephone. W. Vogel, Chicago, Ill.
429,817. Electric Burglar Alarm. H. C. Shubert, Chicago, Ill.
429,825. Electric Regulator. E. Wagemann, Little Rock, Ark.
429,895. Galvanic Battery. G. H. Felt, New York, N. Y.
429,896. Electrode for Galvanic Batteries. G. H. Felt, New York, N. Y.
429,897. Porous Cell for Galvanic Batteries. G. H. Felt, New York, N. Y.
429,898. Solution for Galvanic Batteries. G. H. Felt, New York, N. Y.
429,899. Railway-signal System. L. B. Firman, Chicago, Ill.
429,912, 429,913 and 429,914. Secondary Battery. C. Hering, Philadelphia, Pa.
429,981. Electric-railway Conductor System. C. J. Van Depoele, Lynn, Mass.
429,982. Mechanical Telegraph Instrument. E. R. Waterhouse, St. Louis, Mo.

FINAL NATIONAL ELECTRIC LIGHT CONVENTION REPORT NUMBER.

Western Electrician

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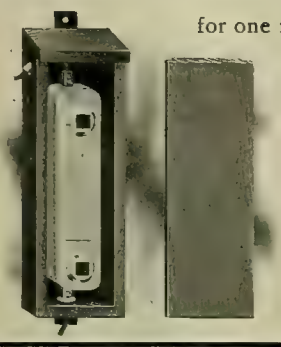

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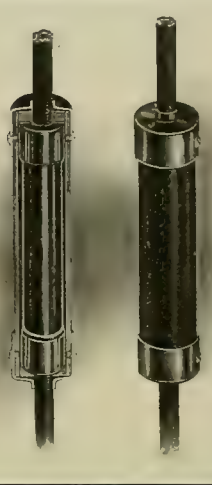

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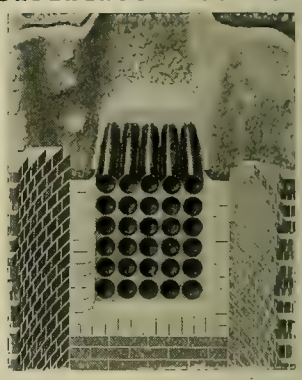
UNDERGROUND CONDUIT



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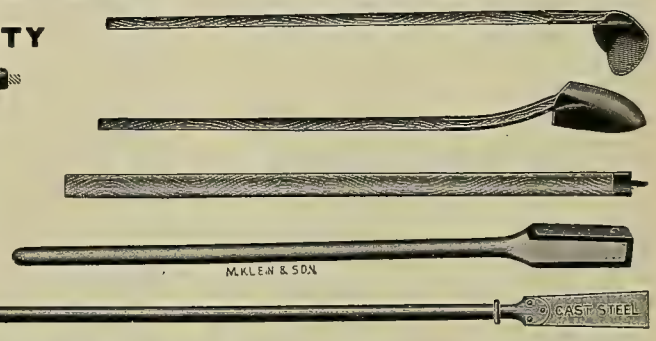

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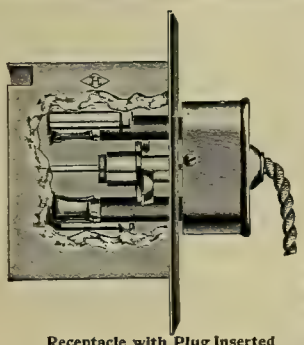

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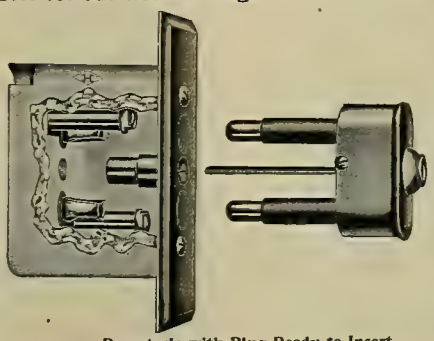

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Holophane Co., The.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters.
Stewart Heater Co., The.

Heating (Exhaust Steam).
American District Steam Co.

Hydraulic Machinery.
Aiton Machine Co.
Allis-Chalmers Company.

Induction Coils.
Acme Wire Co.

Inspection and Insurance.
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Aiton Machine Co.

Insulators and Insulating Materials.
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Locke Insulator Mfg. Co.
Manhattan Elec. Supply Co.
Massachusetts Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
Adams-Bagnall Elec. Mfg. Co.
Badt & Co., F. B.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Hubbell, Harvey, Inc.
Matthews & Bros., W. N.
Morse Frank W.

Lamps, Incandescent.
Bissell Co., The F
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
Moline Incand. Lamp Co.
Monarch Elec. Mfg. Co.
Novelty Incan. Lamp Co.
Standard Elect'l Mfg. Co.
Sterling Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Westinghouse Lamp Co

Lamps, Incandescent—Replacers and Cleaners.
Morse, Frank W.

Lamp, Mercury Vapor.
Cooper Hewitt Electric Co.

Letters, Sign.
Haller Machine Co.
Matthews & Bros., W. N.

Lightning Arresters.
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Ft. Wayne Elec. Wks. Inc.
General Electric Co.
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Manhattan Elec. Supply Co.
Minnesota Electric Co.
Wesco Supply Co.
Western Electric Co.
Woolley Electric Co.

Line Material.
Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnets, Autom. Wound.
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Meters.
Duncan Electric Mfg. Co.
Ft. Wayne Electric Wks. Inc.
General Electric Co.
Helios Mfg. Co.
Westinghouse Elec. & Mfg Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Co.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Allis-Chalmers Co.

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Nippers and Pliers.
Klein & Sons, Mathias.

Paints, Insulating.
Massachusetts Chemical Co.

Paints, Preservative.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

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Phosphor Bronze Sm. Co. Ltd.

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Chicago Pneumatic Tool Co.

Pipe Caps.
Gillette-Vibber Co., The.

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Baker & Co., Inc.

Poles and Ties.
Berthold & Jennings.
Bissell Co., The F.
Bruer. Will F.
Church Lbr. & Coal Co., W. C.
Fowler & Co., John H.
Huebel Co., C. J
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The.
Loud's Sons Co., H. M.
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National Pole Co.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company
Potter & Co., Albert L.
S-E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.
Minn. Steel & Machy. Co.

Pumps.
Minn. Steel & Machy. Co.

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Lord Electric Co.

Rail Joints.
Rail Joint Company, The.

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Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Westinghouse El. & Mfg. Co.

Rubber Machinery.
Aiton Machine Co.

Rubber, Moulded.
Massachusetts Chemical Co.

Scale, Automatic.
Avery Scale Co., The.

Screw Machine Products.
Hill Co., Geo. Q.

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Michigan College of Mines.
Rose Polytechnic Institute.

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Gregory Electric Co.
Rossiter, MacGovern & Co.

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Haller Machine Co.

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Belden Mfg. Co.

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Minn. Steel & Machy. Co.

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Wesco Supply Co.
Western Electric Co.

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Weston Electrical Inst. Co.

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Manross, F. N.

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Minn. Steel & Machy. Co.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
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Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Willard Storage Battery Co

Supplies, General Electric.
Bissell Co., The F.
Central Electric Co.
Chicago Edison Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.

Tanks.
Minn. Steel & Machy. Co

Tapes.
Massachusetts Chemical Co.

Telephone Clamps.
Gillette-Vibber Co., The.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Cook, Frank B.
Conn. Tel. & Elec. Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Long Distance Tel. Mfg. Co.
Stromberg-Carlson Tel. Mfg. Company.
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Western Electric Co.

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Chicago Telephone Co.

Testing Laboratory.
Elect'l Testing Laboratories.

Time Switches.
Bissell Co., The F.

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Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

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Zeidler Lamp & Brass Co.

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Aermotor Co.

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Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

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Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

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Devine Co., J. P.

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Massachusetts Chemical Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire Rope Machinery.
Aiton Machine Co.

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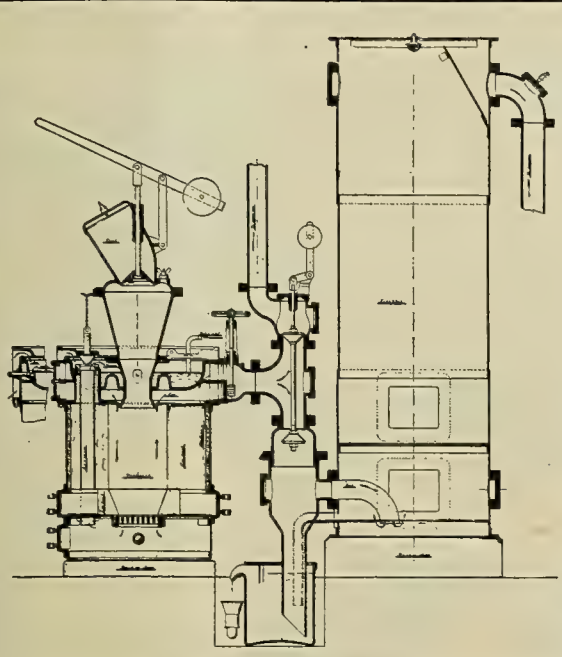
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cable Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Manhattan Elec. Supply Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company

For Alphabetical Index of Advertisements See Page 3.



CROSS SECTION OF THE

Suction Gas Producer

AND SCRUBBER

Used with our

MUENZEL GAS ENGINE

THE gas producer consists of the generator proper, a vaporizer and the purifying apparatus. The generator forms a cylindrical iron shell, lined with fire brick, and is provided below with a fire grate. The cover consists of a head piece carrying the coal hopper, on which latter are mounted the charging lid and closing device for the hood valve.

The scrubber is a cylindrical tank, filled with coke, on top of which a spray of water is fed. In large plants, or where an extensive purification is desired, a second or dry scrubber is installed.

The vaporizer in the larger sizes consists of a rectangular tank placed between the producer and the scrubber. The hot gases coming from the producer flow around vertical tubes containing water. The gases impart heat to the water and the resulting steam is led by suitable pipes under the fire grates in the producer. In the bottom half of the vaporizer is a second set of tubes connected on the one side by a suitable pipe with the atmosphere and on the other side with the producer below the grates.

The air in passing through the vaporizer takes up heat from the gases thus causing a direct saving of the sensible heat of the gases which would otherwise be lost in the scrubber.

In the smaller sizes the vaporizer is in the shape of a pan forming the top of the producer, and receives its heat from the hot gases leaving the fuel bed immediately below. A water supply pipe and an overflow pipe are connected to it and the necessary steam is generated. The steam, together with the necessary air, is conveyed to the underside of the grates by means of pipes which pass down through the fire-brick lining. These pipes are, consequently, very hot and superheat the air and steam.

ASK US FOR CATALOGUE "G"

MINNEAPOLIS STEEL AND MACHINERY CO.

MINNEAPOLIS

VICTOR INSULATORS

A STOCK ARTICLE

No. S190 Floor Tube for 23,000 volts.

If you have been looking for this, here it is.
Solid porcelain, tested and ready for your order.

THE LOCKE INSULATOR MFG. CO.
VICTOR, N.Y.

WIN

If all Central Stations would install

FEDERAL ELECTRIC SIGNS

on the "Free" proposition their total income from electric signs (judging from present sign incomes of Federal Central Station customers) would be

$20,000,000

Write us Today For

"FREE SIGN INFORMATION"

FEDERAL ELECTRIC COMPANY
Lake and Desplaines Streets
CHICAGO, ILL.

DOUBLE YOUR LIGHTING EFFICIENCY

BY USING

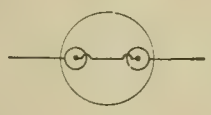
BENJAMIN SERIES DEVICES

WITH

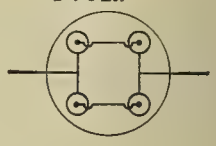
Two 110 Volt { GEM FILAMENT 2.5 W. P. C. —OR— TANTALUM 2 W. P. C.

Cat. No. 12 1-2
2-4-6 Lt.

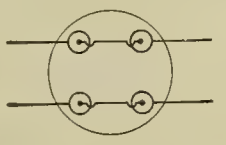
Cat. No. 74 1-2
2-4-6 Lt.



LAMPS IN SERIES

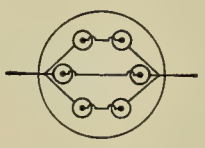


220 Volt



On

INSTEAD OF



Circuits

Cat. No. 412 1-2. 2 Lt.

220-Volt Carbon Filament Lamp.
4 W. P. C.

220-Volt Carbon Filament Lamp.
4 W. P. C.

Cat. No. 19 1-2
2 Lt.

Save Your Current

Cat. No. 92 1-2. 2 Lt.

Increase Your Light

Cat. No. 22 1-2
2 Lt.

Write for Descriptive Literature and Prices

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New York
Chicago
San Francisco

THE CONVENTION CITY HAS
MANY ATTRACTIONS-ONE IS
ITS WELL LIGHTED STREETS

COLUMBIA

ENCLOSED ARC CARBONS ARE
USED IN THESE LAMPS EXCLUSIVELY

COLUMBIA CARBON PRODUCTS

NATIONAL CARBON COMPANY, CLEVELAND, O.

FOSTORIA

FOSTORIA TANTALUM

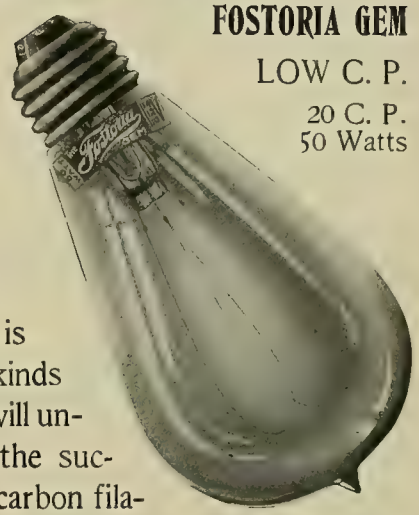
22 C. P.
44 Watts

This lamp is 75 per cent. more efficient than the carbon filament lamps you have been using. It is the most economical electric lighting unit ever developed. We recommend it for either direct or alternating current. Life on former, 700 hours; on latter, 450 hours.

FOSTORIA GEM

LOW C. P.

20 C. P.
50 Watts



The GEM low C. P. lamp is 25 per cent. more economical than the carbon 3.1 watt lamp. It is adapted for all kinds of service. It will undoubtedly be the successor of the carbon filament lamp in all branches of electric lighting in a very short time. Try it now. This lamp is also made in high C. P.'s

---

No regular user of lamps can afford to procrastinate in the investigation of the modern high economy lighting units, of which two are featured above. We have complete bulletins on all of them. They will be mailed upon request.

However, we are still making the famous "Standard Fostoria" (carbon filament) lamp in ever-increasing quantities. Its quality is unexcelled. Its price the same as during the past TWELVE YEARS. We give you more for your money on carbon filament lamps than any other manufacturer.

FOSTORIA INCANDESCENT LAMP CO.
FOSTORIA, OHIO.

OUR 1907 CATALOG IS NOW READY FOR DISTRIBUTION

We believe it to be the most comprehensive catalog that has appeared to date on this subject. It contains 48 pages of concise description, cuts, prices and useful tables covering our products.

Magnet Wire—Electrical Cordage
German Silver Resistance Wire
Cotton Sleeving—Rosin Core Solder
Office and Annunciator Wire
Field Coil and Electromagnet Winding
Switchboard and Jumper Wire
Magnet Winding Machines and Revolution Counters

BELDEN MANUFACTURING COMPANY

192 MICHIGAN STREET, CHICAGO

The Constantly Increasing Demand For

"SHAWMUT" SPECIALTIES

is sufficient evidence that

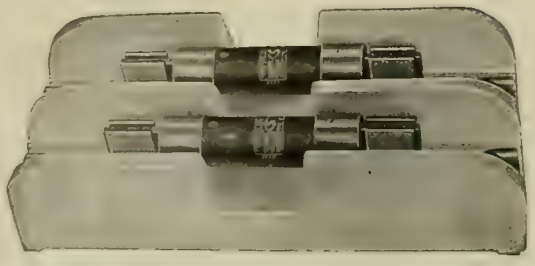
Superior Articles bring **Results**

Why not use

"SHAWMUT"

National Electrical Code Standard Fuses and Bases?

250 VOLTS 0-600 AMPERES 600 VOLTS



Full description and prices in Bulletin No. 36

CHASE-SHAWMUT CO.

NEWBURYPORT, MASS.

A Great Electrical Novelty

Type D, Patent Feb., 1905.

Dimensions: Base, 14 ins.
Height to top of Dome, 25 ins.
Quality: Base of Metal
Finish: Black and Verde
Catch Basin and Dome of Leaded Glass

A PORTABLE
Electric - Luminous
FOUNTAIN

No Water Connection
Self - Contained

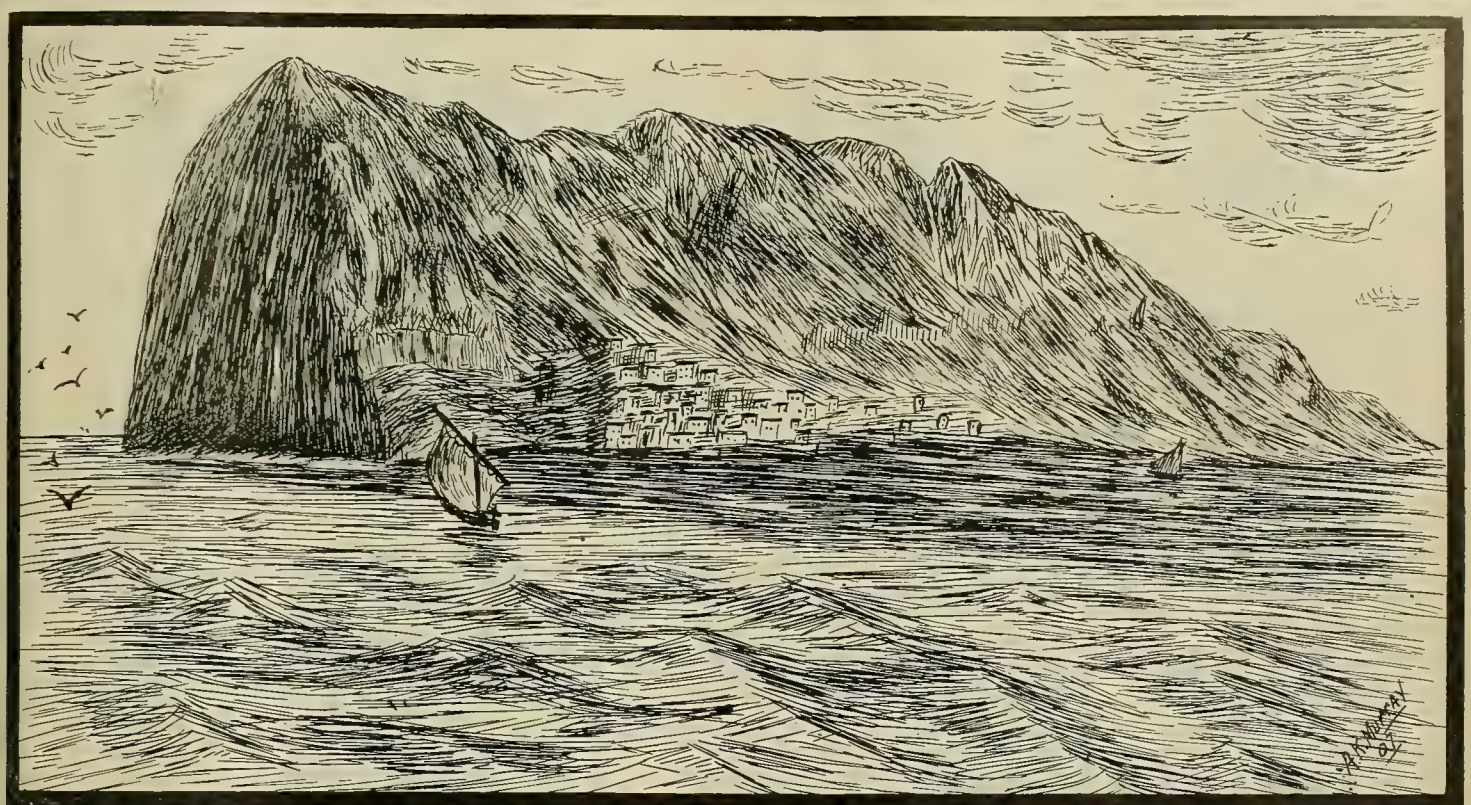
Suitable for all kinds of decorative, table and utilitarian effects.

High Class Representation Desired Throughout the U. S.

Write for further Designs and Prices

New York Electric Fountain Co.

Dept. G. *114 W. 39th St., NEW YORK CITY*



THE ROCK OF THE SCHOTT SYSTEMS GIBRALTAR

Towers Above Them All

LIKEWISE

The Schott Systems

OF

Central Station Heating

Lead all other heating systems in Design, Construction and Efficiency of Operation.

The Schott Regulated Steam System
The Schott Balanced Column Hot Water System

W. H. SCHOTT, Engineer

American Trust Bldg., CHICAGO

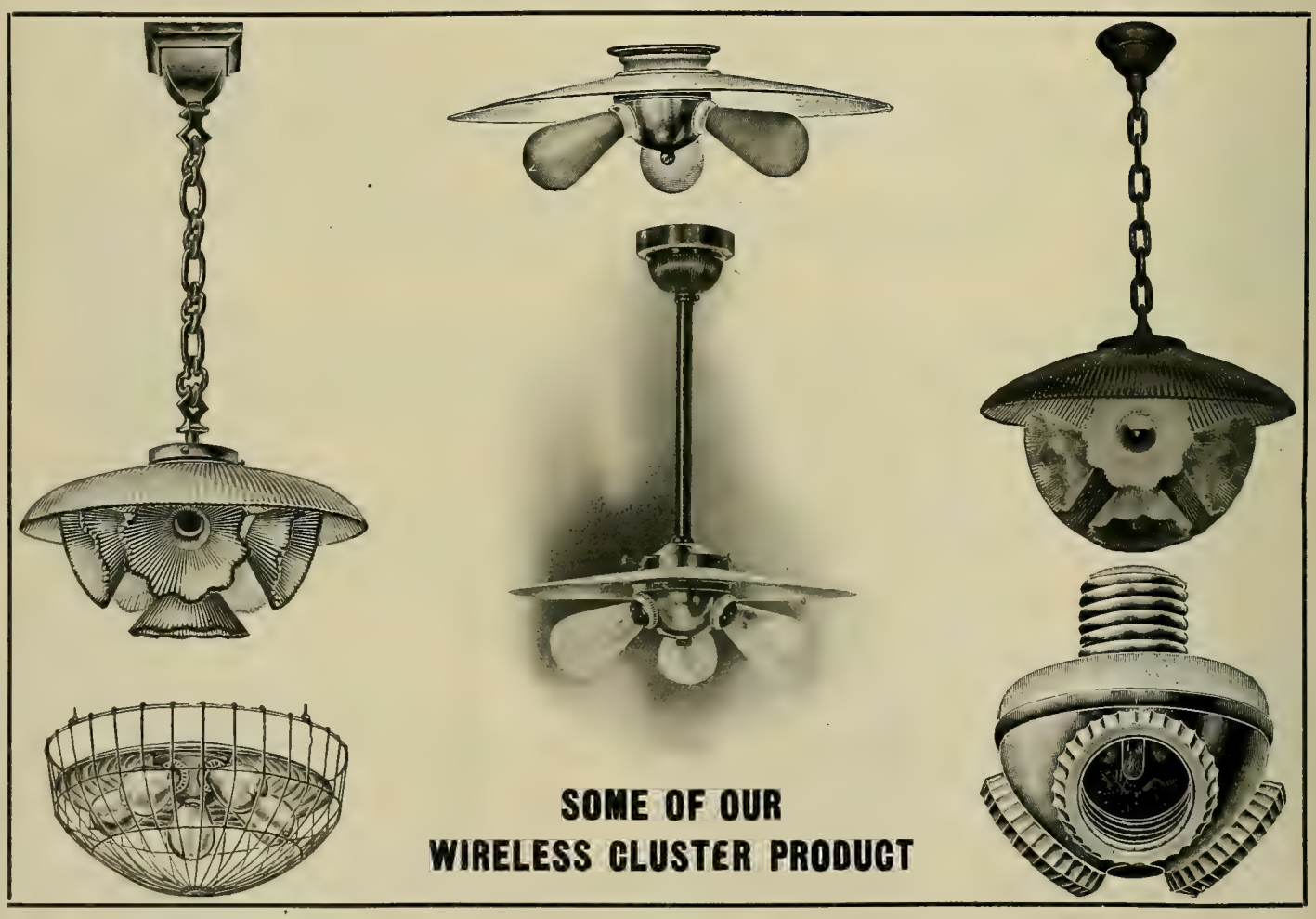
THE DALE COMPANY

(Established 1888)

9TH AVE., 13TH AND HUDSON STS., NEW YORK CITY

THE LARGEST M'F'RS OF

Wireless Clusters, Portables, Lighting Specialties, Gas, Electric and Combination Fixtures in the United States.



WHY THE DEMAND? Because **DALE'S** Wireless Clusters are **LABOR SAVING.** Try them on one installation to **PROVE** what we claim.

In addition to a large stock of the above, other product of our manufacture is carried by

WM. P. CROCKETT CO., Western Ag'ts.

Write for Catalogs

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A. B. Campbell, 1st Vice President
D. L. Huntington, 2nd Vice President & General Manager
H. E. Perks, Treasurer
H. L. Bleecker, Secretary

The Washington Water Power Company

ADDRESS ALL COMMUNICATIONS TO THE COMPANY.

Edison Electric Light & Power System
Spokane Street Railway System
C and C Roller Mills
Brands { Planisifter, Pagoda, Best, Superb

Lieber's and General Electric Co Codes

Spokane, Washington, May 8, 1907.

Electrical Testing Laboratories,
80th. Street & East End Ave.,
New York City.

Gentlemen:-

We have your favor of the 3rd. inst. enclosing report of test No. 2979, covering high tension insulators manufactured for us at Victor, N.Y.

The report is satisfactory, and we would be pleased to receive your bill.

In connection with this matter of testing insulators, would state that we have at the present time over 200 miles of 60,000 volt line in operation, by far the greater part of the insulators of which have been tested by your concern, and we have been in operation on this line since the Fall of 1903. During that time we have had just one insulator fail by puncture.

I am quite sure that your laboratory tests which you have made are in a very large degree responsible for protecting us from this very serious form of interruption. I thought it would be of interest to you to know what results we have achieved by careful and intelligent inspection.

Yours truly,

DLH/SCS

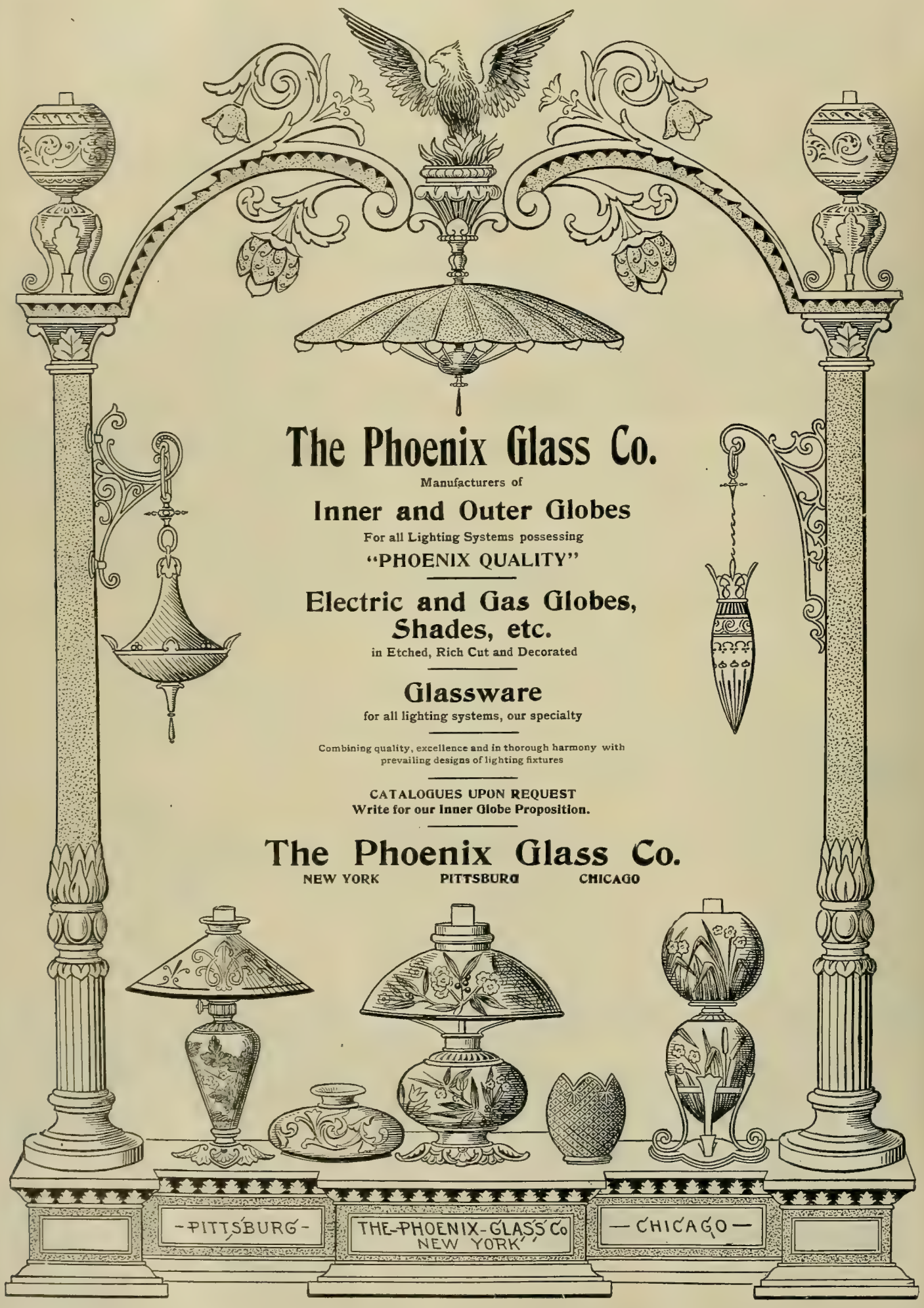
General Manager.

COOK'S JUNCTION BOX

WHY IT'S SUPERIOR

Sleeve splicing or wiped joints unnecessary.
Absolutely moisture proof.
Made of pressed steel, heavily galvanized. Very light and easy to handle.
Has a sliding galvanized sheet metal cover which furnishes added protection.
Equipped with self-soldering nozzle—expert cable splicer unnecessary.
Can be installed and terminal added at any future time.
Can be furnished separately or combined with terminal.
Write today for further information and prices.

Frank B. Cook. 235 W. Lake St. CHICAGO


The Phoenix Glass Co.
Manufacturers of
Inner and Outer Globes
For all Lighting Systems possessing
"PHOENIX QUALITY"
Electric and Gas Globes,
Shades, etc.
in Etched, Rich Cut and Decorated
Glassware
for all lighting systems, our specialty
Combining quality, excellence and in thorough harmony with
prevailing designs of lighting fixtures
CATALOGUES UPON REQUEST
Write for our Inner Globe Proposition.
The Phoenix Glass Co.
NEW YORK PITTSBURG CHICAGO
-PITTSBURG-
THE-PHOENIX-GLASS Co
NEW YORK
—CHICAGO—

GOOD AS DAYLIGHT

And the Most Economical
Electric Light Made

Cooper Hewitt Mercury Vapor Lamp

Saves 65 per cent. of what you pay now. Operates on ½ w. p. c. Gives perfect diffusion of light, no deep shadows, no consumption of light-giving elements, no trimming.

It is, above all others,

THE LIGHT TO WORK BY

Data of Successful Lighting by Cooper Hewitt Lamps

Character of Work	Floor Area Illuminated Square feet	No. of Lamps	Floor Area Per Lamp, 700 c. p.	Illuminated Square feet, 300 c. p.	Total Kilowatts Consumed at 110 Volts
Draughting Room	2040	6	333		2.3
Draughting Room	2140	8	265		3.1
Business Office	11250	32*		350	6.3
Business Office	1030	4*		260	.77
Business Office	1100	3	366		1.1
Press Room	5620	22*		256	4.2
Press Room	18000	44*		410	8.5
Press Room	12000	20*		600	3.8
Composing Room	1200	8*		150	1.54
Composing Room	9600	40*		240	7.6
Leather Factory	35200	88*		400	16.94
Storeroom	2400	6*		400	1.1
Storage Battery Room	12600	10	1260		3.8
Steamship Pier	39770	6	6600		2.3
Railroad Pier	126800	37	3400		14 2

* 300 c. p. Lamp.

Erecting Shop Lighted by Cooper Hewitt Lamps.

Cooper Hewitt Electric Company

220 West 29th Street, New York

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO

STORAGE BATTERIES

OF THE

"Unit Accumulator"

Type for All Purposes

WRITE FOR CATALOGUE, BULLETINS AND ESTIMATES

National Battery Company

ELECTRIC STORAGE BATTERIES

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Pacific Coast, 623 Sansome Street, San Francisco

IF YOU KNEW

WHAT WE KNOW ABOUT

HUBBELL ATTACHMENT PLUGS

YOU WOULD ALWAYS USE THEM

Simple

Reliable

Convenient

21 STYLES 21

"One Cap Fits Them All"

JUST THE KIND FOR FAN MOTORS

A SAMPLE PLUG IS YOURS FOR THE ASKING

HARVEY HUBBELL, Inc.

Bridgeport, Conn.

THE DRY CELLS YOU WILL EVENTUALLY BUY

GAS ENGINE CELL

SPECIAL TELEPHONE

BELL WORK, ETC.

We Shall Be Satisfied With a Trial Order

BATTERY CONNECTOR

A PERFECT CONTACT no matter how hard the JOLTS or VIBRATION

WON'T SHAKE LOOSE

STACKPOLE BATTERY CO.

Electros Ready — ST. MARYS, PA

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This handbook is a reliable treatise on telephony, and a practical book on telephone working and management, based entirely on standard American practice. It is extremely useful to telephone inspectors and operators.

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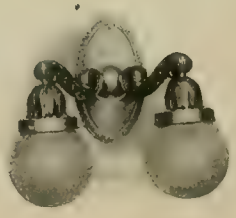

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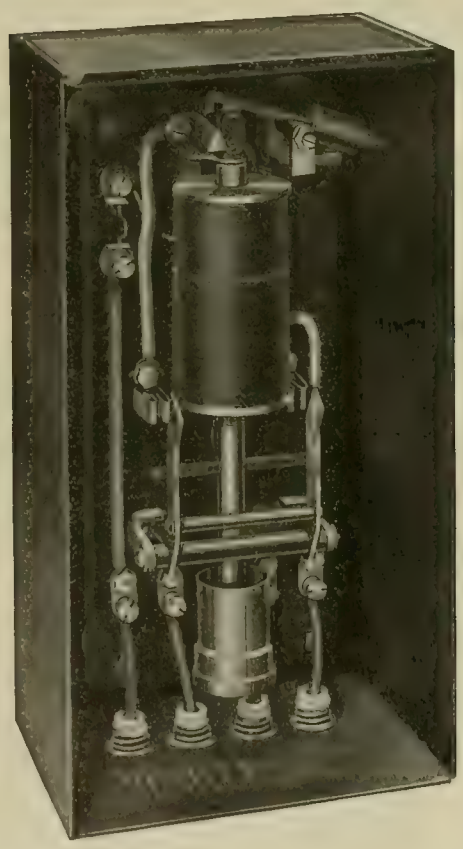

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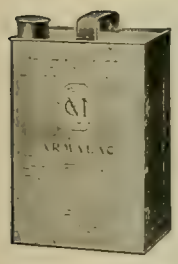

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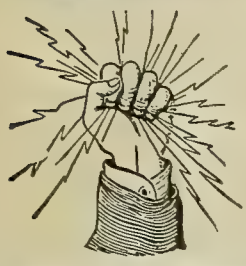

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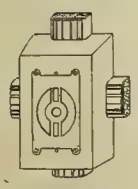

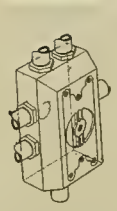

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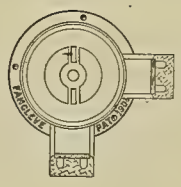

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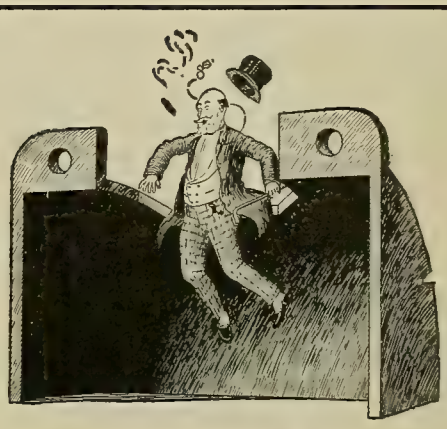

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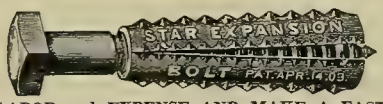

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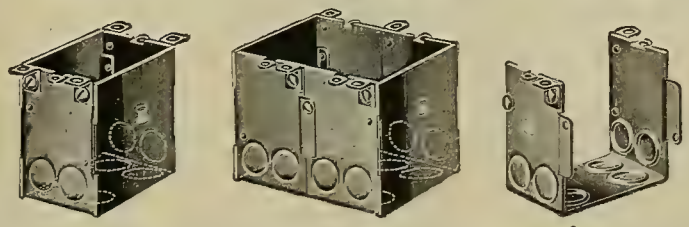

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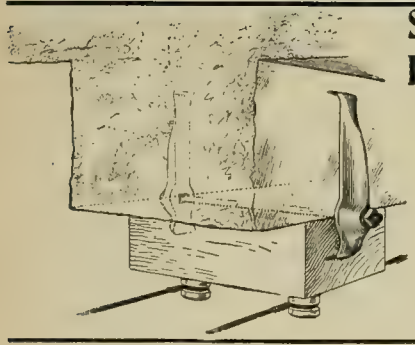

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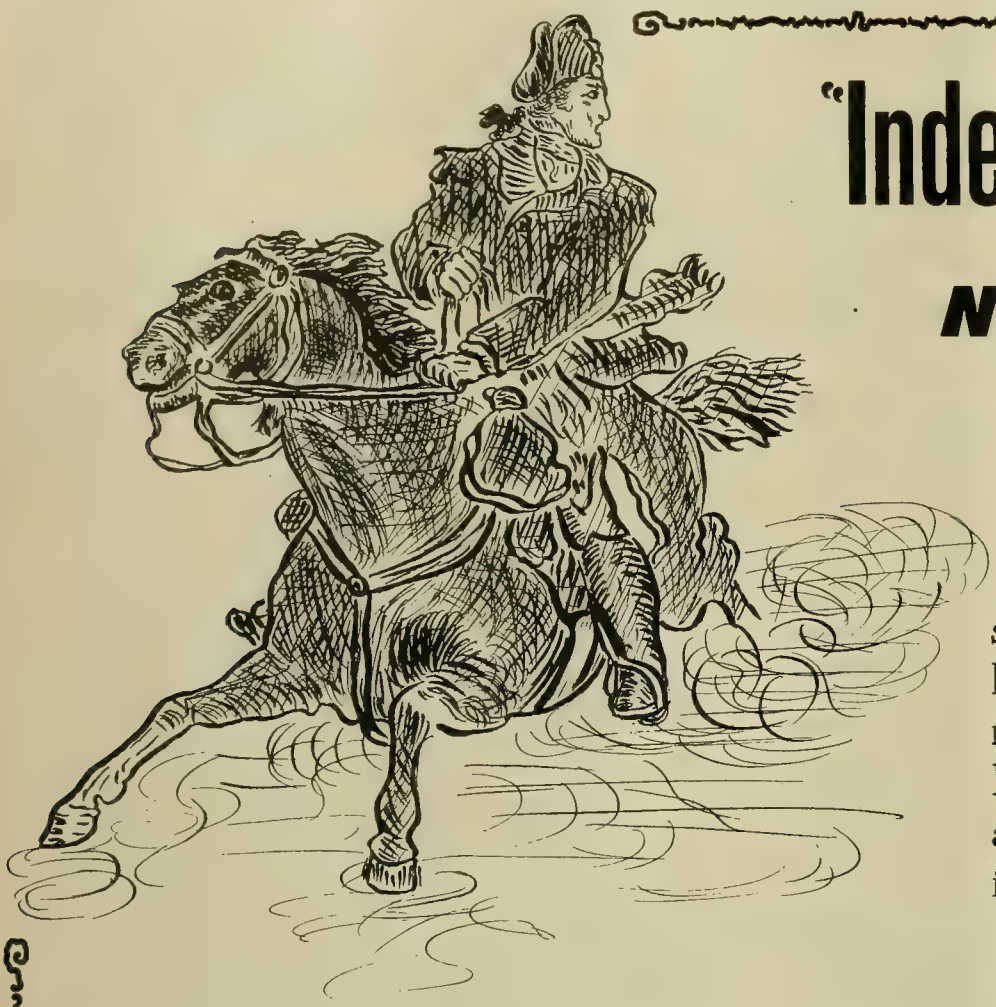

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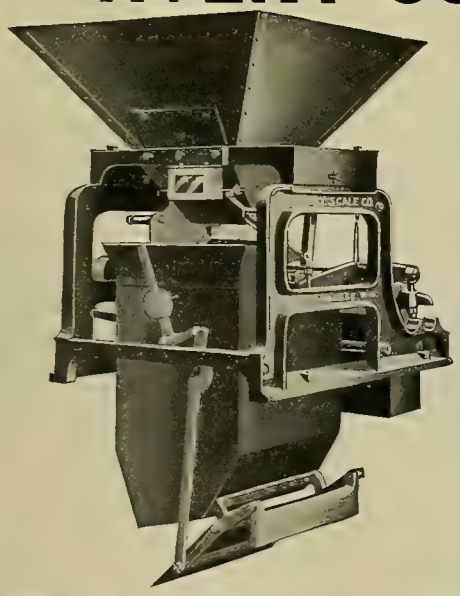

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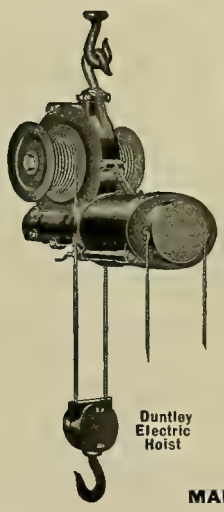

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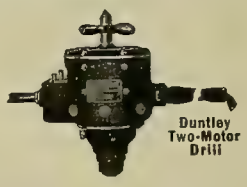

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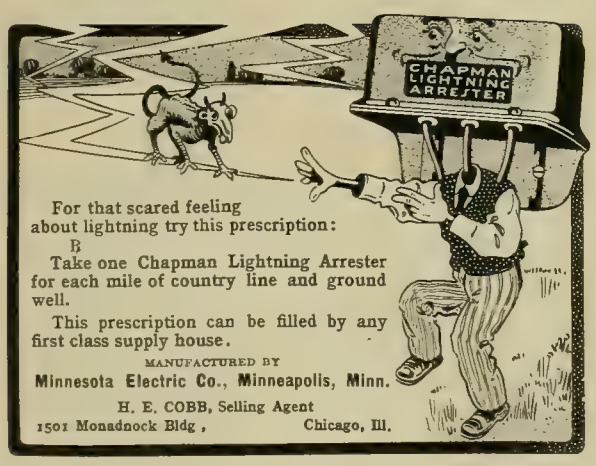

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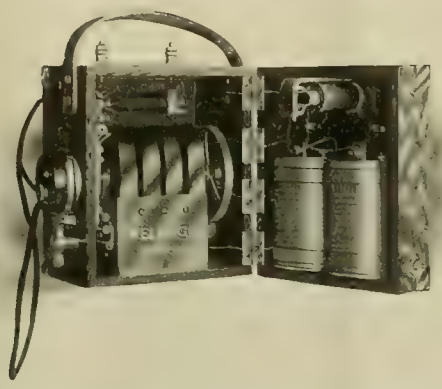

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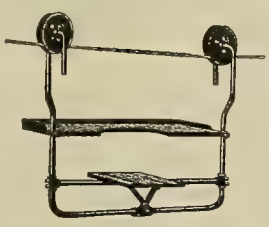

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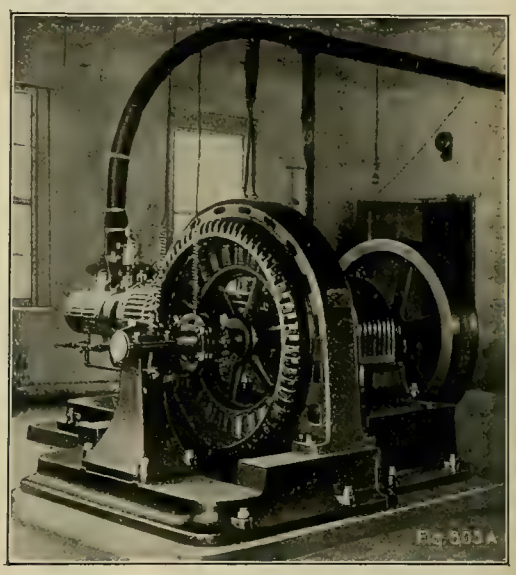

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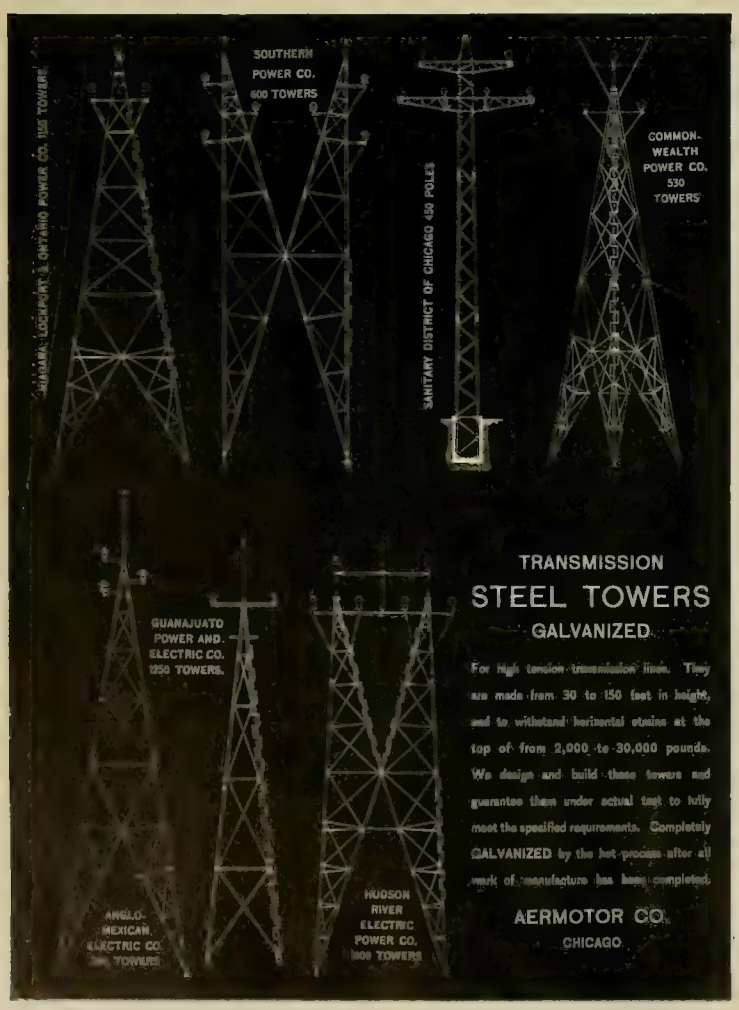

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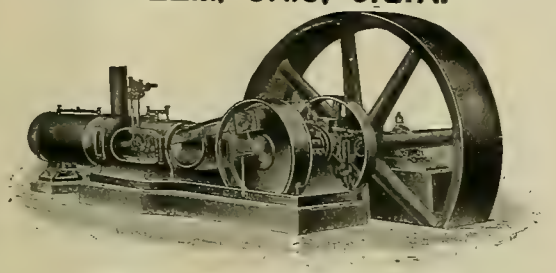

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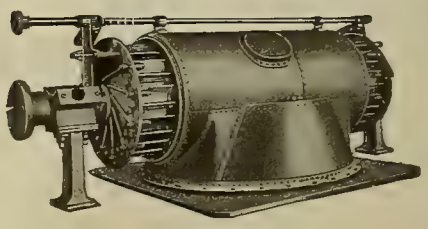

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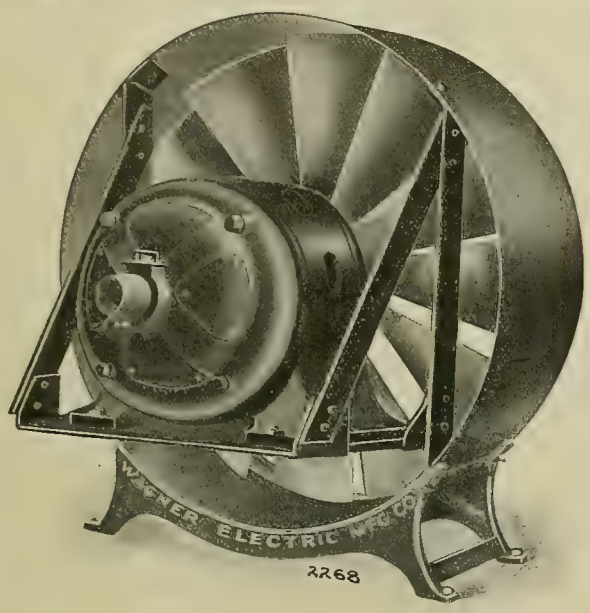

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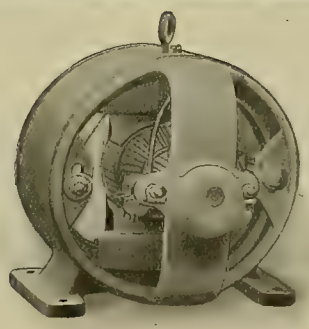

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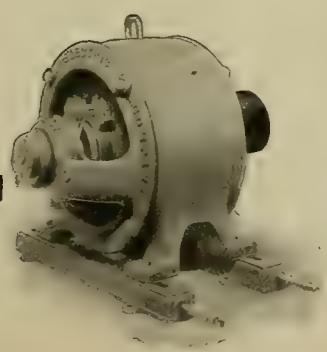

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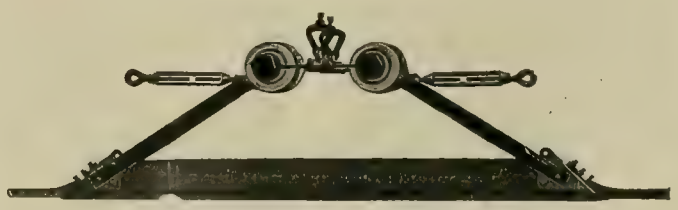

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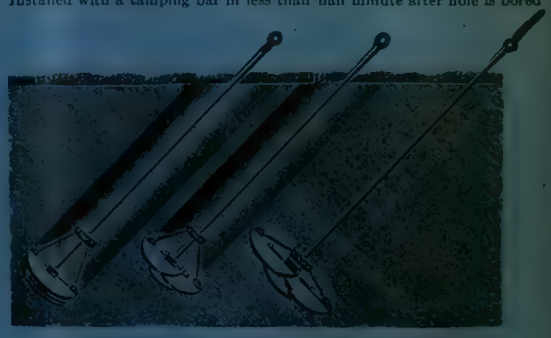

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Fig. 1—Represents Anchor placed at bottom of hole.
Fig. 2—Partially expanded.
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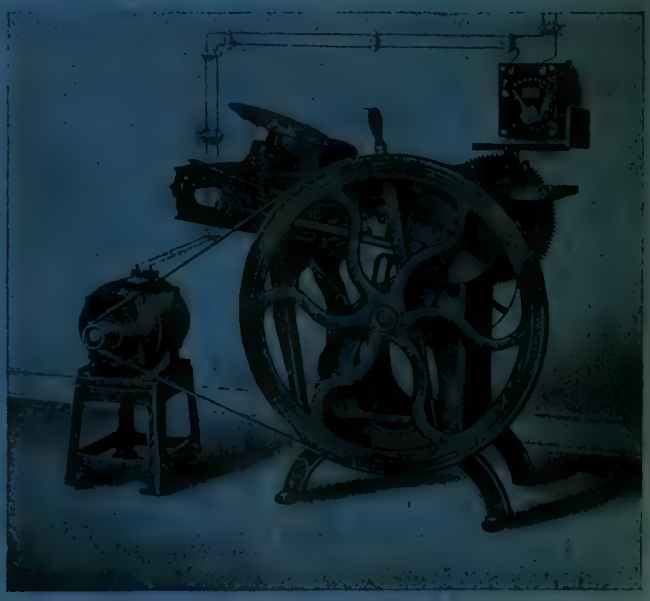

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EVERY SATURDAY

Vol. XL. CHICAGO, JUNE 22, 1907 No. 25

Electric Illumination and Power in Theaters.

By Dr. Alfred Gradenwitz.

Owing to the ever-increasing demand for scenic effects and for the decorative element in theatrical plays, electricity is resorted to not only for the illumination of the theater but also for the power service. Electric light has long been found to be the most advantageous in theaters because of the extraordinary perfection and faithfulness with which any shades and graduations of natural light can be imitated by its aid.

The methods used in connection with electric power and illumination service in theaters have been, in the course of the last few years, developed and improved to an extraordinary extent. A special feature of the methods at present in use is the centralization of service, insuring simplicity and safety in operation. The possibility of installing at any desired point of the stage movable connections of the electric circuit is another advantage of this method.

Considering the use of electric motors for power purposes, this type of motor is obviously the most convenient in theaters, owing to its simplicity of starting and stopping and continual readiness for operation.

The extraordinary safety afforded against the danger of fire is another advantage which has been appreciated, especially in the course of the last few years, while in many cases the municipal authorities have even prescribed the use of electricity.

The varied uses of electricity in theaters should be considered separately—the lighting of the amphitheater and vestibules, the lighting of the stage and accessory rooms, operation of electric motors for driving the stage machinery and ventilating the theater, and the operation of heating devices of the most varied description. Finally, the frequent use of electric signals, alarms, fire alarms and loud-speaking telephones should be mentioned.

Fig. 1 gives a typical instance of the lighting of the entrance room and vestibules intended for spectators, showing the convenient manner of arranging electric lights. This picture is from a photograph illustrating the electric illumination of the staircase in the Frankfort-on-the-Main opera house, in which only incandescent lamps are used. The conductors are arranged in such a way as to be invisible to the eye, although an easy access to them is secured. This is especially the case in connection with the conductors for the big luster and main ceiling lights.

The conductors leading to the big luster are preferably connected to a small switchboard by means of movable connecting plugs so as to allow the fixture to be lowered. This course has been adopted in the Frankfort opera house, the conductors and connecting plugs being shown in Fig. 3.

Special care should be bestowed on the laying out of conductors in the stage. For this purpose the Peschel system of protective steel pipes has been found most convenient. Movable cables are used for the stage lights, the whole conductor system being worked out systematically on uniform principles. Connection between the fixed incoming conductors with the movable cables is effected by means of contact boxes or contact screws. Fig. 2 shows the arrangement of the latter in connection with skylights.

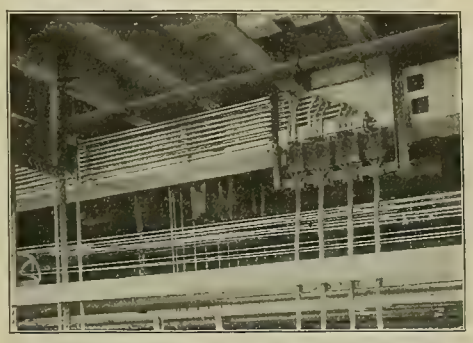


Fig. 2. Connecting Boxes between Incoming Conductors and Movable Cables in Frankfort Opera House.

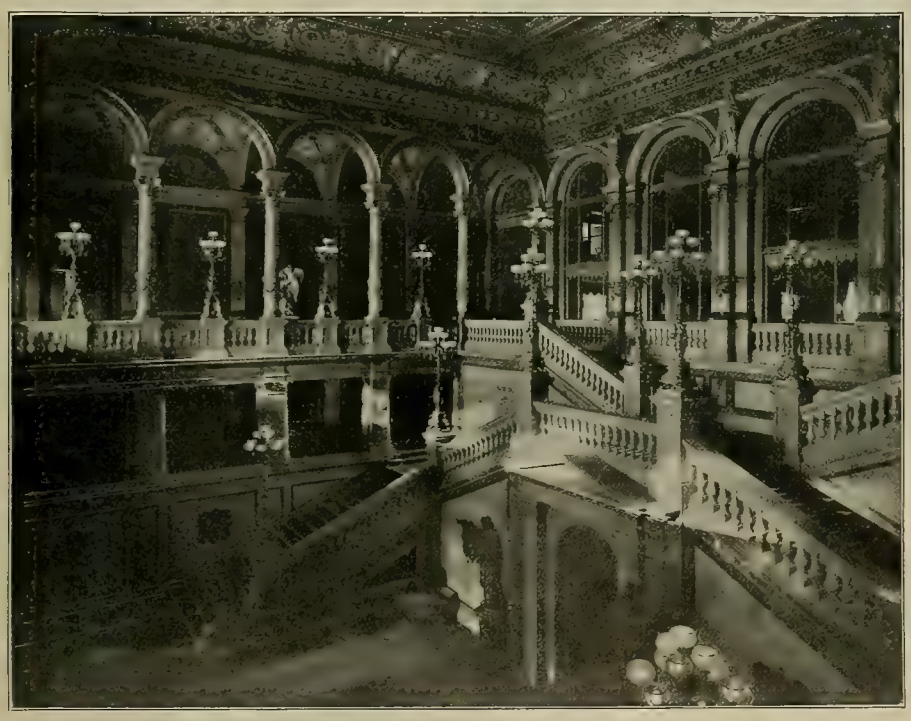


Fig. 1. Electric Lighting of the Foyer of the Opera House in Frankfort-on-the-Main.

The uses of electricity for power purposes have been multiplied to a large extent in the course of the last few years. The operation of rotary stages by electric motors is one of the most interesting uses to be noted in this connection. An installation is shown in Fig. 4 in which the motor acts through the intermediary of a worm gearing and a toothed wheel onto a winch drum, from which a rope is led across guiding and tightening rollers and around a rope pulley fixed to the axle of the rotary stage. A reliable brake allows the rotary stage to be stopped at any desired place.

The "weather machines" (Fig. 5, next page), by the aid of which the noises of rain, wind and thunderstorm are produced, are always operated by small electric motors. Special controllers are provided to allow these noises to be adapted to the sounds of nature as far as possible. These controller starters should preferably be mounted at the manager's box, thus enabling the stage inspector himself to carry out any desired effects and to operate the machines, though the machines are usually installed at a distant place on the machine gallery. No special operators are therefore required in this connection.

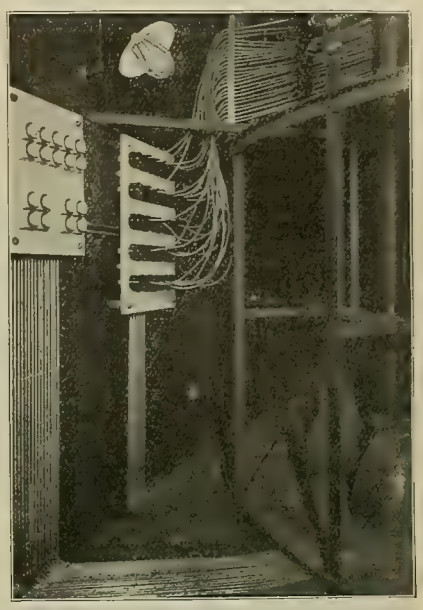


Fig. 3. Switchboard Plugs and Flexible Conductors in Frankfort Opera House.

Fig. 4. Motor-driven Winch for Operating Rotating Stage.

SOME EXAMPLES OF THE USE OF ELECTRIC LIGHT AND POWER IN THEATERS.

Similar motive operation is used in connection with the blower for inflating the air bag for representing waves, round horizons, ambulating panoramas, etc.

The signal-light plant, which has become quite indispensable to an up-to-date theater, is another province of special importance for the use of electricity. Such a plant (see Fig. 6) serves for giving signals by means of white or colored incandescent lamps, which are lighted to give the signals corresponding to the lifting or lowering of prospects, trapdoors, curtains, etc. These signals are given either by the conductor, inspector or prompter to various places on both sides of the stage machinery, as well as from the manager's box to the curtains.

Switches of the signaling plants are combined on small switchboards, above which the checking lamps usually are arranged. These lamps are inserted

in all return conductors, thus indicating to those giving the signal whether the signaling lamp has actually been lighted. The signal lamps are located in boxes, the front glass of which carries a convenient inscription, which, as soon as the lamp is lighted, is made distinctly visible.

Novel Applications of Electric Heat

Following the reading of the paper on "Electric Heating Without Special Concessions from the Central Station," by C. D. Wood, Jr., of New York (given in abstract in the Western Electrician of June 8th), at the recent convention of the National Electric Light Association in Washington, D. C., there was the following brief discussion, in which some interesting statements were made:

E. F. McCabe, Lewistown, Pa.: During the last year I have had three rather unusual applications of heating appliances which I think the members will be interested in knowing about. I chanced into an artificial-ice manufacturing establishment one day and noticed one of the men carrying a piece of red-hot iron into one of the vaults. He said that at times they desired to increase the temperature one or two degrees to change the hydrometric conditions of the atmosphere in the vault. I suggested that I could do it more easily by the application of an electric radiator. The owners of the plant finally told me to go ahead. I got a three-heat electric radiator and installed several in the vaults. By the application of a switch on the outside of the vault they can change the temperature and the hydrometric conditions in the vault easily.

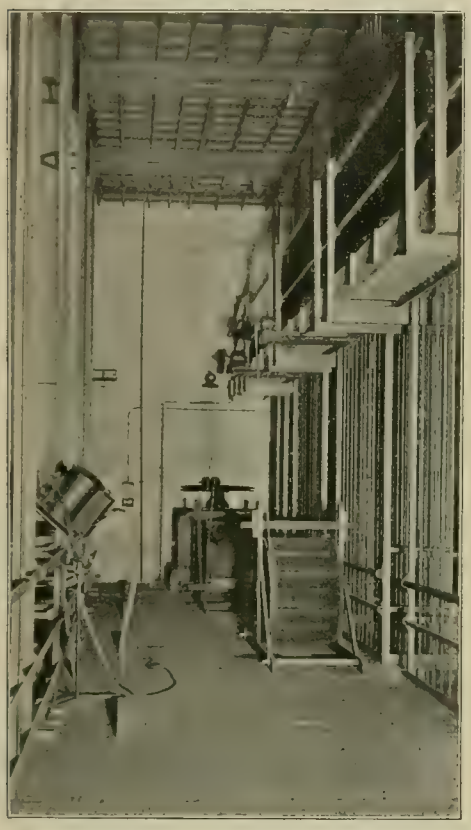


FIG. 5. MOTOR-DRIVEN MACHINES FOR PRODUCING SOUNDS OF RAIN, WIND AND THUNDER ON THE STAGE.

Shortly afterward I walked into a millinery establishment one day and saw one of the ladies in the establishment using an oil lamp, with a wet cloth, on which she placed the frame of a bonnet which was to be changed in shape. I suggested she take an electric heating disk with the wet cloth and do the same thing more conveniently. I also installed a heating stove there for that purpose.

During the last winter I sold to one of my customers an electric flatiron, and a month afterward I met her and asked her how she liked the iron. She said very much, but that ironing was not all she could do with it. She lived in a flat, and one morning the gas pipes were frozen, and being the daughter of one of our foremost electrical inventors, her mind turned toward electricity, and she cooked her breakfast on the flatiron, the breakfast consisting of toast, eggs and coffee.

C. J. H. Woodbury, Boston: One of the applications of electricity which has not been alluded to is rather unique. You will find in many of the retiring rooms for the young women operators employed by the telephone companies that they will have an incandescent lamp, connected by a flexible wire, and in case of any of the young women having a toothache, or a neuralgic pain, or anything of that kind, they wrap a wet towel around the light, turn the current on, and apply the heated wet towel to the affected part. This acts as a counter-irritant, and affords relief.

J. F. Geiser, Waynesboro, Pa.: We put a flatiron recently in an automobile garage as a vulcanizer. It was not my own idea, but the garage man thought of it. There is a thermometer on it, so that he can gauge the temperature, and he is using it successfully as a vulcanizer.

The Service-unit System of Charging.[1]

By J. F. Geiser.

A question which has bothered the central-station people along the line of rates is how to differentiate between different customers. If the company is legally allowed to make different rates to different customers, under different conditions, how shall that be accomplished, so that all customers can get the right rate?

We have in our plant one scale of rates for all customers, from one light to 1,000 lights, from $1 a month to $600 or $800 a month. When a customer gets out of one class and goes into another, he gets the benefit of it without any special agreement. It is not entirely on the plan of charging a certain rate for the first hour's use and another rate for the second hour's use per day, but it provides for something which that method does not provide for. Our rate goes farther and provides for the large as well as the small customer, at the same time providing for the short-hour customer.

Instead of using one hour per day, or two hours per day, as the basis of the sliding scale, what we call a service-unit is used as the basis. That service-unit is composed of two factors, first, a certain number of hours' use, and second, a definite fixed amount of kilowatt-hours, supplied to all customers alike.

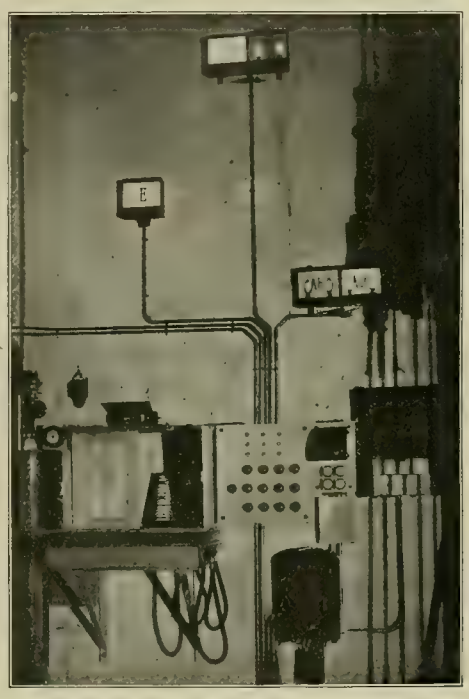


FIG. 6. ELECTRIC-LIGHT SIGNALS IN A MODERN THEATER.

For instance, five hours' use of the capacity demand, plus six kilowatt-hours, is the basis of the sliding scale. The first five hours plus six kilowatt-hours in our rate is charged at the initial rate, the maximum rate; the second five hours, plus six kilowatt-hours, or the second service, at the second rate; the next five hours, plus six kilowatt-hours' consumption, at the third rate, etc.

We find that that takes care of all classes of customers, with the curve of rates very closely approximating our cost curve for the different classes of service. The plan can be varied, of course, by changing the figures for these various points, or for the number of hours' use, and the number of services to be charged at a certain rate.

As an illustration, our rate is 16⅔ cents per kilowatt-hour for the first service rate (first five hours' use of the capacity plus six kilowatt-hours). The second is 15 cents; the third, 10 cents; the next 10 service-units are three cents, and all beyond 13 service units are one cent per kilowatt-hour. The one-cent rate is only the consumption after all the fixed costs are taken care of by the higher rates, with any additions which entail additional costs on the company.

It seems to me that some of the central-station rate problems can be solved along this line.

There is some objection to rates of this kind on account of the complication. Customers do not understand either the justification for a rate of the kind or the rate itself. The difficulty is, if you make a rate that the customer can understand, then he cannot figure it out; if you make it so that he can figure it out, he cannot understand it. That is, if you put it on a basis where he can understand the meaning of the terms, then he cannot apply it to the different classes of load. We have been reasonably successful with this class of rates, and have overcome not only our difficulties in rate schedules, but largely the legal objections also.

1. This is an extract from the discussion at the meeting of the National Electric Light Association in Washington, D. C., on June 1, 1907. Mr. Geiser is superintendent and chief electrician of the Waynesboro (Pa.) Electric Light and Power Company. His system of charging attracted much attention at the convention.

Electrification of West Shore Railroad Between Utica and Syracuse.

The section of the West Shore Railroad between Utica and Syracuse, N. Y., which has been equipped for electrical operation, was officially opened on June 15th. The occasion was fittingly celebrated, Mr. C. Loomis Allen, vice-president and general manager of the Oneida Railway Company, being in charge of the ceremonies. The work of electrification has been carried out by the Oneida Railway Company, a corporation identified with the so-called Andrews-Stanley syndicate, which syndicate, in conjunction with the Vanderbilt New York Central interests, owns several electric-railway properties in New York state.

The Oneida Railway Company entered into a contract with the New York Central Company under which the former agreed to lease the tracks of the West Shore Railroad between Utica and Syracuse, equip them for electric operation and conduct the passenger business between these two points. The New York Central on its part consented to abandon the West Shore local trains on these tracks but reserved the right to continue its through steam trains and to haul freight over the electrified section by steam locomotives. Among the towns traversed are Oneida, Vernon and Canastota. The distance between Utica and Syracuse is a little over 44 miles, but under the West Shore schedule extremely scanty passenger transportation facilities were provided.

It is proposed to give three classes of service over the West Shore tracks between Syracuse and Utica: Fast limited electric cars or trains which will run hourly between the two cities and will make two stops only, completing the run in one hour and 28 minutes; local trains or cars; and the steam service.

To provide for passing the fast-moving units around the slower trains a third track has been laid between Clark's Mills and Vernon, a distance of 8½ miles. In addition, between Oneida and Canastota, a distance of about 5½ miles, a fourth track has been laid to pass the electric units around the freight trains that may be held up in the yards or at watering stations. The outside tracks will be used for the local trains.

Power Transmission Lines.

Power for the operation of the line is purchased from the Hudson River Electric Power Company, which owns the hydraulic power plants at Spiers Falls and Mechanicsville. This company is now extending its transmission line from its water-power plants to Utica, and expects soon to be able to deliver electric power to those points at 60,000 volts. A temporary steam plant is now used.

The contract of the power company provides that it shall deliver power to the transmission circuit of the railway company, which commences at the Clark's Mills sub-station, which is that nearest Utica. The power company's transmission line for this distance of 4½ miles is constructed on a private right-of-way adjoining the West Shore tracks and is carried on two-circuit steel towers, spaced approximately 550 feet apart. At Clark's Mills the current is taken by the Oneida Railway Company and is conducted to the three other sub-stations over its own transmission line, which is also built on the private right-of-way of the West Shore Railroad. For serving the entire section between Utica and Syracuse, about 44 miles, there are four sub-stations.

The transmission towers used on the Oneida Company's transmission line differ from those employed on the power company's line. They consist essentially of a square latticed structure composed of four angles, 3 by 3 by 5-16 inch carried down five feet to reinforced concrete footings under each pier, measuring 5 feet by 3 feet by 10 inches. The distance between towers is 480 feet.

The insulators are of porcelain, supplied by R. Thomas Sons & Co. of Lisbon, Ohio, and are placed at the corners of a seven-foot triangle. They are carried on malleable iron pins 18 inches high, which are designed to withstand a strain of 2,000 pounds applied in any direction at the top of the insulator.

A No. 0 seven-strand hard-drawn copper cable is used for each conductor. Where heavy strains occur, necessitating a double cross-arm, the cable, instead of resting on insulators, is attached to an equalizing saddle to distribute the load equally over several insulators. The use of lightning arresters is confined to the sub-stations themselves.

Sub-stations.

The four sub-stations are of similar design. They are of brick with litholite trimmings, concrete roof and concrete floors. They are divided into two main compartments—at the rear the

high-tension room and in front the converter room. This being one of the first 60,000-volt installations in this section of the country, extreme care has been taken to give the necessary clearances on the high-tension side. The high-tension line enters the under side of a protecting hood at the rear of the building and thence passing through circular openings three feet in diameter in the wall of the building to the disconnecting switches and onto the bus compartments.

The high-tension room is two stories in height, the floor being carried only to the face of the barrier walls, which run three feet apart and three feet in depth, up and down the rear wall. This provides a number of cells or compartments open from top to bottom, which are used for the installation of the lightning arresters and bus-bars.

Against the forward wall on the second floor of this high-tension room are built similar barriers forming cells, in which are installed the high-tension oil switches. These switches are General Electric type H, motor operated. On the first floor of this high-tension room and immediately under the oil-switch compartment and running transversely through these barrier walls supporting the oil switches there are three compartments, three feet square, one above the other, and extending the length of the room. These are the bus compartments proper and carry the high-tension line through the station. It is from these buses that taps are made and carried up to the oil switches.

In the converter room are the transformers, rotaries and switchboard. All of the high-tension wires as far as the transformer terminals are of bare copper wire. In the converter room are two units consisting of one 330-kilowatt 60,000:370-volt oil-cooled transformer, Y-connected on the primary side and delta connected on the secondary side, and one 300-kilowatt 370-volt alternating-current and 600-volt direct-current rotary converter. Between the transformer and the rotary stands the reactance which is used for starting the rotary converters. This is the General Electric Company's latest method of starting rotary converters without synchronizing.

The direct-current feeder panels are connected to the third rail at the station by means of rubber and lead-covered cable, each track being independently fed each way from the sub-station—that is, on a two-track section there would be four feeder panels. Auxiliary feeders will not be necessary for the service contemplated. A storage battery is located in the subway and is used in operating the oil switches.

Third Rail.

The third rail is of the bull-headed or double-headed type, of the same section as that adopted in the New York city zone of the New York Central Railroad, and is adapted for under-running contact. It weighs 70 pounds per yard and was supplied by the Lackawanna Steel Company. The conductivity of the rail is equivalent to 1,023,000 circular mils of copper. This conductivity is sufficiently large so that no auxiliary direct-current feeders are required.

The clearance on the West Shore will permit the passage of all of the cars belongng to the New York Central system and all foreign cars except a very limited type of coal cars with low truss rods. Electric locomotives and motor cars designed for use on the Central tracks can also be run over the West Shore tracks without changing the position of the third-rail shoe. The third rail is normally located between the tracks on tangents and on the high side of the track on curves.

Insulators.

The insulators used for holding the third rail in the brackets were supplied by the Ohio Brass Company and are of semi-porcelain. Two sizes are used, one for holding the rail at the inclines where a shallower insulating block is required, the other for supporting the rail at other points. The insulators are required to pass rigid tests. They must be capable of withstanding a tensile stress of not less than 1,400 pounds without showing any indications of failure.

A great deal of study was put upon the proper material for the insulating block. To secure the necessary combination of mechanical strength and electrical insulation the manufacturers made an extended study of combinations of different clay and porcelain mixtures as well as various methods of drying and burning the pieces. The resultant was a product termed "semi-porcelain."

In laying the third rail a space of about one-quarter inch is left at each joint for expansion and contraction.

Two types of protective covering are used, as on the New York Central, viz., a three-part wooden covering which was originally adopted and a single-piece fiber covering which was manufactured by the Indurated Fiber Company and is considered preferable. The wooden sheathing is of long-leaf yellow pine in three parts, top and two bases. It is not treated with any preservative except a coat of ordinary paint. The indurated fiber sheathing is molded for straight track in sections 43½ inches long. The joints on straight track are covered by a 3½-inch lap joint of the same material. At the bonds a wider section of covering is used.

The majority of the bonds on the third rail are the John A. Roebling's Sons Company's ribbon bond. These bonds are 15 inches in length over all and are soldered to the rail, one on each side of the upper head, and have a very large contact surface per terminal. There have also been installed on a portion of this line about 3,000 Ohio Brass Company's ribbon soldered bonds and about 7,000 American Steel and Wire Company's twin terminal bonds. These bonds are of 500,000-circular-mil capacity each, and are installed two per joint on the upper head of the third rail.

The running rail is bonded with the Ohio Brass Company's 11-inch compressed terminal bond, placed under the fish-plate. There is one of these at each joint, and each bond is of No. 0000 capacity. The track is cross-bonded only at special work. Both rails are available for use for the return circuit.

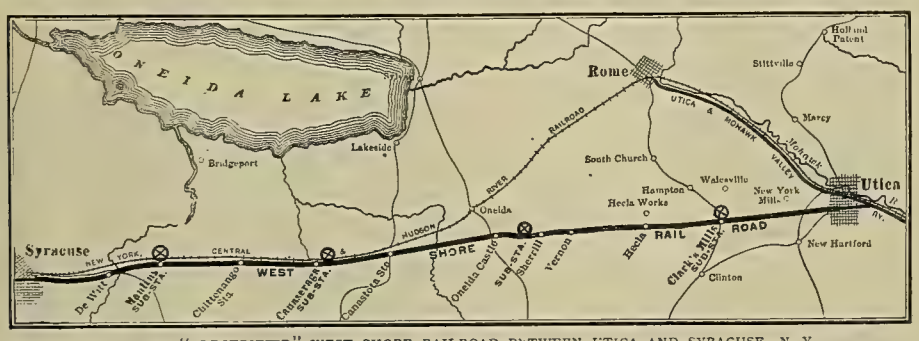
The connection between the direct-current bus-bars in the various sub-stations and the third-rail system is made through several cables of 1,000,000-circular-mil capacity, carried in iron ducts three inches in diameter. The cable is insulated with 3/32-inch rubber and is lead-encased. The end of this duct at the track is brought up to two inches below the top of the track rail, or 2½ inches above the surface of the tie.

Cars.

As the cars are to operate over the city system in both Utica and Syracuse, a different type was adopted than if they were to use the West Shore tracks exclusively. They are about 48 feet by eight feet four inches over all. The interiors are of inlaid mahogany. The floor is covered with interlocking elastic tile. The cars are equipped with 24 reversible and two stationary plush seats with high backs and head rolls. Each car is also fitted with a toilet.

The truck used is the Brill No. 37-E-2, with a wheel base of six feet six inches. The wheel tread is four inches wide and the depth of the flange is one inch, to allow the cars to operate over the city systems in Utica and Syracuse. Each car is equipped with four GE-73 motors with Sprague-General Electric multiple-unit control. Westinghouse automatic air brakes with graduated release and Peter Smith hot-water heaters are used.

VIEW ON "ELECTRIFIED" WEST SHORE RAILROAD SHOWING THIRD-RAIL CONSTRUCTION.



MAP OF "ELECTRIFIED" WEST SHORE RAILROAD BETWEEN UTICA AND SYRACUSE, N. Y.

The first car over the line left Utica at 9:30 a. m. on Saturday, June 15th. It had on board William K. Vanderbilt and C. Loomis Allen of New York; also Horace E. Andrews and John J. Stanley of Cleveland, president and vice-president, respectively, of the line; John Carstensen, vice-president of the New York Central; J. H. Hustis, F. A. Harrington and F. W. Everett, superintendents of the New York Central, and Congressman James S. Sherman of Utica. Among others who made the trip were Mayor Richardson of Oneida, several officials of the cities of Syracuse and Utica, and the following-named electrical representatives: W. B. Potter, Schenectady; George M. Haskell, Philadelphia; N. M. Garland, George W. Swan, Paul T. Brady and F. B. Erwin of New York.

The first cars for the general public left Utica on Sunday morning at seven o'clock, and Syracuse at the same hour. Transfers will be issued for the Utica and Syracuse street railways from the electrified division of the West Shore road.

Ontario's Waterpower Resources.

The fifth and final report of the Ontario Hydro-electric Power Commission has been issued. It deals with the Algoma, Thunder Bay and Rainy River districts, with the exception of the areas north of the Height of Land, which the commission passed over because of the sparse population. These may be the subject of a later report. The water resources of the three districts mentioned are estimated at 350,000 horsepower. Referring to some of the waterpowers, which have been developed in the Algoma and Thunder Bay districts, the report states that the Canada Coffin Company's power station at Turbine, on the Spanish River, has a capacity of 5,400 horsepower, but this year additional units will be installed, which will increase the capacity to 10,800 horsepower. The capacity of the Kaministiquia Power Company's plant at Kakabeka Falls is at present 10,000 horsepower, but this will be doubled in a short time.

The following estimates are given of the cost of power delivered to the sub-stations ready for distribution, viz.: At Port Arthur, 12,382 horsepower from Dog Lake, $9.10, and for half this quantity, $12.60 per horsepower per annum for continuous day and night service; at Bruce Mines, from Slate Falls, 3,300 horsepower, $14.72; at Thessalon, from Slate Falls, 150 horsepower, $27.10. The Rainy River district is reported as being the most copiously watered region, and waterpowers are abundant. All the waterpowers of Ontario have now been reported except those of James Bay. The material collected makes an imposing proof of the great wealth of Ontario's water resources.

Electric Drive in a New Hampshire Paper Mill.

By Norman C. Meade

Electric drive has been adopted to a large extent by pulp and paper manufacturers as a solution of the many perplexing power problems peculiar to this industry. By the use of electric motors a uniform speed is maintained, which not only improves

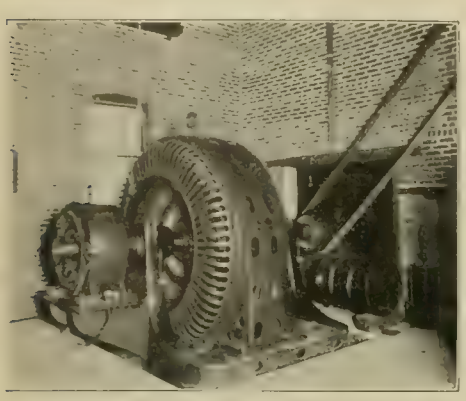


FIG. 1. A 350-KILOWATT ALTERNATOR COUPLED TO WATERWHEEL IN POWER PLANT OF PAPER MILL.

the quality of the product but increases the output as compared with the older methods of mechanical drive. Continuity of service is less liable to be interfered with by reason of the subdivision of the power units. Flexibility and simplicity are gained, and fire risk is reduced to a minimum by the elimination of much grease which always attends the use of overhead shafting. Further, large overload capacity is secured, and the important feature of being able to control absolutely the power supply of each section of the mills or each individual machine is placed in the hands of operatives. These are all very important features and have been given due consideration by pulp and paper manufacturers, as evidenced by the large number of electrical installations in mills of this class.

A typical illustration of the foregoing remarks is found in the pulp and paper mill of the J. E. Henry & Sons Company at Lincoln, N. H., where steam power was used exclusively until about six years ago, when a large number of steam engines were abandoned. Power houses were built at some distance from the mills, where waterpower was available; a transmission line was constructed and electric drive installed in nearly all departments.

Lincoln is located in the White Mountains, with an unlimited supply of timber within a few miles. The company owns 74,000 acres of timberland and operates a railroad about 15 miles in length, extending through this property. A high grade of bag and manila paper is manufactured at these mills, which have an average daily output of 50 tons.

Electric power is furnished by two power houses located on the east branch of the Pemigewasset River—one about a mile and a half from the works

FIG. 2. SWITCHBOARD IN UPPER POWER STATION OF PAPER MILL.

and the other 2 miles which utilize hydraulic power. A 440-volt steam-driven plant is also in operation in the sulphite pulp mill. A three-phase 6,600-volt transmission line connects the hydraulic stations with a transformer station at the mills, where the electromotive force is reduced to 440 volts. All three stations operate in parallel.

The equipment of the upper station consists of two Westinghouse revolving-field alternators of 350 kilowatts capacity, 6,600 volts, 25 cycles, direct-coupled to two 500-horsepower turbines operated at 375 revolutions per minute, made by the Holyoke Machine Company and governed by a Holyoke waterwheel governor. One of these units is shown in Fig. 1. Excitation is furnished by a 15-kilowatt 125-volt exciter mounted on the extended shaft of each generator. The water supply is derived through a penstock 11 feet in diameter and 1,500 feet long, which extends from a dam in the river to a large standpipe near the power house. From the standpipe two smaller penstocks lead to the turbines.

The switchboard, Fig. 2, consists of two generator panels, one feeder panel and one combination exciter panel, and is of standard Westinghouse construction.

The lower power station has a duplicate equipment, with the exception of the main penstock, which is nine feet in diameter and 900 feet long.

The power house in the pulp mill has an equipment of one 310-kilowatt and one 270-kilowatt Westinghouse three-phase 440-volt revolving-field alternator driven by steam engines through rope transmission. Excitation is furnished by two 10-kilowatt 125-volt exciters. Each generator is provided with a switchboard containing standard Westinghouse equipment of instruments.

The transformer house contains six 250-kilowatt oil-cooled transformers, consisting of two banks of three each, connected in delta. They are shown in Fig. 3. The high-tension lines are protected by lightning arresters and choke coils. The switchboard in the transformer house is shown in Fig. 4. It consists of two high-tension panels and three low-tension panels. An additional 60-kilowatt oil-cooled transformer on the outside transforms current from 440 volts to 1,100 volts for the town-lighting distribution system.

The Henry company at the Lincoln mills makes

FIG 3. OIL-COOLED TRANSFORMERS IN TRANSFORMER HOUSE OF PAPER MILL.

sulphite fiber, which is the principal basis of the paper, although a certain percentage of ground wood pulp is used, depending upon the quality of the paper to be manufactured. Spruce wood is used, and is delivered to the mills as cut in the forests and unloaded in a large pond.

The logs, drawn up into the wood room by a conveyor which extends into the water, are next cut into desired lengths by a circular saw driven by a 40-horsepower induction motor. This motor also drives the conveyor. The bark is then removed from the wood by barkers, there being eight in this department driven by a 100-horsepower induction motor. After the bark is removed, the wood passes through a chipper which reduces it to pieces about five-eighths of an inch in length. The chipper is driven by a 200-horsepower induction motor. In addition to the chipper, this motor drives two large blowers, one small blower and two conveyors. The chips are next conveyed to screens where the dust is removed, and the large chips are shaken into a trough of running water where knots and foreign substances separate and sink to the bottom, the chips flowing into a conveyor leading to a re-chipper, which reduces them to a uniform size. The shaker, conveyor and re-chipper are driven by a 20-horsepower induction motor.

After leaving the chipper the chips are conveyed to a storage bin over the digesters by means of a bucket conveyor driven by a 10-horsepower induction motor. From the storage bin the chips are emptied into two digesters, where they are cooked under steam pressure and treated chemically to remove intercellular matter. After cooking, the chips assume the form of pulp, which is withdrawn and drained to remove acid.

In the digester room there is a 75-horsepower induction motor, operating at 480 revolutions per minute, direct-coupled to an acid pump for pumping acid into digesters. Besides the 75-horsepower motor, there is a five-horsepower induction motor, operating a triple water pump which elevates water to a height of 60 feet to a cooling tank used in the acid-reclaiming process.

Two rotary sulphur burners are located in the acid plant. These are driven by a three-horsepower

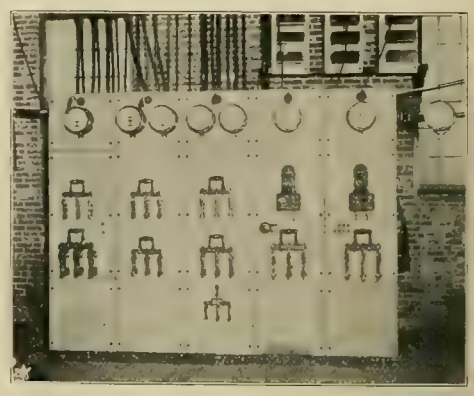


FIG. 4. SWITCHBOARD IN TRANSFORMER HOUSE OF PAPER MILL.

induction motor. In the acid plant there is also located a 75-horsepower induction motor, driving two vacuum pumps, one limewater pump and two agitators. In the filter room there is a 100-horsepower induction motor, direct-coupled to a centrifugal water pump.

The pulp is next pumped to the screen room for further draining. This pump is driven by a 40-horsepower induction motor. Here are located 25 screens driven by a 75-horsepower induction motor.

Certain material which formerly was wasted is now made into a cheap quality of pulp by one of the four wet machines, the four having a combined average capacity of 75 tons of pulp per day. These machines and a large centrifugal pump are driven by a 150-horsepower induction motor. Pulp is pumped from the pulp mill to the paper mill by a stock pump, driven by a 15-horsepower induction motor.

The pulp when reaching the paper mill goes to beaters, eight in number. Here coloring matter and a certain percentage of ground wood pulp is added. The beaters, as shown in Fig. 5, are operated in pairs by 75-horsepower induction motors by means of a silent chain driving a shaft connected to the beater rolls.

From the beaters the pulp goes to two Jordons or grinding engines, where it is further refined to secure uniformity of fiber. The Jordons are each driven by a 75-horsepower induction motor. In addition to the Jordon, each motor drives two agitators in stock tanks and one duplex pump. These motors carry a continuous overload of about 65

FIG. 5. PAIR OF BEATERS IN PAPER MILL DRIVEN BY INDUCTION MOTOR.

per cent. From the Jordons the pulp is conveyed to stock tanks and from stock tanks pumped to the paper machines, which are operated by steam engines.

The finished paper is transferred to the finishing room, where it is cut into the desired sizes. There are three cutters in this room operated by a 20-horsepower induction motor.

Besides the foregoing motors, there are in the paper mill the following applications: Wet machine, driven by 20-horsepower motor; save-all,

driven by 20-horsepower motor; exhaust fan, for removing steam from paper machine, driven by five-horsepower motor; cold-air blower, for cooling calenders, driven by 7.5-horsepower motor; blower, driven by five-horsepower motor.

There are several other departments operated by induction motors, as follows: File room, five-horsepower motor, driving knife grinders; carpenter shop, miscellaneous woodworking machinery, driven by 10-horsepower motor; blacksmith shop, blower and small tools, driven by 10-horsepower motor; machine shop, machines for light repair work driven by five-horsepower motor; pipe shop, two pipe machines, driven by 7½-horsepower motor; a 10-horsepower motor, driving grinder for calender rolls; two-horsepower operating fuel economizer, and a 10-horsepower motor driving hot-water pump for boiler-feed water.

The entire electrical equipment, furnished by the Westinghouse Electric and Manufacturing Company of Pittsburg, is a typical illustration of one of the many electrically driven pulp and paper mills and furnishes a good example of standard electrical practice in this class of industries.

The Rheograph and a New Registering Wattmeter.

By A. de Courcy.

Among the instruments noted at the recent annual exhibition of the Société de Physique at Paris, I may mention one which has considerable interest, this being the new form of rheograph or wave-form recorder which was brought out this year by the French physicist, Abraham, and constructed at the Carpentier establishment. Like the preceding type,

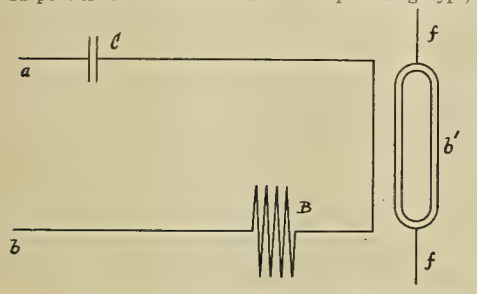


FIG. 1. ARRANGEMENT OF RHEOGRAPH FOR RECORDING VOLTAGE.

which was brought out some time ago, it is designed to give the form of the different waves of current or electromotive force by the projection of a spot of light upon a screen from a moving mirror. The 1907 pattern of rheograph has been designed with a view of giving a large projection so as to be used in lecture rooms upon a screen of some size.

The essential part of the rheograph consists of a special galvanometer which has a movable frame or coil suspended by a very fine metal wire above and below, so that the oscillation period of the coil is considerably above the periods of the waves whose record is to be obtained with the instrument. In its present modified form, the movable coil is

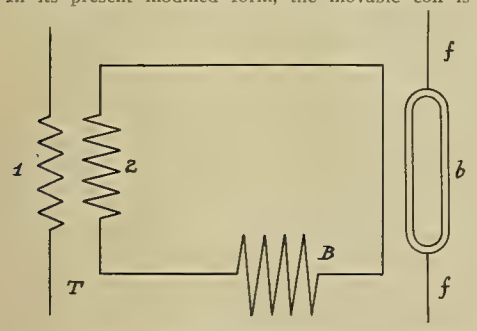


FIG. 2. ARRANGEMENT OF RHEOGRAPH FOR RECORDING CURRENT.

entirely insulated, and it carries only the current which is induced in it by a primary coil which is mounted very close to it, so as to secure the maximum effect.

The general arrangement of the circuits when the instrument is to be used for voltage curves, will be noticed in Fig. 1. A difference of potential U at the terminal points (a) and (b) causes a current to pass in the condenser (C) and the coil (B) whose value J is very nearly proportional to $\frac{dU}{dt}$, providing the ohmic resistance and the self-induction of the coil (B) are negligible. The swinging coil or secondary (b') placed near the primary coil (B) is traversed by an induced current whose value is proportional to $\frac{dJ}{dt}$; that is, to $\frac{d^2U}{dt^2}$.

Considering the case where the rheograph is to give curves of current, an analogous arrangement is adopted which is shown by Fig. 2. Here, however, the condenser is replaced by a transformer (T), whose primary coil (1) carries the current which is to be observed. Following the same formula as above, the current induced in the swinging coil (b) will be proportional to $\frac{d^2I}{dt^2}$. The movable coil is mounted between the poles of a permanent mag-

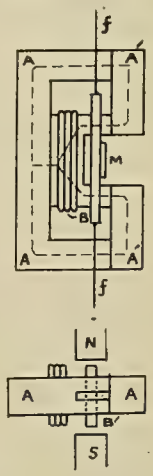


FIG. 3. ESSENTIAL FEATURES OF THE RHEOGRAPH.

net, so that it will be deflected to the right and left in proportion to $\frac{d^2U}{dt^2}$, or $\frac{d^2I}{dt^2}$; but as the torsion couple can be supposed to be negligible, and as the damping factor of the instrument is very small, the differential equation for the equilibrium of the moving coil is reduced to the term representing the acceleration, or $\frac{d^2\Theta}{dt^2}$, Θ being the angle of deflection, and we have very nearly,

$$\frac{d^2\Theta}{dt^2} = \frac{d^2U}{dt^2}, \text{ or } \frac{d^2I}{dt^2}.$$

Therefore the deflection of the coil at each instant is proportional to the difference of potential or to the value of the current.

Turning to the arrangement of the instrument in practice, the design of the new form is seen in the essential features in Fig. 3. At (A A) is a core formed of laminated iron cut into E pattern. Two other laminated pieces (A'A') are placed so as to connect the central part with the upper and lower parts of the core. Around the central part of the core is wound the coil (B) which carries the main current, and the magnetic flux is divided into two parts, as shown by the dotted lines. The movable coil is suspended in front of the core by means of the fine wires (f) (f) at the top and bottom, and the coil is made up of a single turn of copper wire, forming a closed secondary which embraces the enlarged part of the central core. The lower or plan diagram of Fig. 3 also shows this arrangement, with the movable coil (B') placed between the poles of a permanent magnet (N) (S).

To the middle of the coil is fastened the mirror (M) for deflecting the beam of light. It measures about 0.16 by 0.24 inch, and can therefore reflect a considerable amount of light on the screen, which is an advantage. As the suspension of the mirror is vertical, the deflection of the light beam is horizontal to the right and left, and on a screen placed in front of the mirror there would be formed a horizontal line simply. This must now be decomposed so as to give a vertical movement to the reflected ray, so as to produce the wave-form desired.

This is carried out by the apparatus, which is shown in Fig. 4, and known as a synchronoscope. It is placed on the path of the beam coming from the mirror of the coil and very near the latter. The apparatus consists of an isosceles prism (P) which is made to revolve about the axis (O) by means of a synchronous motor. A simple wheel of cast-iron forms the revolving part of the motor,

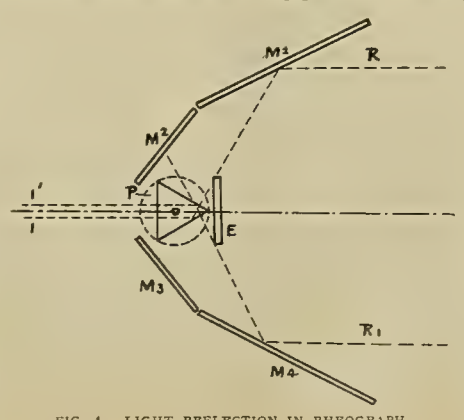


FIG. 4. LIGHT REFLECTION IN RHEOGRAPH.

and it is provided with teeth which pass successively in front of a small electromagnet carrying the current to be observed. The rays (I) (I') coming from the mirror fall upon the prism, enter it and are reflected from the opposite face. They must therefore traverse the third face, and are projected thence by the fixed mirrors (M_1 M_2 M_3 M_4), and are sent at (R) (R_1) upon the screen. Here the mirrors are tangent to a parabola whose focus lies very near the circumference described by the angles of the prism. If the whole mirror were parabolic, the rays would always be reflected parallel to the axis in all positions of the revolving prism, but as the mirrors are plane surfaces in this case, the rays (R) (R_1) are inclined where they meet the mirrors (M_1) (M_4) outside the point of tangency of the parabola. This causes a perpendicular movement to be given to the ray, and thus forms a curve upon the screen. Using only the two mirrors (M_1) and (M_4) there would be three passages of the image at each revolution of the prism, but in the present case the second set of mirrors (M_2) and (M_3) act together with the first, so that there results six passages of the image at each revolution, which is found in practice to be enough to give a practically continuous curve. The opaque screen (E) is used to stop the rays from passing in the direction of the axis.

A new form of registering wattmeter was also remarked. It is manufactured at Paris by Rousselle & Tournaire, one of the leading instrument firms, and is designed according to the pattern brought out in the first place by Siemens & Halske. The present instrument is used as a three-phase wattmeter for widely varying loads. Of the revolving-field type, the wattmeter is formed of a laminated iron ring which carries four internal poles, each having a coil mounted upon it. Two of the

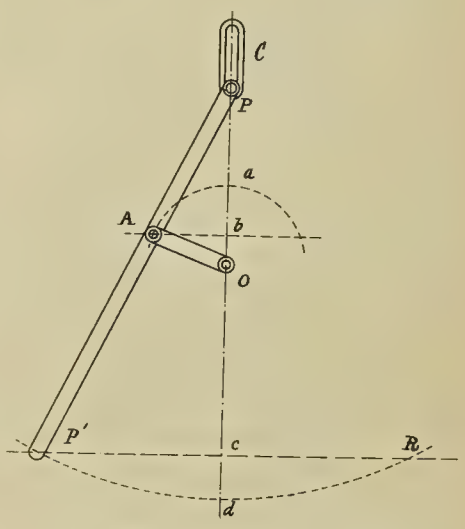


FIG. 5. DETAIL OF REGISTERING WATTMETER.

coils are used for the voltage circuit and two for the current circuit of the wattmeter. Inside the ring is a cylinder made up of laminated iron disks. Lying in the air-gap between these two parts revolves a small tube of aluminum. It is mounted upon pivot supports and works against the action of a spring.

The four coils are connected upon the three-phase circuit according to what is known as the two-wattmeter method. A needle attached to the coil, or a registering arm moving upon a band of paper, will give the indication of the power taken by the instrument. Using the registering method the ordinates given by the arm would be curved, and it would thus be difficult to obtain a good integration of the watt diagram. As the amount of power which moves the swinging arm is considerable, the makers overcome the difficulty by mounting the arm which carries the register pen upon a separate pivot and working it from the wattmeter according to the device which is shown in the diagram (Fig. 5), and so obtain a straight movement of the pen upon the paper and proportional to the deflection of the aluminum cylinder.

Upon the axis of the cylinder is mounted an aluminum arm (A) which is pivoted upon the main arm (P) (P'). The latter is mounted so as to turn upon a pivot at (P), and this pivot also slides in the piece (C) in the vertical direction, so that when the arm (A) turns about the arm (P P') has a combined movement of rotation and sliding at (P), and consequently the point (P') moves back and forth in the straight line (P') (R). To carry this out properly the perpendicular distance (a b) upon the chord of the arc described by the point (A) must be about the same as the corresponding distance (c d), for the arc which the point (P') would describe were (P) to be fixed. In practice the end of the arm carries a registering pen at (P') which moves over a band of paper placed in the lower part of the instrument where it is visible from the front. The paper band is 17 meters long by 0.12 wide, and is unrolled at standard rates varying from 20 to 260 millimeters per hour.

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DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 24th to 28th.

[illegible] Society for the Promotion of Engineering Education (annual [illegible]), Cleveland, O., [illegible].

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society, first annual convention, Boston, [illegible].

International Association of Municipal Electricians (twelfth annual convention), Niagara Falls, N. Y., August 7th to 9th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 20th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

WITH the growth of alternating-current power service has come a demand for an accurate maximum-demand meter for measuring the true energy of polyphase-current consumption. As is well known, the question of power factor—that is, the relation of the true watts in an alternating-current circuit to the apparent volt-amperes—is an important one; but it is only of recent years that the number of alternating-current motors on measured service has become so large that the subject of metering for individual consumers on a basis equitable both to the customer and the central station has received careful study. Mr. L. A. Ferguson, vice-president of the Chicago Edison Company, brought the subject up at the recent convention of the National Electric Light Association in Washington, D. C., and there was a brief but interesting discussion, reported elsewhere in this issue. At its conclusion a committee was appointed to consider the subject of polyphase meters and report at the next convention. This committee consists of Mr. Ferguson, Alex Dow of Detroit and J. E. Montague of Niagara Falls. It has power to add to its number, and a valuable report may be expected.

It is in conducting investigations of this kind that the National Electric Light Association exhibits an important phase of its great usefulness to the central-station industry.

DELAY in the completion of expositions is notorious; an undertaking of this kind fully completed on the opening day would indeed be a rare bird in the land. But the Jamestown Exposition has so far outdone all predecessors in this particular that it has achieved an undesirable notoriety all its own. Many of the visitors to the Washington electric-light convention from various sections of the country "took in" the exposition after the convention, and it is probably safe to say that all of them were disappointed. They visited the Tercentennial Exposition five weeks after the opening day, but it was apparent that six weeks or more, in addition, must elapse before the show will be really completed. When finished the exposition does not give promise of showing anything especially noteworthy to the exposition-surfeited people of this country, so that the delay in presenting what there is, is the more annoying. The display has a very fine marine setting, and the sight presented by the assembled warships in Hampton Roads is magnificent, especially when electrically illuminated at night, but the exposition itself is rather tame. One striking feature, however, is the searchlight illumination. A number of projectors are massed on the roof of one of the principal buildings, and the beams of light from them radiate like the ribs of an open fan. Seen from Old Point Comfort, opposite the exposition, this illumination, streaming across the night sky, has a fine effect.

ORDINARILY the operation of transformers of the same make, type and size in parallel on the secondary sides is a perfectly straightforward proposition, but in the extension of central-station service the question of harmonizing transformers of different design or varying characteristics frequently comes up. As a contributor points out, the essential point to secure is a proportional distribution of loading between the different transformers, varying according to their size. This means a percentage drop in voltage that shall be approximately equal among the units in operation, which of course cannot be directly obtained in many instances on account of the differences in regulation.

In some cases the difficulty can be overcome by installing the equivalent of a secondary belt line in a given district, separating the transformers from one another by several hundred feet if possible, so that the line resistance tends to distribute the load and absorb excessive drains from any one unit. Again, the transformer having the least drop can be connected to the secondary mains in some instances with lines of somewhat higher resistance than are used for the other units. This tends to prevent the transformer with the least drop from taking more than its share of the load when fully loaded, although in light loads the distribution would be even enough for all practical purposes. If the respective units differ radically in regulation, it will not pay to attempt multiple operation of secondaries. It is an easy matter to test out these points with artificial loads at the station before placing the transformers in service and to determine experimentally the sizes of leads desirable.

ELECTRIC POWER is used to a large extent in modern coast fortifications. At Fortress Monroe there is an interesting plant of this character, very well constructed from an electrical point of view. The disappearing 12-inch rifles are elevated, turned or inclined on their axes by electric motors, and the work is done very smoothly, easily and quickly. In case of disablement of the electric plant, either from accident or the activity or good luck of the enemy, means are provided to substitute manual operation. It is therefore somewhat puzzling to read in a newspaper account of recent war maneuvers centering about the defenses of New York city that seizure of the electric power plant there seriously crippled the forts. To quote: "The landing party from Fort Hancock made its way through the Narrows, landed at Stapleton, stole on the Fort Wadsworth reservation, seized the power house and actually turned off the lights for a time. That meant that the fort was put out of action. There were no lights there and no current to fire guns. An attempt to capture the searchlights at Fort Hamilton was foiled and the city saved from the attacking fleet, which was sunk."

While it would be undesirable to be without electric power in a modern fort, it is of course true that that contingency has not been overlooked. Possibly more than one source of current has been provided. But even should there be a total failure of the supply of electricity, workable substitutes, not so good but still very efficient, would be quickly provided both for light and power. Capturing the power supply (probably a difficult feat in time of actual war) would hardly put the fort out of action, valuable as the use of electricity has proved itself to be.

IF HE IS CORRECTLY reported in the newspapers, Mr. C. Hart Merriam, chief of the Biological Survey, Department of Agriculture, United States government, has made a curious statement apropos of the gnawing of insulation from electric wires by rats. In an official bulletin devoted to the praiseworthy purpose of denouncing the common brown rat as a most destructive pest Mr. Merriam is credited with this language: "They gnaw through lead pipes, flooding buildings with water or filling them with gas. They injure furniture and the doors of buildings, and eat insulation from the electric wires, thus causing disastrous fires. The average fire loss in the United States due to defective insulation is placed at $15,000,000 annually, a considerable part of which is said to be caused by rats."

Undoubtedly rats do some damage occasionally to wire insulation. For this reason, among many others more important, they are an unmitigated nuisance, and we are glad that the chief of the Biological Survey is after them with a sharp stick. But what attracts our attention especially is the statement that "the average fire loss in the United States due to defective insulation is placed at $15,000,000 annually." Is this true? And who made the estimate? We do not believe that the total annual electrical fire loss in this country amounts to half the sum named, and it is probably very much less than half. In Chicago in 1906 the total fire loss caused by electricity was $300. And of all electrical fires only a portion are due to "defective insulation." The Iroquois Theater fire of 1903, for instance, which has been classed as "electrical," had its origin in a spark falling from an arc lamp onto stage drapery. Carelessness and not defective equipment is the explanation of most electrical fires. Moreover, electricity, which has really greatly decreased the fire hazard, is made to bear the odium of many fires which it never caused. But a government official and a man of science should not circulate exaggerated and misleading generalities of this character.

Railway-car Lighting.[1]

By George C. Keech.

Mail-car Lighting.

The railroads of this country anticipate that they will be called upon by the government to abandon the use of flaming illuminants in mail cars. As they are also anxious to prevent loss of life and property from fire they have been experimenting with various kinds of electric car lighting. There are three electric systems which are apparently equally successful. One called the "head end system" consists of a steam or gasoline engine in the head baggage car direct connected to a 110-volt generator; each car of the train is equipped with cable connectors, and 110-volt lamps are used throughout.

Another system known as the "axle lighting" consists of a storage battery with a total voltage of usually 30 or 60, which continuously feeds the lamps, and which is charged while the car is in motion by a small generator connected to the car axle; each car has its individual outfit. The third is the straight storage-battery system, the cells being charged at the end of the run. In all cases, and in the two latter especially, it is necessary to use lighting units of the highest possible efficiency.

The greater part of the work in mail cars is done at night, and, moreover, as the windows are few and small, artificial light is called for at all hours. Tests were made on three mail cars of the same dimensions and general arrangement with a different system of lighting in each. The location of the test stations was the same for each in the different cars, the height corresponding with the work done at the various points. For instance, some of the tests were made three feet nine inches from the floor, or the average height at which mail is held for reading addresses. Others were taken at 1½ to 2 feet from the floor, where pouches are thrown in and out at the doors and tags are read. One car was lighted by seven four-burner Pintsch gas lamps hung in the middle of the car and arranged so as to have the greatest illumination at the distributing end. Another was lighted by 31 eight-candlepower round-bulb incandescent lamps, in white-lined, shallow-trough reflectors, operating on the axle lighting system. The single lamps covered the benches and tables, and one five-lamp and one three-lamp cluster were at opposite ends of the car, near the doors. These lamps average 0.7 ampere on 30 volts, or 21 watts each. Cars thus equipped have been in service several years, and the operation cost per car-mile is probably less than that of gas, while the illumination is 67 per cent. greater.

A car lighted by three type H mercury-vapor lamps of 20-inch tube length, operating in multiple on the axle system at 55 volts and 3½ amperes, or 192.5 watts each, was put into service by the Chicago, Rock Island and Pacific Railway at the suggestion of W. E. Ballentine, electrical engineer of the road, and has been in active operation for 75 days at an average of 12 hours a day, or a total of 900 hours. The vibration of the train has not affected the lamps in the least and the tubes are apparently in as good condition as when started and no trouble of any kind has been experienced. The vapor lamps are equipped with reflectors close to the tubes, and as the ceiling and walls of the car are white it is probable that the general effect would be improved by removing the reflectors. As the reading of addresses on mail matter in a moving car for a number of hours at a time is quite a strain on the eyes of the postal clerks, it is not likely that an average of from eight to 10 foot-candles and a maximum of 15 is too much illumination. The experience of the Washington, New York and Chicago postoffices with mercury-vapor lamps has proved beyond a doubt that the quality of the light therefrom is of the very best for mail distribution.

Tests made at 10 different stations in three cars lighted, respectively, by mercury vapor, Pintsch gas and incandescent lamps gave an average of 8.85, 1.32 and 2.21 foot-candles for the three systems, respectively. Other results obtained would show that the investment in batteries and apparatus would be very high to secure the same illumination with incandescent lamps that is possible with vapor lamps.

Passenger-coach Lighting.

A car lighted by three arc lamps operated at 100 volts by a battery of 50 cells charged every other day leaves the Chicago and Northwestern station at Chicago every evening at 6:30 for Waukegan, Ill., the number of hours of lighting between charges being about 10. This car has now been in service for three months. Fourteen tests were made three feet three inches from the floor at the positions persons would naturally hold books or papers when riding two in a seat. The illumination was taken at an angle of 60 degrees from the horizontal. Eight tests were taken three feet from the floor on a horizontal plane for the purpose of showing the variation throughout the length of the car. A reclining chair car in service on the Chicago, Milwaukee and St. Paul Railway is provided with head-end lighting and the body of the car contains 14 eight-candlepower, 110-volt, 30-watt, and four 40-candlepower, metallized filament, 100-watt incandescent lamps. Each eight-candlepower lamp in the lower deck is equipped with a No. 2623, and each 40-candlepower lamp in the upper deck with a No. 7330 Holophane pagoda reflector. The tests taken at the same 14 locations, heights and angle as in the Northwestern car, gave an average of 1.47 foot-candles for the incandescent system as compared with 1.12 foot-candles for the arc system in the other car. At eight similar stations in the two respective cars the maximum variation for the arc-light system was 2.40 foot-candles as compared with 0.85 foot-candle for the incandescent.

The following table shows the comparative results obtained in four cars, three being lighted by incandescent lamps and the other by arc lamps:

	Car 1 Arc.	Car 2 Incandescent.	Parlor Car Incandescent.	Observation Car Incandescent.
Number of lamps	3	18	30	32
Watts per car	750	820	900	1664
Average foot-candles	1.12	1.47	1.66	3.4
Square feet illuminated	419.5	385.4	371	199.5
Watts per square foot	1.78	2.13	2.42	8.34
Foot-candles per watt per square foot	.629	.69	.644	.407

Discussion.

Albert Scheible referred to a paper read several years ago by Professor Shepardson of the University of Minnesota on passenger-car lighting, in which the latter favored horizontal illuminating measurements on account of the tendency of passengers to change their positions while reading.

W. Bentley of the Universal Electric Storage Battery Company spoke of tests made in a car lighted by arc lamps by A. L. Eustis, a student at Armour Institute. The tests were performed at different times by the use of different instruments, and the several results obtained showed very little variation.

A. J. Farrelly, electrical engineer with the Chicago and Northwestern Railway, noted that the variations between high and low readings in one car were in the ratio of about 4 to 1.

W. L. Hanim of the Adams & Westlake Company stated that they had been using a great deal of dense opal glassware in their car-lighting apparatus and they found that the effect was very pleasing to the eye.

C. R. Gilman, electrical engineer with the Chicago, Milwaukee and St. Paul Railway, said that the length of some of their trains was a tax on their head-end system of lighting. The Pioneer Limited, for instance, sometimes left the station with a head-end of 240 amperes and 110 volts. They are looking for a more efficient system of illumination.

L. J. Kennedy of the Consolidated Railway Electric Lighting and Equipment Company said that he had been interested in certain tests made of mercury-vapor lamps in mail cars on the Rock Island system, and he thought that the results obtained were very satisfactory. He referred to the fact of the car remaining in a dark train shed for a considerable length of time when the train is not running as necessitating a heavy drain on the batteries. Among others who took part in the discussion were F. E. Hutchison of the Pennsylvania Railway, A. Merrylees of the Rock Island and W. A. Derby of the Burlington road.

[1] Abstract of a paper read before the Chicago Section of the Illuminating Engineering Society, June 13, 1907.

Arrangements for the Institute Convention at Niagara Falls.

The twenty-fourth annual convention of the American Institute of Electrical Engineers will be held at Niagara Falls, N. Y., June 25th to 29th. Institute headquarters will be at the Cataract Hotel, where the sessions will also be held. There are 10 other good hotels. Members should personally arrange for accommodations, also for transportation. The concession of a fare and a third, obtained for previous conventions, has been granted only by the New England, the Trunk Line and the Eastern Canadian passenger associations. The Central, Western and Southern associations, however, have summer tourist rates to the Falls.

There is an excellent list of papers on the programme. President Samuel Sheldon will have for the subject of his address "The Properties of Electrons." Messrs. E. E. F. Creighton, Percy H. Thomas and N. J. Neall will treat the subject of lightning and lightning protection. "Interaction of Synchronous Machines" and "Heating of Copper Wires by Electric Currents" are the subjects, respectively, of papers by Prof. Morgan Brooks and Dr. A. E. Kennelly.

The high-tension transmission committee, of which Ralph D. Mershon is chairman, has made preparation for thorough discussion of the subject of high-tension transmission. Twelve good papers by men familiar with the various phases of the subject are on the programme.

N. W. Storer will present a paper on "Single-phase versus Three-phase Generation for Single-phase Railways," and A. H. Armstrong will discuss "The Choice of Frequency for Single-phase Alternating-current Motors." Electric-railway subjects, motors, transformers, wire, etc., are treated by a good variety of papers. Among the miscellaneous subjects on the programme, the proposed revision of the standardization rules will be reported by the committee.

The local committee under the leadership of Philip P. Barton has made careful provision for the entertainment of members and visitors. Ralph W. Pope is secretary of the Institute, his address being 33 West Thirty-ninth Street, New York.

Electric Scintillator May Illuminate Niagara Falls.

It is proposed to illuminate the falls of Niagara by the electric scintillator, an effective display illuminating device recently invented by W. D'A. Ryan, the well-known illuminating engineer of Lynn, Mass. The apparatus was designed by Mr. Ryan partly as a new feature of the Jamestown Exposition, but for financial and other reasons it was decided not to use it. The practicability of the device and its capability to produce exceptionally striking illuminating effects were, however, demonstrated in a 54-night consecutive run at Bass Point, Nahant.

Details of the device as applied to the artistic illumination of jets of steam were given in an illustrated article in the Western Electrician of February 2d. Since then it has been improved so that it can be operated in all conditions of atmosphere. When the device was installed at Bass Point the light was visible in Boston and surrounding cities to a distance of 30 miles. The climatic changes introduced a variety of effects and the blending of colors was carried to a degree of remarkable beauty. It is said that the scintillator has somewhat the same psychological effect as music, and owing to the variety of blendings the public did not tire of it, many people returning to Bass Point several times.

As for the apparatus proposed for use at Niagara Falls this will differ materially from the scintillators above referred to, particularly in its size and application. Mr. Ryan proposes to use two batteries, one of five 60-inch projectors mounted at the highest available point on the Canadian side and so placed as to catch the crest of the falls and plunge the light into the broken water as it rushes down between the bridge and the brink on the American side. These will be so placed that they can be used to advantage to sweep the rapids and the Canadian Falls. The color attachments will be used so as to tinge the water various shades, including carmine, crimson, orange, yellow, green, violet and purple of the purest shades obtainable. These various shades will be combined in different ways so as to introduce innumerable pleasing tints and shades in various combinations.

The second battery will consist of 25 36-inch projectors mounted in the form of a crescent at the base of the Gorge on the Canadian side. These will also be provided with color attachments and the projectors will be so placed that they can be concentrated on either the American or the Canadian Falls or subdivided so as to cover the Canadian and American Falls as well as the Maid of the Mist Falls.

Along the edge of the water opposite the battery in the Gorge the scintillator head could be installed and also the mortars for discharging the smoke bombs and mines.

The illumination without special features would consist merely of throwing white light onto the Falls without attempting any spectacular effects. Special features of 12 distinct varieties are said to be possible with Mr. Ryan's device, including the following:

"Three aerial maroons exploded with heavy detonations at an elevation of about 500 feet, throwing out large banks of white smoke. As the smoke floats away it is picked up by the Gorge battery and tinted similar to clouds at sunset.

"Artificial aurora-borealis by the Gorge battery, supplemented by the Cliff battery. As these rays reach into the sky with ever-changing color the tints will be reflected in the water and will be visible from all points around the Falls or Gorge, and under suitable atmospheric conditions the beams in the sky should be visible in Buffalo and Rochester to such a degree as to excite comment.

"Play of color over the water and cliffs and under the Suspension Bridge.

"Concentration of white light from the Gorge battery onto the American Falls and the concentration of the Cliff battery onto the head waters and crest of the American Falls.

"Simultaneous burst of white light from subdivided batteries on the entire American, Canadian and Maid of the Mist Falls."

Special features can be introduced in the winter time, when the effect will be enhanced by the snow and ice on the trees and other objects in the parks surrounding, and wonderful effects can be obtained in a snowstorm. The proposition is to illuminate Niagara in a distinctive and dignified manner and on a scale in keeping with the surroundings.

Measuring the True Energy of Polyphase Service.

At the [illegible] of the National Electric Light Association, Washington, D. C., on June 7, 1907, after the reading by Mr. Ferguson of the paper of Our Service [illegible] Methods of Charging for Electric Current," the following interesting discussion [illegible]

L. A. Ferguson, Chicago: I think it would be advisable to have a discussion here of the necessity of obtaining some meter that would measure the true energy on polyphase service for general use, not for large customers, but general motor service, and the president asked me if I would provoke such a discussion at this convention.

This whole subject of charging for alternating power service is very important at the present time. The use of alternating-current service for industrial power is growing tremendously all over the country, and this is especially true in the large cities and also in those sections of the country where waterpower is available, but at the present time it is difficult to deal with the customers on a differential system. If you are selling on flat rate per kilowatt or horsepower per year, of course there is nothing to consider, but there are some of us who believe that at least where steam power is the source of supply, such flat rates are not accurate, and the differential system should be used so as to avoid difficulties with our customers in making comparisons with their costs. If we sell on a differential system everyone pays exactly on the same basis. The difficulty is that we have no means of measuring the maximum demand.

We have made a number of experiments in Chicago to ascertain whether the Wright indicator could be used for this purpose. It has been our practice to sell alternating-current service on a sliding scale of prices, so much per kilowatt-hour, but we want to apply the maximum-demand system to this service. We made some experiments with the Wright indicator and came to the conclusion we could not use it for more than one reason. One reason is that the power factor of the different phases is not the same, and therefore we cannot simply take the indication of one phase and assume that is the maximum demand for the entire installation. Our contract department objected very seriously to the method of charging which involved charging for the idle current, that is, charging on the basis of the kilowatt amperes, because it made the customers' bills so high, so we were forced to try to find some method of charging that would be fair to our alternating-current customers as well as our direct-current customers. We made an investigation of all our direct-current power business, taking about 2,000 customers, involving about 10,000 horsepower, and found what was the ratio between maximum load and connected load and applied these results to our alternating-current business.

Of course that is approximately correct, that is, it is correct collectively, but the difficulty is that it is not correct in any individual case, so that we still feel, notwithstanding the fact we are able to do business on that basis, that we ought to have an instrument for determining the true energy. Mr. Semenza points out very nicely, and Mr. Newbury pointed out the first day of our convention, the importance of this question of power factor, and what the effect was on the company's investment by low power factor, that is, if the generators were heated up, lines heated up, transformers heated up, and therefore we should charge for the idle current. We should look at this matter from an engineering viewpoint. What we should do is to find a system that will measure the true energy and then put our price somewhat higher in order to compensate for the loss due to low power factor. We have instruments which will take care of large installations, but what we want is an instrument which can be used for small installations, something not too expensive for general use.

Howard T. Sands, Haverhill, Mass.: Mr. Ferguson refers to the fact that the very large installations have a satisfactory instrument for ascertaining the true energy. I ask what that instrument is, also what, in Mr. Ferguson's opinion, should be the proper lag for a three-phase indicator. I am at present using the Wright indicator for ascertaining the demand. I find, however, that the curve of the present Wright indicator to my mind is altogether wrong. I do not believe we have any right to impose upon a customer the demand charge, when from 80 to 90 per cent. of that demand can be reduced in the sharp peak of a load lasting for only a matter of five or six minutes. If we are going to surround the sale of electric power with a lot of theoretical conditions we had better get out of the business. We have to compete with the isolated plant and the man who has his own steam plant. I have served my purpose by forgetting all about power factor, but simply taking 75 per cent. of the volt-ampere reading of the demand indicators and charging him for the demand at the primary and charging the balance at the secondary rate. I would like to ascertain what would be, in the opinion of Mr. Ferguson, the proper lag, if a proper three-phase indicator can be found.

Peter Junkersfeld, Chicago: As has been pointed out, the production of energy is in no sense dependent on the power factor. The distribution of energy is very largely dependent on the power factor. Commercial considerations come in, and that is the complication of explaining this effect of the power factor on the customer, either when soliciting his business, or later, when explaining the bill. The polyphase circuits are nearly always unbalanced, and for that reason, as Mr. Ferguson indicated, the ordinary Wright demand indicator gets us into difficulties right away. There may be a very large percentage of difference of current in the three legs of the system.

We have come to the conclusion in Chicago that perhaps the simplest way is, as one gentleman has just said, to forget the power factor at the time, but not to forget it at the time of fixing the rate, doing so in the interest of simplicity. The indicating wattmeter is an instrument developed to a very high standard. The art of clockmaking is also developed to a high standard, so that we are handling a great many large customers by simply using the indicated output for a definite period of time, one hour, a half hour, or 15 minutes, as the case may be.

In supplying large railroad systems, where there are hundreds of cars and the load curve shows no sharp peaks, the average demand for one hour does very well, but for industrial power or interurban railways, where the peaks are sharp, that works a hardship on the company. It is another way of reducing the price, so that in this case it would be fair to the company and more equitable to both company and consumer to use the average demand over a 15-minute period. That can be done by a time-lock attachment to the meter. We have used such an arrangement for a year, and in this way we get the average demand for a period as may be agreed on by the contract and justified by the conditions. In that way you get something which the average customer can understand where you are soliciting business, and it is a simple thing to explain. In this sort of power it does cost more for distribution if the customer's demand is at the low-power factor, and the thing to do is to keep that in mind when fixing on that sort of power.

Alex Dow, Detroit: The question of a demand indicator for polyphase circuits is now being studied not only in the United States but in England and on the Continent, and the General Electric Company has to my knowledge in the last two years done a great deal of experimental work on it. The downright difficulty, however, is not to combine the clock suggested by Mr. Junkersfeld with the integrating meter, nor to devise an instrument to give a record of the load at any time or any number of times, or to integrate for any period. The primary difficulty is to find out just what we want, and these expressions of opinion by Mr. Ferguson are very much in line with the necessities of the meter manufacturers today, that the people who want to buy such meters should get together and settle definitely what sort of a meter it is that they require, and having settled that, what sort of a price they are willing to pay for it. Practically you can get anything. It becomes an exceedingly complex instrument, and while the complexity is warranted in such installations as Mr. Junkersfeld talked about, the cost of the instrument would not be warranted in the average small polyphase motor installation. What then is wanted, gentlemen, and what I hope will come as a consequence of this talk now, is an expression of opinion definitely as to what one device is wanted, what the device shall do, or what two alternative devices are wanted, and that being done, consideration should be given as to what the selling price should be to warrant its manufacturing in quantity and its purchase by our members. In making this statement I know I am expressing the very recent views of the meter manufacturers.

Philip Torchio, New York: I desire to confirm what Mr. Dow has said. You can get any instrument for measuring large amount of power you wish from the manufacturers at the present time. Some of the instruments which are in operation around Niagara Falls register the maximum output in any one hour; some of the other instruments register the maximum demand over five minutes. Some of the instruments are based on the overlap and are recording instruments which give the load diagram for 24 hours. All of these instruments that are being manufactured can be secured for that purpose.

Referring to the power factor, I think we who supply light from our central stations are very much interested in the power factor, not only for the reason that we do not want to overload the cables, transformers and generators, but also for keeping the regulation good and with low power factor, the regulation, of course, becomes very bad. The manufacturer ought to be impressed with the fact that induction motors must be made with the best power factor that can be had, and if the motor cannot be made with a good power factor, at least the controlling and starting devices be made to reduce the inrush current to a minimum. In an instance where we were asked to bid on very large motors to supply water-pumping stations, motors of about 800 kilowatts each, it was made possible to start the pumps under full head and still not have an inrush current more than 50 per cent. of full-load current, and that is all arranged by proper resistance in the starting.

R. W. Rollins, Hartford, Conn.: Mr. Ferguson made the statement that instead of installing Wright demand meters on his polyphase system they were basing their calculations on the results of their experience on the direct-current system, based on 10,000 horsepower. It would be interesting to me to ascertain the relation of the maximum demand to the full 10,000-horsepower rating.

Mr. Ferguson: My object in bringing this matter up was not to discuss instruments and details of instruments, but to find out whether there was a necessity for such an instrument. We have discovered that there is a necessity for it. I assumed that it was generally known that the ordinary integrating wattmeter could be used for large power. That was not the point to be discussed. It was to find out whether there was a necessity for an inexpensive meter which could be applied to all of our power business. In large railway or industrial power-work installations the matter of $50 or $75 or $100 for a meter does not cut any figure at all, and such a meter is on the market; or even the ordinary integrating wattmeter can be used by taking readings at intervals of an hour, 30 minutes or 15 minutes. I think that will answer Mr. Sands' question as to what kind of an instrument I refer to. I will answer Mr. Rollins' question and think it will also answer Mr. Sands' question regarding the percentages used.

We made a study of 10,000 horsepower in motors (the total of 2,000 motors) on our alternating-current system and found that the average of the business, that is, ratio between the maximum load and connected load, was 64 per cent., but that varies a little from conditions. Where a customer has one motor the ratio between maximum load and connected load is higher than where there is more than one motor installed, and therefore you have to differentiate between the two. You can see why that is. If a man has 50 one-horsepower motors they would not all be used at once, whereas if he has only one 50-horsepower motor he is using it all the time. We found it was better to make the classification according to horsepower. This tends to take into consideration just as well the difference between groups of motors and installations of one motor.

I will read the classification under which we are working. Class A installations, up to 10 horsepower; where one motor is used we use a figure of 85 per cent. of the connected load; where more than one motor is used, 75 per cent. of the connected load. Class B installations, from 10 to 50 horsepower, irrespective of the number of motors, 65 per cent. of the connected load. Class C installations, all over 50 horsepower, irrespective of the number of motors, 55 per cent. of the connected load. These figures represent the average figures of our alternating-current system, and at the present time we are working under that schedule.

Mr. Sands: I understand that in England demand indicators are being used for motor work which will not register a maximum demand of less than 15 minutes, or a half hour or an hour. I ask what you think is the fair time limit on demand indicator for power work?

Mr. Ferguson: That would depend on the size of the power station. In a large system like New York, Philadelphia, Boston or Chicago it would not make so much difference; an hour could be used without any difficulty. If you are in a small town where the size of the power house was small you would have to make the limit of time less, because you would overtax your generators if you had great, high flashes, lasting for five or 10 minutes. In a large system these things come together and overlap, so that you would not be bothered even if you take a longer time.

Mr. Sands: Don't you think a man with a steam plant can overload his plant for a period of 10 or 15 minutes for 33⅓ per cent. with no appreciable difference to him in the cost of power? We must meet that, in a measure, in fixing our demand.

J. F. Geiser, Waynesboro, Pa.: As I understand Mr. Ferguson's position, the meter is for inductive load only, that is, only furnishing power service for individual power motors. All of our load is not inductive load. The same method would not apply to non-inductive load that applies to inductive load. In many places the power service is separate from the lighting service, and every day the demand is becoming greater for all kinds of service from one service connection through one meter. In our own place we have it entirely that way, only one meter for all kinds of service, inductive and non-inductive.

There are various devices which may be attached to the service either small or large, and we cannot tell today what is going to come out tomorrow, and whether it is going to be inductive or non-inductive. We ought to have meters that will measure that demand in such a way that we can take care of all the customers, all sorts of loads, as much as possible on one set of meters and one set of charges. I do not know how the

question affects most of the members here, but with us we find the maximum-demand meter does not entirely satisfy the customer; he would rather contract for a definite demand. They want to know beforehand on what basis their maximum demand is put, and on what basis they are being charged. Something in the nature of a current limiter, it seems to me, would be an improvement over the maximum-demand meter. There is a demand for an instrument which will limit the demand in such a way that the customer will know it, at least, if he exceeds that demand.

H. T. Hartman, Philadelphia: The proposition advanced by one of the recent speakers that the peaks integrated over a half hour or hour should be taken as a fair average seems entirely too high. Take for example an elevator load; we all know that if we were to take as its maximum the average over a period of an hour or a half hour we would be allowing entirely too little. The Niagara Falls, Lockport and Ontario Power Company has recently installed a very large transmission system, and it has adopted as an average the one-minute peaks over the month; the 30 highest one-minute peaks are taken as representing on the average the demand for which it must charge in order to get a sufficient amount for its fixed charges.

A. A. Dion, Ottawa, Canada: I ask Mr. Ferguson, assuming that the Wright demand meters are used to determine the maximum load on alternating-current motors, large and small, such as we find in a large city, whether the lag of the Wright demand meter, such as is furnished in this country, is such that the starting current of these motors will not be recorded?

R. S. Hale, Boston: We have Wright demand indicators on practically all of our direct-current power business and we find no trouble at all from the starting current.

Mr. Ferguson: I will answer the question of Mr. Dion regarding the operation of the Wright meter. It rises to about 80 per cent. of the true maximum in five minutes, and then it continues very slowly until after the load has been on, say, for 20 minutes, when it reaches the true maximum. The Wright meter does not take into consideration flashes or momentary peaks. If you keep shoving on peaks one after the other it will force the instrument up. We do not apply the Wright meter to our alternating-current service; we use a system of percentages, which I explained, were arrived at through a study of the ratio between maximum load and connected load in our direct-current business, assuming that what was fair for the direct-current was fair for the alternating-current business. I think the simplest way to get at the whole subject would be to appoint a committee to look further into the matter. The Association of Edison Illuminating Companies has a committee on meters, and that committee is considering this subject. They are working with the manufacturers on a meter which can be used for general purposes. I move that a committee on meters be appointed by the president to investigate the whole subject of meters, with especial reference to the particular subject we have been discussing this morning. (Carried.)

President Williams: I will announce as the committee on meters the following-named gentlemen: L. A. Ferguson of Chicago, Alex Dow of Detroit and J. E. Montague of Niagara Falls, with power to add to their number.

BOOK TABLE.

Armature Construction. By H. M. Hobart, B. Sc., and A. G. Ellis. New York: The Macmillan Company. 1907. Pp. (5¾ by 8¾ inches), 348, with 420 illustrations, including numerous colored diagrams. Price, $4.50.

The subject is treated from the constructional and practical viewpoint rather than from the designing and calculating basis. Accordingly, theoretical elements are employed only to facilitate an intelligent understanding of the various methods and points entering into the construction of armatures. The subject of windings is dealt with in the aspect of their practical possibilities, the electromagnetic properties not being considered to such an extent as they would be in a more general or theoretical treatise.

The introduction is devoted chiefly to a description of the component parts of a dynamo-electric machine and the work performed by each, the relation of the armature to the machine being clearly explained. Attention is called to the erroneous tendency to synonymize the terms rotor and stator with the terms armature and field, respectively, the difference in meaning between these terms being fully explained.

The book contains 13 chapters, the following-named subjects being treated separately: Armature laminations and their preparation; the armature frame, armature-core ventilating pieces, assembling the core, construction of squirrel-cage armatures, commutator construction, continuous and alternating-current armature winding systems, insulating of armature conductors, the winding of continuous and alternating-current armatures and the design and construction of winding forms, finishing and testing. A number of valuable tables are given.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXI.—Central Stations.

Central stations, or electrical power houses, consist of an assembly of all the generating, regulating and controlling devices of an electrical system grouped in a conveniently located building.

Location of the Station.

There are, of course, a great many points to be considered in the location of a central station with reference to the territory which it serves, but the most important of these considerations is cheap and convenient fuel supply and ample water supply for boiler and condensing purposes in case of a steam plant. There are a large number of hydraulic central stations throughout the country, but the location of these is, of course, fixed by the situation of the waterpower from which they derive their energy.

For a number of years in the early days of electric lighting direct-current distribution was used almost exclusively, and in such cases it was very important that the station should be located close to the center of the territory which it supplied, as the cost of copper became extremely high if current had to be transmitted to any great distance from the station. At the present time, however, almost all of the large central stations generate alternating current and distribute it over a wide territory by means of suitably located rotary converter sub-stations, where alternating current is converted to direct current for use in the immediate vicinity of the sub-station.

For this reason the old practice of locating the station as close to the center of the load as possible is no longer of great importance, and this permits much wider latitude in the selection of a site with reference to fuel and water supply. It also allows in many cases a cheaper location to be selected, as it is not necessary now for a station serving a thickly settled business district to be located in the center of that district, where the price of real estate is naturally highest.

It must also always be borne in mind that the greatest item of expense in the distribution of large amounts of current to considerable distances is the copper which is required in the transmission system, and one of the principal objects in the design of every central station is to keep the amount of copper required for the distributing system down to a minimum.

In considering the fuel and water supply in relation to the location of the central station it is apparent that the most advantageous site is on the bank of a navigable river, where coal can be delivered to the station in boats and where, of course, an ample water supply can always be obtained. Where no navigable water is available a railroad must be depended upon for the supply of coal. In such cases the station should be located on a spur track, where coal can be delivered in carload lots to the station without breaking bulk.

If no stream of water is available and a supply of city water must be used it will generally be necessary to use surface condensers and supply some device for cooling the condensing water, and using it repeatedly in order to avoid excessive charges for water. It is also important that the water be as pure and soft as possible, as hard water deposits scale in the boilers very rapidly. In case only impure hard water is available, it will generally pay to provide some kind of water purifying and filtering plant for the boiler feed water.

It becomes evident, therefore, that where several locations for central stations are available it is a matter of nice calculation to determine the preferable site. This should not be governed entirely by the first cost of the station, as the most economical situation in the end will be the one for which the operating expenses plus the interest on the investment is a minimum.

Arrangement of Machinery.

The three distinctive features of every central station operated by steam power are the boilers, the steam engines and the generators, each of which has more or less auxiliary apparatus used in connection with it.

It is, of course, impossible to even suggest the numerous arrangements and types of machinery which are employed in various stations. Scarcely any two central stations are alike in these respects, and space only permits suggesting the most important points to be considered in the design of the central station.

The boilers should be located in a room separated from the remainder of the machinery so as to avoid the presence of coal dust or ashes around the engine and generators. Where a number of boilers are installed they are usually set in batteries of two boilers each, with sufficient space between the setting to allow easy access to the rear of the boilers.

In any large central station it should always be the aim to so design it that as many operations as possible should be performed automatically by machinery, so that a minimum of manual labor be required. The cost of manual labor always greatly exceeds that of mechanical power, and every device which tends to reduce the amount of attendance required reduces the operating expenses of the station.

After the various types of machinery with which the station is to be equipped have been selected the first point for consideration is the relative location of the various machines. In some cases the design of a station may be controlled by the area and shape of the ground on which the station is to be located. In a number of large stations which have been built in populous cities this consideration has led to storing the coal in bins under the roof and locating the boilers, engines and other electrical machinery on successive stories; but such conditions are unusual, and in general sufficient ground is available for any desired design of the station.

The system of piping between the engine and boilers has a marked effect on the location of these machines. The most restricted arrangement, and the least desirable, is where a single boiler or battery of boilers supplies steam for a single engine, and the most flexible and therefore the most desirable and most expensive arrangement is where any engine in a plant may be supplied with steam from any boiler.

Another point which should be taken into consideration in every case is the possibility of future extensions. Very few plants are built whose initial capacity is intended to be the ultimate capacity, and it is highly important that arrangements should be made so that extensions to the plant can be made without disturbing or rearranging the machinery already installed.

Coal and Ash Handling.

Having decided upon the most advantageous location for the boilers, the next consideration would be the location of the coal-handling machinery, if such is to be used. In a station of comparatively small capacity the boilers would generally be hand fired; but where the station is of sufficient size, automatic coal handling and stoking will add considerably to economy of operation. For stations of this class the coal, as previously mentioned, should be delivered in carload lots and the coal storage bin should be so located that coal may be dumped directly into it from the cars without handling. In some cases this condition is obtained by running the cars up elevated tracks over bins in the building, into which the coal is dumped directly from the cars, and in other cases outdoor storage yards are supplied, from which the coal is elevated to hoppers by means of cranes or a conveyor system.

A very usual and satisfactory arrangement of the boiler room is to have the coal hoppers arranged above the boilers and have these hoppers filled by means of a coal conveyor. Some kind of mechanical stoker is desirable for plants of large size, and the coal from the hopper may be conveyed through chutes to the stokers, and the ashes from the grates can fall into pits beneath the boilers, from which they may be removed by the same conveyor system which handles the coal.

By means of suitable damper regulation the coal in such a plant may be burned with the utmost efficiency and but little attendance is required. With the arrangement described the coal would be delivered in carload lots and dumped directly into the storage bins. From the bins it would be elevated to the hoppers above the boiler by the conveyor. From the hopper it would feed through chutes to the mechanical stokers, and after being consumed in the furnace the ash would fall into pits beneath the boilers, from which it would be removed by the same conveyor system handling the coal.

Draft and Fuel Economy.

The draft required will depend very largely upon the kind of fuel used. Ordinarily stacks of sufficient area for the boilers and of sufficient height

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

to produce the required draft, as used, but it may be necessary to supplement the draft of the stack by a forced draft. This is accomplished by means of a blower which forces the air underneath the fire bars and through the fire.

A forced draft only is necessary where the size of the stack is insufficient to produce sufficient natural draft and it is possible to dispense with the stack altogether and use forced draft exclusively. It is claimed for the latter method that fuel can be burned with the utmost efficiency, as exactly the right condition of draft can be obtained mechanically. In general, however, the use of forced draft will be found less economical than the natural draft, owing to the cost of the power used to operate the engine or motor to which the blower is attached.

Another device largely employed for reducing the consumption of fuel is an economizer. This consists of a group of tubes located in the lower part of the stack, through which the feed water of the boilers is passed. The heat of the gases in the chimney raises the feed water to a high temperature, thus utilizing the heat of the escaping gases in the chimney.

[To be continued.]

QUESTIONS AND ANSWERS.

Testing Internal Resistance of Battery.

H. B. Stabler, Washington, D. C. If your attention has not already been called to an error on page 520 of your issue of December 29, 1906, please refer to this page, middle of first column, where a writer gives a formula for obtaining the internal resistance of a battery by measuring its voltage on open circuit, and with its circuit closed through a known resistance. He states, referring to his Fig. 7, which shows a battery with a resistance (R) and a voltmeter connected in parallel across its leads, that $X = \frac{V_1 - V_2}{V_2} R$, where

X = the internal resistance of the battery,
V_1 = the reading on open circuit,
V_2 = the reading obtained around the shunt,
R = the resistance of the shunt.

Obviously the ratio of the fall of potential through the battery to the fall of potential through the shunt is equal to the ratio of the internal resistance of the battery to the resistance of the shunt, if the resistance of the battery leads and connections is negligible. Putting this statement in the form of an equation, and making the assumption that the voltmeter is of negligible conductivity—that is, that its resistance is so high relative to the resistance of the battery and shunt as to produce no appreciable error through the current which it takes—we have:

$$\frac{V_1 - V_2}{V_2} = \frac{X}{R}, \text{ or } X = \frac{V_1 - V_2}{V_2} R$$

as the correct expression for the battery resistance, and applying this to the numerical case cited by the writer, in which the voltmeter readings V_1 and V_2 were respectively 10 and 9.5 volts, and R was 20 ohms, we get $X = \frac{10 - 9.5}{9.5} 20 = 1.05 +$ ohms, instead of 1 ohm, as stated.

ANSWER

Mr. Charles H. Coar, the writer of the article in question, thanks Mr. Stabler for calling attention to the error noted, although the difference is but 0.05 of an ohm. He adds:

One equation as printed, $\frac{(10 V_1 - 9.5 V_2)}{10 V_2} 20 R = 1$, is in error also, due to the fact that 10 is classified as V_1 when it is dealt with as V_2. In addition to the explanation offered by Mr. Stabler as to the correctness of his formula one could say:

10 = Voltage on open circuit,
9.5 = Drop around the known resistance,
0.5 = Drop around the unknown resistance.

Since $I = \frac{E}{R}$, then $\left(\frac{0.5}{20}\right) = 0.475$ ampere flowing in the circuit. Since $R = \frac{E}{I}$, then $\frac{0.5}{0.475} = 1.05$. Hence the unknown resistance in this instance must be 1.05 ohms.

Irregular Action of Motor.

L. M., Chicago. I would like to know what is wrong with a three-phase General Electric induction motor of 15 horsepower and a starting compensator. Sometimes it starts all right; then again it starts and runs very slowly. On the starting side it only has to pull 10 horse-power.

ANSWER

The low starting effort is probably due to a poor joint or poor switch contact in the compensator. Joints and switch contacts should be carefully inspected. If they appear to be in good shape the motor leads should be disconnected and the voltages taken across the three phases on the starting and running taps on the motor side of the compensator. If these voltages are correct the trouble may be due to poor soldered joints in rotor winding. This is unusual, unless the motor has been operated under very excessive load.

Industrial Plant Lighting Discussed in New York.

At a meeting of the Illuminating Engineering Society held in New York city on June 14th, a paper prepared by George C. Keech of Chicago on "Industrial Plant Illumination" was read by A. S. Hubbard. This paper was presented before the Chicago Section of the society on May 9th, and in the Western Electrician of May 18th appeared an abstract of the paper, together with a report of the Chicago discussion.

Following is an abstract of the New York discussion:

A. S. Hubbard: In connection with the lighting of linotype-machine rooms, it might be well to say that in the face of the linotype machine, where the type is led down through the tubes, the letters are so deeply set that it is impossible to get a light thrown in on its face, so that each linotype has a small incandescent lamp, for the purpose of throwing the light on the stick. I tried several times to use a high-candlepower unit, but I do not think any high-candlepower unit could do the work. I think it must be accomplished by a small unit at each machine.

Mr. Childs: I would like to call your attention to what the mercury-vapor lamp has done in the last three or four years. A few years ago there were no lamps at all; the color of the light was very strongly against it, but in a short time people became accustomed to the light, and they got to know the value of it. Employes in factories, and girls working in mills were at first strongly opposed to it, on account of their appearance under it, but it seems that after the lamps had been used a short time the good qualities appealed to them; and when they changed back temporarily to the arcs or to the incandescents, they switched back again to the Cooper Hewitt lamp. Some large factories and plants have installed 100 or 150 lamps and a few use as many as 200 lamps. Another field for the lamp is the pier. We now have probably a dozen piers around New York that are lighted by all the way from one to 15 lamps for each pier. Ten of our lamps would replace about 15 arcs. Of course, the field is very large, and the total number of Cooper Hewitt lamps out today is comparatively small, but I think we have now a total of about 15,000 or 20,000 lamps in actual use.

V. R. Lansingh: I want to call attention to the unit which Mr. Keech uses in his paper, namely, the foot-candles per watt per square foot. We have in this unit the amount of illumination received for a given expenditure of energy per square foot, and it really gives us the efficiency of a system of lighting. I think if we had some short name for it, it would become a very valuable unit for that work. Coming now to the question of shop lighting, there are two methods by which we can light such interiors. First, a general illumination of sufficient intensity so that detail work can be done in any part of the room, such as the use of mercury-vapor lamps, arc lamps, or clusters of incandescent lamps, and second, the use of general illumination of lower intensity, and special illumination at the points where we wish to use it. The second method has very rarely been used in a scientific way. That is to say, the general and special illumination has been installed, generally speaking, in the worst manner possible, and in order to compare these two methods we would have to take an up-to-date system in both. It is hardly fair to compare, for example, as highly efficient a system as the mercury-vapor system with a three-ampere arc, low in efficiency. We should take an up-to-date system of the one and compare it with an up-to-date system of the other.

E. L. Elliott: A great deal has been said of the waste of light and the inefficiency of illuminating systems. In all the forms of lighting the only waste is that of the illuminant used, whether electric current or gas, but in the case of industrial plants, where the output depends upon the illumination, the loss of output represented by the loss of wages is vastly more important as an item than any loss of current or of gas. In regard to the unit which Mr. Lansingh spoke of, it is complicated. It involves four different quantities, the relation of four different quantities; you will do exceedingly well if you get laymen to understand the term foot-candle, which comprehends only two quantities. If the unit, foot-candle per watt per square foot, which is a triple-decked fraction, is to be used for an electrical term, then in gas, the foot-candle per cubic foot per hour should be employed.

In regard to the color of the light for industrial use, the question of the effect of an approximately monochromatic light upon the eyes is most important, and only the results of experience will be sufficient to test that matter. It is astonishing how quickly one may get used to an unusual color of light. The mercury-vapor light to me was a horror until I sat under it a little while, and I was astonished myself to find out how soon I became accustomed to associating with people with green faces and purple lips. There is one remarkable thing about the mercury-vapor light, which accounts probably for its use in photographic rooms, and in such places as use white and black, printing offices, for instance. There is a peculiar relief given to the black letters upon the white by the monochromatic light, which Dr. Bell ascribes to the fact that the monochromatic light makes the letters stand out more distinctly than would be the case with a composite light.

Until very recently the measurement of illumination has been rather an indeterminate boast, or perhaps I should say, unreliable. The best instrument of the kind for it was undoubtedly the Weber photometer. There have come out recently a number of instruments which it seems have all the elements of accuracy of the laboratory set. It consists of a standard light source, a method of changing the qualities of two illuminations, and a method of varying the intensity of the standard illumination to correspond with the tested illumination. A considerable number of methods of comparison have been devised, but the best standard light service, and the one now most universally used, generally called the secondary standard, is the incandescent electric lamp run on a standard current from a storage battery. The portable storage battery of sufficiently large power to run an electric lamp is a recent acquisition; it is not the storage battery that is important, but the standard lamp. The metallic filament, with its low resistance, has made possible the manufacture of an exceedingly small incandescent lamp which can be run on an exceedingly small current, so small that it can be run on a single cell of storage battery, or a few cells of dry battery, maintaining a pretty constant current. Dr. Bell has designed a luminometer, not yet upon the market, which uses the ordinary Bunsen screen, and a small incandescent lamp. W. D'A. Ryan likewise uses an incandescent lamp and opalescent-glass block screen.

H. V. Allen: I would like to call attention in regard to the efficiency of a system of lighting when using a monochromatic light, as to the true measurement of the intensity of the light. Where we use a white screen the monochromatic light is practically all reflected into the eye, and when that light falls on the surrounding walls or table which may contain a great deal of red, the resulting illumination falls off very much. I have often noticed, on brasswork, where the lamp would give a bright light, the brass itself would not be well illuminated; this is more true where walls are varnished or covered with shellac. In these measurements there is a question whether the candle the photometer measured was the exact, true per cent. of illumination. I had a case some time ago which illustrated that point. I was in a factory where they were using a mercury lamp in the shipping department; they also had an arc lamp equipped with a standard reflector; they were using a set of platform scales; the workmen would throw a box of goods on the scales and try to read the figures. Under the mercury lamp the figures did not show up; at a distance of six feet it was practically impossible to read them. With the arc lamp turned on they had absolutely no difficulty at all.

Percy H. Thomas: Consideration of the color of the light must be made to determine whether or not it is suitable before the source is seriously considered for use. The luminometer measures the actual intensity in any desired direction and at any desired location as contrasted against the standard light; but of two systems of illumination, giving the same reading on the luminometer, one of which we will say is arc lamps having a varied intensity, assuming they have not shaded globes, and the other having a tube like the Cooper Hewitt, there will be a great difference in the practical usefulness of the lights. The arc light dazzles the eye in such a way as to make the pupil close up, and with a given illumination the opening into the eye is very much less than with a tube where there is no such intensity; as a result more light gets into the nerve lens with the tube. The intensity of the light source is a very important element in determining the usefulness of a given illumination; a bright point of light, like the tips of arc-lamp carbons, dazzles the eye and causes the pupil to contract; the net result is a much reduced area for the admission of light to the sensitive parts of the eye, so that with a given illumination an unsatisfactory physiological effect is produced. With the tubular form of light source the lack of this brilliancy allows the pupil to relax, and a much larger area opening is presented for the admission of light. This consideration is of the greatest importance.

The great need at the present time in the laying out of industrial plants seems to be common sense. There are many installations where the system chosen is not properly carried out. There are certain advantages in the Cooper Hewitt tube light which are unique. One is its long life and the

freedom from necessity of care. I know of one particular insulation where lights were placed in the corner of a factory where it was only occasionally necessary to run the machine, and the advantage possessed by the Cooper Hewitt tube is that when the machine is needed in a hurry the lamps are always there, and it is not necessary to clean them up. There is another advantage that the Cooper Hewitt has over the individual type of illuminants, and that is its constancy with variation of voltage. There is no other commercial lamp, unless it be the Nernst lamp, which will keep anywhere near to the constant candlepower of the Cooper Hewitt, with a varying voltage.

P. S. Millar: There are two points which appeal to me particularly. First, it is very encouraging that there is a certain class of light, even of abnormal color, which will fill some uses so satisfactorily, taking advantage of the very high efficiency which we have in the mercury-vapor lamp. The second point is the fallacy of basing conclusions as to the efficiency of illuminants upon the results of the illumination measurement. The basing of conclusions as regards ultimate efficiency on the measurement of illumination is fallacious because of a number of conditions affecting the measurements and the results. Among these are the location of the equipment and the age of the lamps; the selection of the lamps with reference to the circuit upon which they are being operated; the question as to the proper plane of measurement, etc.

Tungsten Lamps for Series Street Lighting.

The General Electric Company announces that it is ready to supply tungsten lamps for series incandescent street-lighting service. The application of incandescent lamps to street-lighting service is likely to be widely extended by reason of the advantages tungsten lamps possess for this class of service. These new lamps can be supplied in low-candlepower sizes, permitting distribution of lamps at frequent intervals and thereby securing maximum economy with uniform and satisfactory lighting.

The high efficiency now obtained by the tungsten lamp will enable central-station companies to compete successfully against any other form of street illuminant of low or moderate candlepower. Tungsten lamps are particularly adapted to series lighting service, as the lamps are employed in low voltages, which permits the use of short, stable and durable filaments.

General Electric tungsten lamps will be supplied for 40 and 60 candlepower in the following ampere ranges—4, 5.5, 6.6 and 7.5 amperes. Forty candlepower is considered the minimum desirable candlepower for this class of illumination. The current of present 3.5-ampere systems can be increased to 3.8 and 3.9 and thus come within the four-ampere range. Further data and prices are given in a bulletin which will be sent on application.

Chicago Tunnel System to Be Extended.

Samuel McRoberts of Armour & Co. has been elected president of the Illinois Tunnel Company which owns and operates the 47 miles of freight tunnels underlying the central business district of Chicago. The big project was launched and brought to its present working state under the guidance of Albert G. Wheeler as president of the company. It will now be turned over to new interests, which propose to extend the system and take up the work of placing it upon an earning basis.

As readers of the Western Electrician are aware, a number of railroad freight yards and business houses are connected with the tunnels, and electrically operated trains are carrying mail and merchandise. It is said that contracts have been signed with a number of downtown business establishments and office buildings whereby merchandise and coal will be transported underground in the tunnel district.

"We will rush the work on the subway system as rapidly as possible," Mr. McRoberts is quoted as saying, "and within the next 90 days hope to have completed our connections with the various railroad freight houses, the contracts for which have already been signed and accepted. We will adhere to our present policy of excluding passenger traffic, but the mail service will be extended."

It is announced that the San Juan Portland Cement Company, which has broken ground for a new cement mill near San Juan, Cal., has closed a contract with the General Electric Company for steam-driven three-phase generating units, and transformers for a capacity of 3,750 horsepower for its power plant. The plant will be located near the cement works and will supply current for the induction motors that will operate the machinery.

Recent Steam-turbine Developments.[1]

By W. L. R. Emmet.

From a consideration of the general principle and from some of the literature that has been produced on the subject, it might be supposed that the design of steam turbines was a very simple matter, and that many good designs simply awaited the capital for their commercial production. In reality the design of turbines involves very great practical difficulties, and is in its nature dependent upon very difficult experimenting. Steam is an elastic fluid, carrying much energy, which is convertible into heat, pressure or velocity. In passing through the small spaces of a turbine at lightning speed, it is subject to eddyings, vibrations, condensations, rarefactions and re-evaporations which may have radical effect upon the efficiency. The value of fuel and power is such that in our day inefficiency in prime movers cannot be tolerated, and if we are to build engines at all, we must build good ones.

In a turbine of the Curtis type the necessity for elaborate experimental development is particularly urgent, its fundamental process being the complex action of a single steam impulse upon two or more moving blades, while in other turbines that have been produced each row of blades has a relatively independent action.

The designs of the improved machines now being produced have not been simply dependent upon data obtained from small experimental apparatus, but are largely the result of analysis of performances of some of the earlier large machines. It is only within recent months that the results of this actual experience with large commercial apparatus have taken material form.

The main objects sought in the development of the Curtis turbines have been: High steam economy; the use of a small number of rugged parts instead of a very large number of fragile ones; the elimination of all small clearances; the economic recovery of the large energy available in high vacuum, and the production of flat load curves, particularly with reference to high overload economy.

The steam consumption of smaller machines is relatively large. This is a necessary condition in all steam turbines, unless the speed can be increased in almost inverse ratio to the capacity. The natural limitations of alternating-current frequency and the desire for mechanical reliability have led us to adopt very moderate speeds for smaller machines, and thus to sacrifice degrees of steam economy which might easily be attained if we used, for the same sizes, speeds as high as those adopted by makers of turbines of other types. In spite of this disadvantage, our results in smaller sizes are relatively good, and serve to demonstrate the flexibility and excellence of the Curtis idea.

Tests of 9,000-kilowatt Turbine Unit in Chicago.

During the last year four 9,000-kilowatt units have been installed in the Fisk Street station of the Commonwealth Electric Company of Chicago. One of these machines has been tested at different loads by engineers employed for the purpose by the owners. These tests were part of a general investigation of station conditions, which has not yet been published. They were conducted with great care and were repeatedly verified before being accepted. The following figures give the results of five tests that were made:

Tests of 9,000-Kilowatt Turbine Generating Unit at Chicago.

Load in Kilowatts.	Gauge Pressure Lbs.	Vacuum Inches.	Superheat Degrees F.	Water Rate Lbs. per Kw.-Hr.
5,374	182	29.43	133	13.15
8,070	197	29.55	116	13.0
10,186	176	29.47	147	12.9
12,108	182	29.34	148	13.05
13,900	198	29.31	140	13.6

The steam economy shown by these tests we believe to be higher than any previous result within the same ranges of temperature and pressure. This machine at full load with a 28-inch vacuum delivers to the switchboard 21 per cent. of the total energy in the steam and 67.3 per cent. of the total available energy in the steam.

It delivers to the shaft 70 per cent. of the total available energy in the steam. It is interesting to consider what relation this result may bear to the ultimate possibilities of turbine improvement, and we have some information from which conceptions on this subject can be formed. The simplest application of the turbine idea is found in the delivery of steam through a straight nozzle against a single row of moving blades having a velocity best suited to the speed of issuing steam. Such simple arrangements have been tested, and efficiency curves have been traced with friction losses completely eliminated, and with all degrees of velocity in steam and in wheels. Many such investigations have been made in Schenectady, and similar investigations on an elaborate scale have been made in Germany. The best bucket efficiency produced in such test has been 75 per cent. of the available energy corresponding to the temperature range. Thus in this large commercial machine we get a shaft efficiency of 70 per cent. as compared with a bucket efficiency of only 75 per cent. in the most ideal turbine arrangement that we have been able to devise. This comparison leads us to expect that we may be nearing the limits of possible improvement in the simple production of power from steam.

Overload Economy.

High economy at overload is the direct equivalent of increased peak-load capacity, since it makes it possible to obtain a larger maximum output from a given installation of boilers, plant and auxiliaries, and from a given operating force. If units in one station have a peak-load efficiency 25 per cent. higher than those in another similar station, it implies that the peak capacity of one is 25 per cent. greater than that of the other.

When the matter is considered in this way, it will be seen that these 9,000-kilowatt machines have very great superiority of value as compared with any other large prime movers now in use. The plant in which these units are installed was originally designed for 5,000-kilowatt machines, and for each generating unit a battery of eight 520-horsepower boilers was installed, these batteries of boilers being the equivalent of those which had been adopted in large engine stations built at about the same time. In the test results given it will be seen that the machine tested was operated at 13,900 kilowatts, taking its steam from these eight boilers. That the firing of these boilers during this run was not abnormally heavy is shown by the fact that the superheat carried amounted to only 140 degrees, while the superheat was higher in other tests, and is known to be higher when boilers are forced. The superintendent of the plant in which these machines are installed has stated to the writer that they could without difficulty supply steam for 15,000 kilowatts if the generators were capable of carrying such a load.

The plant in Chicago in which these machines are installed is the handsomest and most substantial steam plant ever built, and yet if the units were assigned ratings equivalent to those of other prime movers its cost per kilowatt would unquestionably be the lowest that has been produced. Consideration of the economies from this standpoint will show any unprejudiced investigator the wastefulness of using inferior apparatus when such results are obtainable. It will also show the great advantages of power production on a large scale, and will indicate that great changes in existing methods are to be looked for at an early date.

Vacuum.

Another feature of these tests which will immediately impress everyone who is familiar with steam practice is the extremely high degrees of vacuum that are carried. The machine tested is equipped with a base condenser which forms an integral part of the turbine unit. This condenser contains 25,000 square feet of tube surface with one-inch tubes. The record shows that there was no appreciable diminution of vacuum with increased load. This high vacuum is due to the free access of steam to the tube surface and to the absence of any air leakage for which this arrangement provides. The value of such high vacuum is very great when the prime mover used is capable of effectively getting the benefit of it. The available energy with a 29-inch vacuum is 10 per cent. higher than that with a 28-inch vacuum, and in this machine at full load the gain of water rate accomplished by increasing the vacuum from 28 inches to 29 inches amounts to seven per cent. The machine was designed for 28.5 inches of vacuum, and between 28 and 28.5 inches the gain is very nearly proportionate to theory.

No Leakage Loss.

In addition to the advantages in the matter of capacity and fuel consumption, the turbine has many practical merits which need not be enumerated. There is, however, one point, brought up by recent experience, which is interesting in this connection. The large turbines here described operate with very large clearances, and consequently are in no way subject to deterioration by wear or increase of leakage. The economy of reciprocating engines is greatly affected by leakage and by correct adjustment. We recently made a test of three reciprocating engines operating a large plant, each having a rating of about 2,000 horsepower. It was found that they all gave a steam consumption of about 34 pounds per kilowatt-hour condensing, while the same engines if in adjustment would consume not more than 20 pounds per kilowatt-hour.

Mechanical Conditions.

The vertical-shaft steam turbine has been rapidly introduced, and machines of this type have been installed in great numbers in all parts of the world. Many different designs have been made to meet different conditions, and, as is natural in such a process, mistakes have been made which in some cases have caused serious inconvenience. I will not attempt to give any complete explanation of these difficulties, but it may be useful to explain that the most serious troubles have arisen from unexpected tendencies to vibration in certain particular designs. The balanced condition of a vertical machine is peculiar, and certain conditions must be conformed to in order that steady running may be obtained.

1. Abstract of a paper read before the National Electric Light Association at Washington, D. C., June 6, 1907. Mr. Emmet is the well-known engineer of the General Electric Company.

Certain machines that have given trouble in this respect have been sent out in considerable numbers, and in many cases it has been impossible to afford immediate relief for the trouble. Generally speaking, however, the vertical type has shown itself to be wonderfully dependable and free from many of the difficulties which endanger the operation of other kinds of machinery.

Our more recent experiences have enabled us to greatly improve all the mechanical conditions governing the action of our turbines. Bearings and steam packings are much improved. The valve mechanisms have been brought to a simple and reliable condition. Means for providing freedom from vibration have been discovered, and all parts have been designed and proportioned in the light of experience.

Generators.

In connection with steam units that are capable of affording such high degrees of overload economy, it is particularly desirable that generators be used that are capable of operating continuously with very heavy overloads, and efforts are being made to accomplish this result, both in connection with machines already installed, and with new designs that are being produced. On account of the necessary compactness of high-speed electrical apparatus, the losses are concentrated into a very small space, and the dissipation of heat produced presents an interesting problem. If air is used for cooling electrical apparatus, about 90 cubic feet rising 20 degrees Centigrade in temperature will carry away the heat equivalent of about one kilowatt.

From this it appears that to dissipate the heat from one of the large units above described when operating at 15,000 kilowatts, it will be necessary to circulate 35,000 cubic feet of air a minute, notwithstanding the fact that the efficiency of the generator under that condition is considerably over 97 per cent.

Where such units are installed in stations and allowed to take their ventilating air from the room, they are liable to get an insufficient supply, or to draw in air which has already been heated by contact with other heated surfaces. It is therefore desirable to make arrangements in such station by which an ample supply of air for ventilating generators is obtained from outside of the building. In many existing plants it would be economical and desirable to install blowing apparatus, in order to provide for increased capacity, and in other cases where apparatus is designed to move large quantities of air, it would be desirable to make connection to sources of cool air, without the necessity of blowers. In every case coolness of the apparatus should be sought as a measure of safety and reserve capacity.

Discussion.

Mr. Mason: I would like to ask what the proportion of cost of auxiliaries would be where it is necessary for a higher vacuum; that is, there must necessarily be some increased cost for an auxiliary required to be able to produce a better vacuum than 27 inches. Also what the proportional charge is which goes against the auxiliaries in the steam consumption on theses tests.

P. H. Kemble, Windsor Locks, Pa.: I ask Mr. Emmet in reference to the lack of economy of the turbine in the smaller sizes, how small a turbine he would recommend for the use of a small station, as against the Corliss engines, where the capacity of unit would not be over 250 kilowatts.

E. J. Richards, Newburgh, N. Y.: The figures which have been given apply to large stations, of which there are comparatively few in the country. I ask what we may be led to expect in units of 500 and 750 kilowatts, compared with the large units, in the way of economy.

J. R. Bibbins, Pittsburg: In regard to the comparison which Mr. Emmet has made between the turbine and the engine at the Manhattan station, New York, I ask him if he has correctly determined the results to make them comparable in reference to the engines for superheat and vacuum and if so, what curve, what percentage of curve, he has used in bringing the results to a comparable basis.

Frank W. Bullock, Jamestown, N. Y.: Mr. Emmet speaks of 29.31 inches of vacuum. I would ask the altitude at Chicago and also how nearly absolute 29.31 is.

B. S. Josselyn, Baltimore, Md.: What is the greatest degree of efficiency that has been obtained by the Curtis turbine in pounds of coal per kilowatt output hour, with the very best degree of anthracite for that purpose?

Howard T. Sands: Operating the turbine at 130 degrees superheat, what would be the effect on the turbine of a sudden increase of superheat, say, to 200 or 225 degrees?

Lawrence Manning, Owosso, Mich.: What has been the best efficiency actually obtained at full load of 300 and 500-kilowatt turbine unit as now manufactured; that is, at 150 pounds steam pressure, with and without 100 degrees superheat?

Mr. Emmet: I do not think I can give very positive information as to the relative cost of auxiliaries of different degrees of vacuum. I will explain, however, that these units in Chicago are equipped with condensers in the base, and the latest designs of condensers in the base produce such vacuum as we are producing there. Although not exactly the same as those used in Chicago, they are put into bases of the same height as those ordinarily used for exhausting, so that there is virtually no additional condenser; the condenser is part of the turbine, and the expense incident to the condenser is the cost of putting in 20,000 feet of three-fourths-inch tubes under one of these units, which we have called 9,000 kilowatts, and which produce these vacuums. These tubes and heads and connections depend upon the conditions of the installation largely, but they are not very different from the cost of condensers as ordinarily used for less degree of vacuum.

These condenser bases are decidedly better than the exterior condensers. They give better access to the steam. The steam is blown into the tubes at higher velocity, comes out of the wheel at 600 feet a second, and enters the mass of tubes, and we think we can by that means get along with less surface. I will answer one of the later questions in this connection, talking of the condensers, by saying that the vacuum in Chicago is corrected to 30 inches barometer, and is absolute vacuum. There is only 0.7 of an inch absolute back pressure; that is, 0.35 of a pound absolute back pressure, which we are running with that heavy load in Chicago. Atmospheric pressure has nothing to do with the absolute pressure, or the economy of the machine. If the atmospheric pressure is low, it makes it easier to pump out the air; that is the only difference.

In considering auxiliary steam consumption it pays to take live steam to heat feed water in the interest of the circulation to boilers, and feed water should always be heated; but in the turbine in Chicago they take the steam from the auxiliaries and apply it to the feed water. Applying that steam to the feed water, the extra consumption of steam incident to the running of the auxiliaries is less than one per cent.; probably .07 per cent.

The economy of this plant could be considerably increased, and ultimately will be, by taking steam from the middle of the turbine and adding it to the feed-water heaters, so as to bring the temperature of feed water higher; the auxiliary consumption is so small that it does not sufficiently heat the feed water. But we can take the steam from the turbine after it has done more than half its work and use it to heat the feed water; two-thirds of the work has been taken out of the steam, and two-thirds of its latent condensation is available for feed water. That is being done in Boston.

As to how small a turbine can be advantageously used in central stations, that, of course, is a question of local conditions, or what we are comparing it with. I can say that with 250 kilowatts output on a condensing turbine, we can get, with a fair vacuum—28 inches of vacuum—23 pounds per kilowatt-hour. I have told you in my paper of three large engines in Schenectady which use 34 pounds per hour, condensing. Since I wrote this paper I have read the tabulation in a book published by Mr. Barris of a number of engine tests in commercial service which he has made, and from them a curve could be made of steam consumption under commercial conditions. From his figures it would appear that our 34 pounds at Schenectady, which we considered preposterous, was not unusual, but that few of the engine plants tested had less than 20 per kilowatt-hour, and that on small sizes, in fact, on all sizes throughout the range, they were running 50 per cent. above our turbine, and our turbines were not, as I say, depending on adjustment. If you have the turbine, and it is fit to run at all; it will give the results. The buckets may become clogged, with dirt or something of the kind, but if so they can be cleaned.

I have been asked about 300 and 500-kilowatt machines. I will say that in the 500-kilowatt four-stage machines the steam consumption, with 28 inches of vacuum, saturated steam, is 19.5 pounds per kilowatt-hour at full load, and a little better than that with different loads. I think that machines that are now coming out will be about a pound better than this, but I simply say that as something to base figures on. In the case of the 300-kilowatt machine, I should say that, while we could produce nearly as good results, they would probably be two pounds higher. In our 300-kilowatt turbine, we use 1,800 revolutions per minute, on 60-cycle, and 1,500 on 25-cycle, and these speeds are low for such small turbines, but even under these advantageous conditions, I think the turbines are much better than engines, underload and overload, and almost as good at full load as the engine when in perfect adjustment, but the engine is never in perfect adjustment.

The wear of our valves in our own reciprocating engines which we make, the difference between a machine valve and an accurately ground valve, will make a difference of 25 per cent. in steam consumption. When people begin to use engines, they do not get down to these refinements of fit, and the steam is consumed.

There was a test made somewhere in the West, the results of which were sent us, a comparison between a reciprocating engine and one of our early 500-kilowatt turbines. (The turbine was a machine decidedly inferior in results to the machine just mentioned.) But they ran the machines both with a fixed waterbox load at first, and they got both on the engine and the turbine, a brand-new engine, about 21 pounds per kilowatt-hour, as I remember it. Then they ran on their railway load, and running under the variable conditions of railway load, the efficiency of the engine was away off, something like 30 per cent. off, as compared with the turbine, which was about the same on variable load as steady load.

I have been asked to state the effect of superheat and vacuum in these results. I may say that in this engine and turbine comparison, the engine was running with 28-inch vacuum in this particular case, there being good vacuum conditions in this station. The turbine shows a somewhat higher degree of vacuum, because the vacuum is obtainable with the turbine, but with the engine no increase of vacuum above 28 inches would improve the engine the slightest degree. The turbine curve is based on 28.5-inch vacuum, which I consider a conservative figure, and there is no question they should run as low as that in one of these Manhattan stations, and the engines in the test had 28 inches of vacuum, but the engine has already got to the top of its range at 27-inch vacuum, and nothing is gained by increasing the vacuum.

The question of pounds of coal per kilowatt-hour in station operation of course depends on station management of boilers, the load factor and a lot of other conditions. The results actually being produced in Chicago are the equivalent of 1.8 pounds of good coal per kilowatt-hour, that is, with all the standby losses, all the waste and imperfection of combustion of a rather low average efficiency. If they were burning good coal with similar combustion efficiency, they would be running at about 1.7 pounds per kilowatt-hour. The indications are in such a load factor as we have in Chicago, with perfect conditions as to combustion facilities and firing and distribution of load, that they could get down with good coal to below 1.5 per kilowatt-hour, which is equivalent to one pound per indicated horsepower on an engine. That is all-day economy. If, instead of that, we figure on the basis of continuous operation under the most economical conditions, you can see what we would come to. With saturated steam, consuming about 15.5 pounds of saturated steam per kilowatt-hour output, that would be the equivalent, with good firing, careful running of the boiler, of possibly 1½ pounds per kilowatt-hour output.

The effect of superheat has been referred to. I will say that that effect in all our turbines is practically one per cent. reduction in water rate for 12.5 degrees of superheat, but it must not be assumed that this is all gain, because it costs money to produce the superheat, and that is also an uncertain and variable amount, depending on local conditions. Superheat is something which has been very extensively used, in Europe particularly, high degrees of superheat, but when we analyze it all, it seems to be rather an overwrought commodity; with 150 degrees superheat there is possibly a gain of 1½ per cent. without corresponding trouble. As to the question regarding the effect of very high superheat, it has no effect except to diminish the water rate. With 225 degrees superheat we get in the neighborhood of 16 per cent. diminution in the water rate, and the cost of producing that superheat will counterbalance two-thirds or probably three-quarters of that. There is no particular trouble to be anticipated, unless it is in creating leakage somewhere. Our turbines are designed with steel steam chests and steel valve parts and are not affected by such degrees of temperature. We can run up to 600 or 700 degrees, without injury to the turbine.

Chicago Street-railway Situation.

The Chicago City Railway Company has arranged to raise the first installment of the $16,000,000 that will be required for the rehabilitation of its roadbed and service under the terms of the traction settlement. The money will be expended for rails, cars and material and for labor on reconstruction under the supervision of the Board of Supervising Engineers. The company has contracted for 10,000 tons of grooved steel rails, 400 tons of which are being delivered. The actual rehabilitation was begun last week, when a gang of men was set at work laying a new track in Root Street from the Stockyards to Wentworth Avenue.

The plan for settling the differences between the Chicago Union Traction Company and its underlying companies is said to be advancing satisfactorily and will result in a reorganization of all the North and West Side interests into the Chicago Railways Company, which, it is proposed, is to take up the work of reconstruction under the terms of the new franchise ordinances.

In order that ships at sea which are equipped with wireless apparatus may obtain the exact time for comparison with chronometers and thus determine accurately their longitude the Canadian government has installed a device at Camperdown, the government station at the entrance to Halifax harbor, Nova Scotia, to transmit automatically by wireless the exact time furnished by the government observatory at St. John, N. B. The time signals will be sent each week-day morning.

Some Electric Power Experience.[1]

By Sarah M. Sheridan.

This paper is a statement of some lessons taught us by experience in the sale of electric power. We know now that we could have read most of these lessons in various textbooks and printed proceedings. We have grouped them into one paper, hoping that the paper may help some other member companies that are learning by experience. In two years and four months we have added to our commercial power load 5,965 horsepower in alternating-current motors and 3,862 horsepower in direct-current motors, and in the last 12 months have increased our day load 50 per cent.

During this time we have followed the quite common practice of loaning and renting motors for trial installations. To do this it was necessary to carry a stock of motors that reached a value of $46,000 during the year 1906, when our average monthly gain in motor connections was 450 horsepower. When our power business showed decided and permanent growth, several of the local construction companies, seeing that their business could be increased if they could handle an entire installation, including motors, put in motor stocks and adopted our plan of trial on loan for 30 or 60 days, renting the motors for longer periods if purchase seemed likely in the future. This movement by the contractors is gradually relieving the central station of the necessity for carrying a stock of motors.

Our rental charge, after the loan period, was 25 per cent. per annum on net price of motor.

The company has always taken care of emergency cases, due to fires or breakdowns, of isolated plants at a minimum rate, and this custom has frequently led to permanent business. We have also found that considerable business may be done with contractors on construction work; and while this class of business occasionally requires extensions to our lines, we can well afford to make them, considering the advertising it gives electric power among contractors.

Observations taken in 100 factories at odd times show that on an average but 50 per cent. of all the machines will be loaded at any one time, because operators preparing work or adjusting machines are idle, or for the moment away from the machines. This statement to a manufacturer will not often be credited until he has proven it by observation. The fact is, however, well known to our selling force, and is considered when specifying motors required and in estimating probable costs; and the saving of expense with metered central-station drive against other power, due to this condition, is a good selling point.

Individual motors are not to be recommended unless a saving in current consumption equal to 20 per cent. per annum on increased investment will be effected. Except where individual drive is desired for special convenience, a less saving is not worth considering, as a customer would doubtless earn as much on the same money invested in his business.

In woodworking shops, individual motors displacing one large unit, have shown considerable saving. Instances: A shop operating a 20-horsepower motor, with average monthly bills of $40, installed nine motors aggregating 42.5 horsepower, and reduced its average monthly bill to $32, in addition to providing for increased output. In another shop a 10-horsepower motor was replaced by nine motors aggregating 28 horsepower, effecting a reduction of 20 per cent. in customer's bills, with the same work.

Customers should be influenced to use roller bearings on shafts, which bearings in some cases reduce the friction load of the shafting 20 to 25 per cent. as compared with good babbitt bearings; also to install shafts in separate short lengths where practicable, which is a decided advantage if part of the shop is run overtime or at times when the shop is operating only in part.

With large blowers it is frequently found that the fan is delivering more air than is actually required. In displacing a steam installation recently it was found that two ounces less pressure was sufficient for the work, and by reducing speed of fan we reduced the customer's bills about $15 per month. This brought cost of electric power low enough to compete successfully with steam.

In another instance we reduced the pressure at blower one ounce by moving it so as to shorten the length of the pipe by 100 feet, thus reducing load by six horsepower. In another installation of the same kind, four horsepower was saved by straightening several sharp curves on the blower pipe. The use of motors made these changes simple and cheap.

Our experience, as illustrated by these instances, has made us very suspicious of fans, blowers, air compressors and centrifugal pumps. The power required by these devices varies so rapidly with variation of speed that it pays to investigate every such machine in an installation and to make certain that it is not being run at a higher speed than is necessary to deliver the proper pressure. To run blowers needlessly fast is a very common fault.

In a small machine shop our engineer reduced friction loss by changing the location and piping of an air compressor, so that an intermittent small loss in an air pipe was substituted for a constant considerable loss in friction of a shaft. The electric drive was entitled to no credit for this, but got it just the same. In the same shop a portable desk fan, playing directly on tanks to be cooled, was substituted for a wooden-blade fan that was bolted on each side of the end of line shaft. These changes effected a reduction of 15 per cent. in current consumption.

A shop manufacturing steel products asked us to install a 50-horsepower motor for three months, to take care of part of its plant while rebuilding boilers. This gave us an opportunity of studying its conditions and before the three months were up we made the following recommendations: To install a motor-driven air compressor to supply air instead of steam to oil burners of forges, which change saved the cost of power in saving of oil; to arrange work so that the big grindstones were operated off our peak, thus giving the limited service rate for that service, and to do all work requiring high-pressure steam two days a week instead of each day (this change greatly reduced their standby charges for steam and dispensed with services of one man); also to install a governor on air compressor to close inlet valve and allow compressor to coast until tank pressure fell to line pressure. With these economies and the usual cutting out of shafting the cost of operating the shop by electricity was reduced below its steam costs. The company equipped its shop with motors and at present has an installation of 150 horsepower with monthly current bill averaging $250.

By changing tight cross belts to wide slack open belts on a shaft driving 20 machine tools the power required was reduced three horsepower. In a polishing room where 10 double heads in one row with one exhaust fan at each end were operated we recommended placing the machines in two rows with one fan between the rows, which effected a saving of eight horsepower. In endeavoring to deliver the required power at a machine driven by a countershaft we changed the 12-inch pulleys on the main and countershafts to 24-inch pulleys with the desired result and incidentally reduced the load two horsepower.

By reducing speed of the line shaft in a large machine room from 220 to 190 revolutions per minute a saving of eight horsepower was effected without decreasing the output, as speed of tools was taken care of by cones.

A motor replacing a gas engine operating automatic machines by the improved speed regulation increased the output of the machines 10 per cent.—the constant turning moment permitting a heavier feed to the cutting tools.

In the foregoing case the output of the shop was increased because the steady motion given by a motor allowed a heavier cut to be taken than when the tools were driven by a gas engine. In other cases we have found that the cutting speed could be increased to a point higher than was possible with the unsteady gas-engine drive.

In one small factory we were unable to discover why current consumption should be 25 per cent. higher than our estimate. We finally prevailed upon the manager of the concern to allow us to test out his machines, which his superintendent maintained were in excellent condition. After working for two days we found that the bearings in the air compressor were running on the iron of the boxes. Proper babbitting of the machines reduced the customer's demand two kilowatts, and we retained the business.

In the matter of factory lighting: We usually advise such customers to do their general floor lighting with gas arcs, but to install individual incandescent lights at the machines. Since adopting this policy we find that we are relieved of the many complaints on lighting bills that were so frequent two or three months in the winter, when our factory customers would come to us with lighting bills that were sometimes as high as those for power. Our rate system makes a high price per kilowatt-hour for lights operated for only a few hours annually, while the gas company makes no difference between short-hour and long-hour customers, so all parties are satisfied by this division of service.

In this respect of willingly letting short-hour factory lighting go to the gas company while we take the power business we believe our practice is unusual. We know that we get power business, which we very much want, by adopting this method; while if we insisted on getting the evening lighting the combined cost would be prohibitive. Other respects in which we think our power practice is unusual are that we have taken special pains to assist customers in keeping down constant losses, such as friction and windage, and that we regularly offer a reduction of the standing-charge item of our price in consideration of a customer undertaking to refrain from using specified parts of his equipment during the hours of our winter lighting peak.

1. A paper read before the National Electric Light Association at Washington, D. C., June 6, 1907. The authoress is sales manager for the Detroit Edison Company.

Writing for Technical Journals.

The easiest way to find how little you know about a particular subject or thing is to endeavor to write about it. Unqualifiedly, I believe this to be true. How many of us have started to describe some little thing only to discover that at some point we must do a little investigating before we could go ahead! In description of principle or fact we must get the successive steps in their proper sequence and true relation if our ideas are to be conveyed logically to the reader or before they will "sound right" to us when we read them. So I believe that whether our subject be a chicken-coop or a 10,000-horsepower plant we know more about it after we have described it than we did before; our ideas are clearer, more logically formed. This is no new principle; it is applied in every school and college today, and why is it not as applicable here?

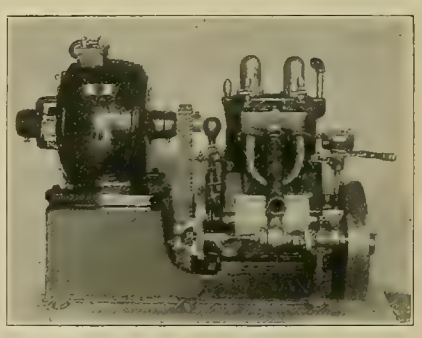
But the greatest benefit derived is that of the interest stimulated by writing. If we get into the habit of describing things about the shop our interest grows, our knowledge broadens. If our story about a special chuck is published, we inadvertently feel a pride in it, and want to see what the other fellows are saying, and so we read more and our interest broadens.

Someone's description of a milling fixture may have helped you out of a hole; so you want to give other readers anything you have "up your sleeve" in return. And so you gradually obtain the power of seeing things, not just looking at them.

Every foreman, no matter how large or small his shop, has done something that is worth telling about. How much better it would be for him if he would not stop at developing the idea but would write it up for publication, and in so doing stamp its principles upon his mind and at the same time develop his receptive powers and become on the alert for someone else's ideas that he can apply to his own work.—"Egypt" in the American Machinist.

A Compact Generating Unit.

The accompanying picture shows a compact, light-weight generating unit, one of the latest products of the Richardson Engineering Company of Hartford, Conn. A conspicuous feature is the silent-chain drive, which enables the company to use a



A NEW GASOLINE-ELECTRIC GENERATING UNIT.

higher speed dynamo and lower speed engine, making a satisfactory set with little vibration and of light weight.

These equipments are built especially for charging automobiles, lighting, and for launch and yacht work. At present they are made in two sizes. The two-horsepower size weighs 370 pounds, while the five-horsepower unit weighs 580 pounds. The set embodies a two-cylinder four-cycle gasoline engine, throttle-governed, jump spark, combined with one of the company's standard dynamos, 110-volt, direct current. Special voltage can be had on order. A circulating water pump is part of the engine, and everything is mounted on an iron base. All that is necessary is to connect the coil and gasoline tank for water connections to have a working outfit.

Society for the Promotion of Engineering Education.

The fifteenth annual meeting of the Society for the Promotion of Engineering Education will be held at Case School of Applied Science, Cleveland, Ohio, July 1st, 2d and 3d. The society is doing good work in promoting and improving technical education. It has a large membership, which includes some of the best educators and engineers in the country. One-sixth of the present membership is drawn from the ranks of consulting and practicing engineers. The present officers are: President, Dugald C. Jackson, Massachusetts Institute of Technology, Boston, Mass.; vice-presidents, R. C. Carpenter, Cornell University, Ithaca, N. Y.; Charles S. Howe, Case School of Applied Science, Cleveland, Ohio; secretary, William T. Magruder, Ohio State University, Columbus, Ohio; treasurer, Anson Marston, Iowa State College, Ames, Iowa.

Inspection of Old Wiring.

The reduction of fire hazards by inspection of new wiring installations is approved practice in all progressive cities, and no arguments are needed to demonstrate the foresight of such work. The reliable wiring contractor and the electrician who understands his business have nothing to fear from intelligent inspection by insurance and municipal authorities. The activity of inspectors with reference to new installations seldom applies in the examination of old wiring, however, for the reason that municipalities are inclined to limit the appropriations for city electrical departments to sums inadequate to provide for the regular examination of either old installations or outside work in addition to the maintenance of fire-alarm and police-telegraph systems, routine office work and the in-inspection of new wiring layouts.

A study of the causes of fires as given in the annual reports of chief engineers of fire departments in various cities shows that an exceedingly small percentage of the alarms arise from electrical troubles, but it is none the less important that high standards of wiring shall be insisted upon, because the electrical industry as a whole suffers an injury whenever fires are credited to it, regardless of the justice of the claims, and of course because losses can only be reduced by attention to every possible conflagration cause. There is a vital need of inspection of old wiring, for the deterioration of existing installations and the improper connection of apparatus to systems by unauthorized or inexperienced consumers pave the way toward even more serious results than are ordinarily to be expected in the case of new work carelessly installed.

An illustration of the evils of irresponsible wiring occurred recently in an ice-cream factory operated by electric motors. The original installation was a two-horsepower 550-volt direct-current motor, duly inspected and approved, a certificate of operation being given to the local lighting company by the city. A few months later a second motor was installed and connected to the mains. No notice for inspection was sent; neither the city nor the electric-light company had knowledge of the installation of the second motor, and so no inspection was made. The motor was mounted on a revolving iron post and was improperly installed, the floor all around the motor being constantly covered with water. Repeated movements of the revolving post caused the breakage of one of the motor leads, the broken end of the wire coming in contact with the casing of the motor and grounding the current through the wet floor, iron post and motor casing. A workman who investigated the cause of stoppage was killed by the shock, and another employe was seriously injured. The inspection of the installation by the proper authorities and the execution of construction work by qualified employes or contractors in such cases would do much to improve the conditions.

H. S. K.

Big Power Project in India.

There is under discussion in India a large hydro-electric enterprise which Consul-general Michael at Calcutta believes should result in sales of American machinery. A young electrical engineer is now in England for the purpose of persuading certain capitalists to accept terms agreed to by the British Indian government looking to the improvement of these waterpowers in the Himalaya mountains.

The capitalists want the government not only to grant concessions covering the waterfalls but to guarantee six per cent. interest on the capital invested in their development. The government will enter into an engagement to take from the company for all time electricity for lighting all of the forts and cantonments within supply distance of the waterpowers which would be in itself a fine income. Besides this the government is willing to take electricity for lighting stations and yards and shops along the line of the North Western Railway, which the state owns.

The waterpowers are so situated that electric lighting could be furnished to the fort at the mouth of the Kyber Pass and along the road leading through the pass to the farthest outpost of the government. This patronage of the government, it is believed, would pay a handsome interest on the necessary investment to make all the improvements required for a first-class plant or plants. In addition to this the plan which has been worked out contemplates the construction of electric railway lines reaching out into the country as feeders to the main line of railway and for the accommodation of the millions of people living within the area that would be accommodated by these lines.

The possibilities of extending the lighting and railway electrical power to be furnished by the three waterfalls, one of which is 200 feet, and the volume of water unlimited, are beyond easy calculation. In all probability, it is said, all of the electrical machinery needed in the enterprise will be contracted for in America. Special mention is made of the transformer of large size, such as would be required, which is said to be manufactured successfully nowhere except in the United States.

It is a part of the scheme to run an electric railway from Peshwar up the Kyber Pass to the British outpost station in the pass. Manufacturers are advised by Mr. Michael to correspond with the electrical engineer, whose address may be secured from the Bureau of Manufactures, Washington, D. C.

Freight Handling at Schenectady.

An interesting complaint has been filed with the Interstate Commerce Commission by the General Electric Company, directed against the New York Central Railroad Company and the Delaware and Hudson Railroad Company. The General Electric Company says that it uses about 50,000 freight cars a year in getting its raw material to the Schenectady works and in carrying out its electrical machinery and supplies to customers in the United States and adjacent foreign countries. In effect the company charges that it has itself to deliver and distribute these cars after loading and unloading, owing to lack of facilities on the part of the railroad companies. The company thinks itself entitled to a reasonable allowance for doing this work, inasmuch as it has paid the common carriers the full tariff freight rates, under protest. The Interstate Commission is asked to adjudicate the matter.

GENERAL TELEPHONE NEWS.

The Crete (Neb.) Telephone Company has been incorporated for $100,000 by R. F. Ireland and George H. Hastings.

The Kearney County Telephone Company of Norman, Neb., has been capitalized at $30,000 by C. Norman, J. S. Sharp and others.

The Union Telephone and Light Company of Granville, N. D., has installed a power generator for its switchboard and will make other changes.

The Manning Telephone Company of Malone and Waco, Tex., has been incorporated with a capital of $15,000 by W. J. Manning, H. Henderson and others.

Articles of incorporation have been filed by the Low Moor (Iowa) Farmers' Mutual Telephone Company, of which T. H. Dunn is president. The capital is $5,000.

The Winnipeg government has started the construction of toll lines toward the Minnesota boundary line to connect with the Independent telephone lines there for North Dakota and Minnesota.

The council of Anoka, Minn., is considering an ordinance to charge a license of $10 for setting a new telephone pole and $5 a year thereafter on the pole. The ordinance fixes the maximum rate for house connection at $1 a month and for business places, $1.75.

Charles H. Hanna, who purchased the telephone system at Greenfield, Ind., is offering the plant and franchises for sale. The plant cost $9,000. Its lines extend to all parts of Hancock County, but the business is said to be handicapped for want of long-distance connections.

The Seymour (Ind.) City Council has granted the Citizens' Telephone Company a franchise to construct and operate a telephone system in Seymour. The Seymour Home Telephone Company has occupied this field for a number of years. It has about 600 telephones in use in the city.

The following-named telephone companies have recently been incorporated: Tibbey (Okla.) Telephone Company, capital stock $5,000; Waterloo (Okla.) Rural Telephone Company; Lanyon (Iowa) Mutual Telephone Company; Persia (Iowa) Mutual Telephone Company, capital stock $10,000; Low Moor (Iowa) Telephone Company; Central Texas Telephone Company of Houston, Tex., capital stock $50,000.

G. F. Shepley, K. C., counsel for the government in the inquiry before the Canadian Railway Commission concerning the operations of the Bell Telephone Company, has issued a summary of the evidence submitted at the inquiry with his comments thereon. "Our summing up," he says, "is that, from the standpoint of the Bell Company, there is evidence that would justify this board in saying that the tariffs are more than adequate and that there is evidence that would justify this board in concluding, from the standpoint of the public served, that the individual tolls, local rentals, long-distance tolls and local tolls are all susceptible of modification without doing any real injury to the interests of the Bell Telephone Company."

CORRESPONDENCE.

Continental Europe.

Paris, June 5.—Material has been recently ordered by one of the large French companies, the Energie Electrique du Sud Ouest, from the Thomson-Houston Company, for a hydraulic plant to be located on the Dordogne River. The station is to be erected at Tuiliere, near the town of Bergerac, and the pole line from the plant which runs through the surrounding region is to be operated at 52,000 volts. Bordeaux and Angouleme will receive the current, besides a number of smaller towns. The dam to be erected on the Dordogne will use the total flow of the stream and the turbine house will contain nine principal units of 2,700 horsepower each, using three-phase alternators of 1,750 kilowatts, working at 5,500 volts. Besides the hydraulic installation there will be provided a steam plant which is to serve as a standby. During the first period of working this part of the station is to be equipped with two Curtis turbine-alternator units, with three-phase machines of 3,000 kilowatts each, working at 5,500 volts. There will also be installed five groups of three single-phase transformers of 1,200 kilowatts capacity each to step up the machine voltage to 52,000 volts for the overhead line. This will be one of the most important enterprises recently carried out in France.

There are several new electric-railroad projects on foot in Switzerland, and some of these I have already mentioned. Not long ago a syndicate applied for a concession from the Grand Council for a narrow-gauge railroad running between Lenk and Adelboden. Some of the officials of the Montreux-Bernese Oberland electric road are interested in the project, and the new line will no doubt connect with this road. The town of Lenk is a much-frequented tourist resort. The new road will have many steep grades and tunnels, seeing that it passes through a mountainous region. It is to be about 15 miles long and one-meter gauge. Motor cars and trailers will be used for the passenger service. Freight cars will also be operated. The line will probably cost $800,000.

The Societa Industria, which carries on operations in the central part of Italy, obtained a concession some time ago for the fall of the Tronto stream, which will be utilized for a turbine station. Accordingly, the company has been making arrangements with the German Lahmeyer firm for the electric outfit, including four three-phase alternators. The station will be erected near Trisungo, and it is expected to utilize a 300-meter head of water with a flow of six cubic meters per minute. After an eight-mile canal leading from the dam comes a reservoir, whence there will be two penstocks leading to the station. Four turbines of the horizontal shaft Pelton type will give about 20,000 horsepower in all. On each wheel will be mounted a three-phase machine, and the line will be operated at 55,000 volts. Most of the current will be used at a point lying 30 miles from the station for electrochemical work.

Bids are asked for the construction of a trackless trolley road in Switzerland, running between the towns of Bulle and Fribourg. The time limit has been extended to December 21, 1908. An electric line will be built between Sepey and Ormont-Dessus, and bids for the material will be received until October 15th of next year.

A. DE C.

Great Britain.

London, June 7.—Municipal mismanagement is rather prominent just at the moment. The attention of all municipal London and many others has been fastened for a week upon the Local Government Board inquiry into the Hammersmith workhouse scandals, which incidentally involve some extravagant work upon the electrical installation. For some reason an alternating-current supply from the Borough Council's electric supply mains was actually converted to continuous current for both lighting and power purposes, while the standard of fittings and wiring adopted seems to have been out of all proportion to the needs of the case. Even from the evidence it is difficult to express an opinion upon the case, assuming it were wise to do so, but the whole fiasco rather emphasizes a growing practice on this side. In the first place boards of guardians and others employ an electrical expert and then refuse to adopt his suggestions and advice, and secondly, the architect is becoming to be credited with an allowance of electrical training which is undoubtedly lacking, and again the electrical engineer is put upon one side. This is specially prominent in purely wiring and fitting work where the interior fitting must necessarily be carried out by collaboration between the electrical engineer and the architects. The cost of the wiring per point at the Hammersmith workhouse was £2 3s. 4d., including main cables and fittings, but this is a class of work the cost of which varies within such wide limits—so rampant is the jerry wireman—that without an actual inspection it would be unfair to say this figure was too high. At the same time real good work-

manship can always be relied upon for at least 25 per cent. or 30 per cent. less.

Drastic remedies are being proposed by a number of provincial municipal electricity committees in order to bring about a little better financial state of affairs. A notable case is Wigin, where there has been a tremendous loss upon the electricity and tramways undertaking during the last year. Things are always pretty bad when the electrical engineer's salary is proposed to be reduced, although it is pleasant to record that the suggestion in this case was not acted upon. From the discussions in the council it is quite clear that dissensions among the members have precluded the engineer doing himself justice. At Swansea a committee of investigation has been at work, while at Cardiff the electrical engineer and manager with commendable foresight realized the point to which he was drifting and threatened to resign unless given an absolutely unrestricted control for a certain period. He gained his point. Altogether municipal management is rather under a cloud at present.

Some 2,000-kilowatt Willans-Dick-Kerr turbo-alternators which are under construction here for the Sydney (Australia) municipal electricity works are interesting, in that this type was selected by the city engineer after a special tour of the world. The sets run at 1,500 revolutions per minute and have a normal output of 2,000 kilowatts with a power factor of 0.85, but are capable of withstanding an overload of 25 per cent. for two hours. They generate three-phase current at 5,200 volts and a periodicity of 50. The alternator, made by Dick, Kerr & Co., has a few improvements which have only lately been introduced, prominent among which is the construction of the rotor, which has four separate radial poles, each carrying its own field coil and provided with a laminated pole-tip. The field winding is built up of solid copper strips wound on edge, while the brushes are of special graphites of very low friction coefficient and high conductivity. It is claimed for the salient pole construction mentioned above that there is a lower magnetic leakage in the field and armatures, which enables the machines to be designed with lower stator iron losses. There are also a few points of difference in the turbine which has been made by Messrs. Willans & Robinson. There are two balance pistons instead of three, the one dispensed with being the large diameter balance piston on the steam end. In this way the body, which is built up in three sections, instead of being cast in one piece, is shortened in length.

Fulham (London) Borough Council has decided upon a considerable extension of electric street lighting by Nernst lamps because photometric tests have shown that whereas incandescent gas mantles give, if anything, more light immediately round the post Nernst lamps have a more distributive or penetrative effect. G.

Dominion of Canada.

Ottawa, June 15.—The report that the Electrical Development Company had succeeded in financing, in England, the completion of its plant, has been confirmed by the president, Sir Henry M. Pellatt of Toronto. Sir Henry declined to give any particulars, but the loan secured is said to be in the neighborhood of $1,000,000.

The Ontario Hydro-electric Power Commission has decided that the first of the four surveying parties which will make the survey for transmission lines will be sent out at once. This party will survey the line from Niagara Falls to Hamilton. The other parties will make surveys for the Hamilton and Toronto district and the district from London west. The intention is to have all the information at hand in case the Ontario government decides upon building transmission lines on its own account.

The Ottawa Electric Railway Company has just been approached by representatives of a wealthy American syndicate which wants to buy the franchise, plant and properties of the company. Since the Ottawa street railway has become known as a paying enterprise, several offers have been made for it, but the present one is the most favorable that has yet been received. It is, however, probable that the line will remain in possession of the present owners. The company paid dividends last year amounting to 12 per cent.

The city of Toronto has received the sum of $41,965 from the Toronto Street Railway, it being the city's share of the gross receipts of the railway for May last. The city's percentage for May, 1902, amounted to $14,524.

The Ottawa municipal electric-lighting plant is proving a paying concern. The report of the Civic Lighting Commission says that a net profit of $7,050 was realized for the last year. Since the taking over of this plant two years ago about $40,000 has been spent in extensions. The city bought out the Consumers' Electric Company two years ago, and comparing the last year's business with the last year of operation by the company, it is shown that the number of customers and the gross receipts have both increased about 80 per cent. W.

Winnipeg, Man., June 15.—That the Manitoba government fully means business with regard to the construction of government telephone lines within the province is evidenced by the fact that Hon. J. H. Agnew, provincial treasurer, is now calling for tenders for the purchase of $500,000 40-year four per cent. telephone debentures, bids to be in the office of the provincial treasurer, Winnipeg, by noon, July 1st. This money will be used to defray the cost of the construction of long-distance lines in Manitoba, and as soon as it is expended tenders for further debentures will be called.

Wilford Phillips, manager of the Winnipeg Electric Company, states the company is now arranging for the construction of a line along Pembina highway to St. Norbert, a distance of 13 miles. Some of the work will be completed this year.

The installation of the electric-light system at Enderby, B. C., is now nearly completed, and from a canvass made it appears as though nearly everyone in the town will take advantage of the new system. The town has arranged for the installation of 20 street lights.

Capitalists at Fort Francis, Ont., are considering the advisability of constructing an electric railway to Duluth. It is stated the trip could be made in three hours, and sufficient power will be available as soon as the power plant at International Falls, on the Rainy River, is completed.

Officials of the Canadian Pacific Railroad have been investigating the possibilities of developing power along the man line between Winnipeg and Fort William. It has been found that at several places in the vicinity of Fort William, Port Arthur and Kenora there is a large amount of power not being made use of, and it is expected the company will obtain privileges and use electricity as motive power in some of the sections between these two cities.

An electric-light plant is one of the proposed civic improvements for Yellow Grass, Sask., this summer. A. S. Baker can give information.

Cyrus S. Eaton, representative of the International Lighting and Heating Company of Cleveland, Ohio, is now in Portage la Prairie, Man., arranging for the erection of a plant. The system to be installed in that town by the company will cost $100,000.

The Town Council of Port Arthur, Ont., has decided to double-track the municipal street-railway system at a cost of approximately $55,000. In connection with this work a large amount of supplies will be required.

Woodman Bros. of Brantford, Ont., have received the contract for the overhead work in connection with the mountain extension of the Brantford and Hamilton Electric street railroad.

A. F. McCallum has been appointed engineer of the Hamilton, Waterloo and Guelph electric railroad in connection with the proposed extensions to be built this year. R.

New England.

Boston, Mass., June 15.—At the annual meeting of the Metropolitan Home Telephone Company in this city Colonel Albert Clarke was elected president and Albert L. Ireland, vice-president. Colonel Clarke is prominent in the business life of Boston. The company obtained its franchise last fall by a grant which the Boston Board of Aldermen passed over the mayor's veto. It is the purpose of the company to ally itself with other Independent telephone organizations.

Interurban trolley projects have been the subject of numerous hearings before the Massachusetts Railroad Commission during the last month, the Boston and Eastern Interurban Company being given a series of hearings this week. Plans of the engineers were submitted for approval. The district to be served between Boston and the shore cities to the northeast has a population of 2,855 per square mile and is one of the most densely inhabited in the state, taking in such cities at Chelsea, Everett, Lynn, Salem, Peabody and Danvers. The tributary population in 1910, it is figured, will be about 200,000, exclusive of Boston.

In the Connecticut Legislature on June 11th a bill was reported favorably which seeks to impose additional restrictions on the issuance of mortgage bonds by steam and electric-railway corporations. On the previous day another bill was reported which aims to regulate the financing of all public-service corporations.

The Uxbridge and Blackstone Street Railway has passed into the control of the New Haven steam road. It is capitalized at $80,000 and operates about 10 miles of track. This gives the New Haven control of the roads between Worcester, Mass., and Providence, R. I., and a trunk line express service is to be put in operation as soon as possible between the two cities via the new acquisition. B.

New York.

New York City, June 15.—The Board of Estimates at a recent meeting decided to break up the telephone monopoly, when the members of the board, acting as a committee, recommended that the board itself grant the application of the Atlantic Telephone Company for a franchise after the proposal of the New York Telephone Company to enter into an agreement with the city for what amounted to a monopolistic franchise had been rejected. The only thing now remaining is to determine the terms of the grant. The new telephone company announced last year that it intended to use automatic telephones and to charge a much lower rate than the present one.

On the 13th of June the bids for the Manhattan subway loop to connect the two bridges were opened and exactly 13 bids were received. The present commission was organized exactly 13 years ago. Those close to the commission do not believe that the committee can possibly pass on the bids till its next meeting. The contracts for the building of the two trolley approaches, as mentioned last week, will be awarded within the next two weeks; it calls for the successful bidder to commence work within five days from the time the contract is awarded and stipulates that the entire improvement shall be completed by October 1st. Bids for the Brooklyn side will be opened shortly. A committee of Brooklynites recently called upon the State Railroad Commission and called its attention to the fact that there was no elevated station within two blocks of Delancy Street, where the present terminal of the Williamsburg Bridge is located, and suggested that the Grand Street station be closed and one opened at Delancy Street. The committee has the matter under consideration.

It is also reported that this commission has issued orders to the Edison Electric Illuminating Company to erect 15 additional arc lights along Broadway, Brooklyn. All of these lights are to be swung on mast arms from iron poles and are to be connected to the underground system. The present lights will be rearranged, so as to make the street better lighted.

Electric signs which hitherto have been allowed to hang from stores, theaters and other buildings without a tax of any sort, will now be required to be licensed, the fee being 10 cents per square foot for the area of one side of the sign. The Edison Company alone has something like 2,000 of these which it lends customers who agree to take their current for a year or more, and it is taxing the Department of Water Supply, Gas and Electricity to its utmost to inspect these signs and to give the necessary permits. The law states that it is to go into effect immediately, and so an extension of time till August 1st has been asked for, to allow of the proper blanks, forms, etc., to be prepared.

A suit is to be brought with the object of having the constitutionality of the law creating the Public Utilities Commission passed upon. This announcement came from the Rapid Transit Commission, which stated that the suit would be brought in the name of a taxpayer. It is believed that there will be a long fight in the courts to see if the law is constitutional, because it gives the city officials no voice in the spending of the city's funds for transit purposes or in the solution of the transit problems. This move to tie up the Utilities commission was anticipated by those behind the bill.

A judgment establishing the liability of a railroad company for injuries sustained by passengers in the rush-hour crush was entered in the county clerk's office in the case of Mrs. A. C. Henry against the Brooklyn Heights Railroad, the plaintiff receiving $176.57 damages. No charge was made against any employe of the company, and the case went to the jury on the one proposition that the company was itself negligent in permitting its platforms to be overcrowded and in not employing sufficient men to patrol the platform and prevent injury of its patrons at the hands of the crowd.

The Huntington and Babylon Railroad Company was granted a franchise by the Village Board at Amityville, L. I., to build and maintain an electric road on certain of its streets, the franchise to run for 50 years, with an option to renew for 25 years under certain restrictions and conditions. The company is required to build within two years and work to commence within 30 days. A fare of five cents only is to be charged within the village limits. After 22 years the company is to pay the village $100 per annum, to increase $50 each year until the amount of $500 is reached. E. H. S.

Ohio.

Toledo, June 15.—The Department of State has granted a charter to the Akron, Canton and Youngstown Railway, capital stock, $200,000. It is to be an electric railway, to pass through Summit, Portage, Stark and Mahoning counties. The incorporators are headed by Z. W. Davis.

The People's Light, Heat and Power Company of Columbus has decided to issue $250,000 five per cent. bonds for the purpose of retiring $92,000 worth of bonds and other obligations, and also to supply funds for the remodeling of the present plant by the installation of a direct-current system. The company has a contract for lighting the streets of Springfield, Ohio.

The Columbia Gas and Electric Company, the recent merger of the several gas and electric companies in Cleveland and Cincinnati, has definitely announced plans for the building of a million-dollar 16-story structure in Cleveland. The building will

be the finest of the kind in Ohio, 60 by 100 feet, 16 stories below the tower.

The Fisher Electric Company of Toledo recently changed its name to "The Toledo Electric Company." This concern has been in business for a number of years and will continue. Mr. Fisher, who is now in New Mexico for his health, has not been actively connected with the business for some time.

DeFrance & Strub is the name of a new firm of electrical contractors who recently opened offices in the Produce Exchange Building, Toledo. They will do all kinds of wiring and general electric work.

The county commissioners of Lucas County have placed advertisements for bids for the construction of the Lucas County Infirmary power house. Edward Bayer, 1630 Nicholas Building, Toledo, is the engineer in charge.

Findlay, Ohio, is the latest town to report trouble on account of electrolysis. The telephone cables under the Blanchard River bridge are the ones that are suffering this time, and several lengths were taken out and new ones substituted.

The Board of Public Service of Hamilton, Ohio, passed a resolution ordering the city auditor to certify to council that the board is ready to award $53,000 worth of contracts for the improvement of the electric-light plant and to certify to council that there is a sufficient amount of money in the treasury for the expenditure. It is understood from the opening of the contracts, that the engines will be furnished by the Hooven, Owens & Rentschler Company; generators by the Allis-Chalmers Company; condensers by H. Worthington of New York; the arc-light system by the General Electric Company; the switchboards by the Fort Wayne Electric Works, and poles and outside electrical work will be done by the F. Bissell Company of Toledo. S.

Indiana.

Indianapolis, June 15.—Engineers and officers of the Capital Circuit Traction Company have just been to Omaha to investigate the gasoline motor cars being used for short hauls. They returned highly enthused over the success of the motors and will consider using them for power instead of electricity, believing the use of gasoline motors means quite a saving in initial cost.

Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, associated with ex-Governor W. T. Durbin, Ball Brothers and Theodore Rose of Muncie, contemplate the building of a road to Madison from Greensburg, a distance of 52.4 miles, provided the residents at each end of the line and along the route will put up $300,000 of the $1,321,967 of the estimated cost.

To prevent its franchise from lapsing, the Indianapolis and Western Traction Company, now a part of the Terre Haute, Indianapolis and Eastern, ran a car over the new line from Plainfield to Greencastle on the 12th inst. The time limit was to expire at midnight, and the trip was completed at 11:50 p. m., 10 minutes ahead of time. The road is not yet completed, and it required a great deal of labor to make the running of a car possible. Regular passenger service will be established by July 1st. The road will be extended from Greencastle to Brazil, to connect there with a line from Terre Haute.

At the annual stockholders' meeting today of the Indiana Traction and Terminal Company the old board of directors and officers was re-elected. The report of the treasurer showed that the company is in good financial condition. It was said that in all probability a small dividend would be paid soon.

M. Kuroki, a professor in a Japanese university, who was sent to this country and Germany to inspect electric railways, was in Rushville a few days ago to inspect the alternating-current system employed by the Indianapolis and Cincinnati Traction Company. Prof. J. W. Meares, electrical adviser for the English government in India, is at present in Indiana, making an inspection of the interurban systems.

The announcement is made that the Union Traction Company would expend an additional sum of $15,000 on the large car shops being erected in Anderson. This amount will make the total expenditures for the car shops $140,000.

The Plymouth Lighting Company of Plymouth has incorporated to build and operate an electric-light plant. Estimated cost, $100,000. L. P. Kleitz, J. Emmerling and P. A. Neuffer are directors.

The Central Indiana Lighting Company, a branch of the National Heat, Light and Power Company of New York, otherwise known as the electric-light syndicate, has acquired the plant of the Alexandria Electric Light and Power Company at Alexandria. The sale to the syndicate took place while a sale by the receiver was pending. The Superior Court deferred the sale by receiver, and the Central Lighting Company finally acquired the bonds of the Alexandria company in receivership and then assumed other obligations that made a total consideration of between $50,000 and $60,000. The new owners will take charge of it at once and make considerable improvement. The new owner of the Alexandria plant has appointed J. F. Jeffries as superintendent. He was one of the largest stockholders in the defunct company.

It is announced in official circles of Richmond that the eastern syndicate which owns numerous lighting and power plants in Indiana is preparing to enter on another campaign for the purchase of Richmond's municipal light plant. The syndicate will agree to pay the city a sum equal to that which has been spent by the city in building and maintaining its plant up to the present time, approximately $250,000, and in addition will accept a franchise which will fix the maximum rate at nine cents a kilowatt, the rate now charged by the city. The city officials will oppose the acceptance of the proposition on the ground that the city plant is not only paying its way but is making a profit monthly. The question will have to be submitted to a vote of the people. S. S.

Illinois.

Peoria, June 15.—E. H. Parker of Kilbourne, Ill., will establish an electric-light plant at that place, and expects to have the plant in operation inside of 60 days.

The Paris and Northern Traction Company has been incorporated with a capital of $5,000, with the principal office in Paris. It is proposed to construct an electric road from Paris, Edgar County, through the counties of Edgar and Vermillion to Ridge Farm and Brocton in Vermillion County. The incorporators and first board of directors are F. L. Kidder, L. L. Canine, John J. Cummings and J. E. Parish of Paris and George E. Fair of Chrisman, Ill.

The supervisors of Sangamon County, of which Springfield is the county seat, are considering the advisability of establishing an electric-light plant for the county buildings. The county is now paying for heating and lighting the sum of $5,406, and the supervisors estimate that it can be done for $4,410 with their own plant, which would cost $12,000.

The annual report of the Illinois Traction Company shows gross earnings for the first four months of the present year of $1,105,324, an increase of $212,939, or 23.72 per cent. over the corresponding period of last year. The increase in net amounts to $92,909, or 24.29 per cent. This makes the earnings of the company, after the bond interest has been deducted, at the rate of 22 per cent. per annum on the preferred stock. It must also be taken into consideration that the company is spending a great deal of money in building new lines that will open much new territory, also that the company has only been operating a little over two years.

An electric-light plant will be built at Washburn, Ill., at once. Messrs. Shade and Green of the Consolidated Electric and Manufacturing Company have the contract and will commence work at once.

General Manager Schmidt of the Utilities Company at Springfield has made the county supervisors an offer to light the public buildings. On a five-year contract he gives the rate of four cents a kilowatt-hour; on a three-year contract, 4½ cents, and on a two-year contract five cents a kilowatt-hour.

Eugene Tetu, who has been cashier of the Central Railway Company of this city for several years, is contemplating resigning. V. N.

Northwestern States

Minneapolis, June 15.—The Des Moines, Winterset and Creston Interurban Company will be given a site for a station, terminal right-of-way and $10,000 at Creston, Iowa.

Owing to inability to dispose of its bonds at par the construction of an electric-light plant at Deer River, Minn., will have to be postponed.

The City Council at Faribault, Minn., is considering the matter of taking over the plant of the Polar Star electric-light plant and a committee has been appointed to investigate.

Bonds have been voted at St. Charles, Minn., to purchase the electric-light plant.

Extension of the lines of the Manitowoc and Northern Traction Company south to Sheboygan, Wis., and north to Kewaunee, Algoma, Sturgeon Bay and Green Bay is probable as the outgrowth of the recent merger of the Milwaukee-Northern interurban and the Sheboygan Heat, Light and Power Company.

The Independent Light and Power Company of Davenport has awarded the contracts for furnishing the machinery and equipment for its new plant.

The capital of the People's Light Company of Davenport, Iowa, has been increased from $500,000 to $1,500,000.

Bids are asked at Virginia, Minn., for an electric-railway franchise. R.

Pacific Slope.

San Francisco, June 12.—The local strike situation has not improved much. The telephone operators are holding out as well as they can. The service has not improved particularly of late, but the strike-breaking operators are giving prompt attention to telephone calls. The officers of the District Council of the Brotherhood of Electrical Workers, who demanded that the members of the union rescind the strike order and return to work, instead of remaining out from sympathy with the telephone operators, have been defied by the strikers. It was threatened that other union men who are in good standing would be brought to San Francisco to take the places of the defiant strikers. The United Railroads is still improving its service a little each week, and there is very little violence. The company will push the prosecution of the striking conductor who is said to have placed a small dynamite bomb on the car tracks.

Col. T. W. M. Draper and associates of San Francisco are again taking up the proposition of building a railroad from Grants Pass, Ore., to Crescent City, Cal. They have just completed an inspection of the route surveyed by them three years ago.

Advices from Boise, Idaho, say that a new stamp mill is being installed at the Black Pearl mine, to take the place of the mills now in use. The machinery will be operated by electricity. An auxiliary steam plant will also be built to insure constant operation.

F. J. Johnson of St. Marys, Idaho, is making application to the Town Board for a franchise for electric lights and power. He will also carry a stock of fixtures.

The Davenport Machinery Company owns the present steam electric-lighting plant, also a water-power right on the Spokane River 14 miles from Davenport, Wash., where 4,000 horsepower can be developed. The company will develop this at once and transmit power to Davenport, Harrington, Sprague, Ritzvillo, Reardan and other towns. Otto Weil of Spokane has prepared plans.

E. J. Felt has applied to the City Council of Olympia, Wash., for a franchise over leading streets of the city, to enable his line from Tacoma to enter this city.

A movement is under way for the erection for what will be the largest car manufacturing plant in the West. The company is known as the W. H. Judson Company. First, shops will be built on the line of the Oregon Water Power and Railway Company, and will be completed by November 1, 1907. The project has been under way since September, 1906. The location will probably be within 15 miles of Portland, if not in the city.

According to recent reports, the Great Northern Railroad will supplant steam with electricity for hauling trains through the Cascade Tunnel in the state of Washington. A.

PERSONAL.

H. L. Wherland has resigned his position as superintendent of the city water and light plant at Ortonville, Minn.

F. H. Silverton has resigned as superintendent of the municipal electric-light plant at St. Peter, Minn., and will be succeeded by H. A. Hildebrandt of Brooklyn, N. Y.

Arthur E. Appleyard, well known in street-railway circles through his connection with the organizing of the Ohio Union Traction Company, which endeavored to control 700 electric roads in Ohio, is said to have failed financially through some unprofitable stock-market ventures. He began to operate in the stock exchange when the street-railway deal fell through.

The 153d annual commencement of Columbia University was held on June 12th. Wholly unannounced, Governor Hughes appeared and received the honorary degree of doctor of laws. Fourteen electrical engineers, presented by Frederick A. Goetze, dean of the faculty of applied science, received their diplomas. The honorary degree of master of science was conferred upon Charles G. Curtis, C. E.

Sir Benjamin Baker, the eminent English civil engineer, died suddenly on May 19th. He was one of the designers of the Forth Bridge, but his greatest achievement is the great dam across the Nile at Assuan, now about to be raised. The London Times Engineering Supplement says of him: "Londoners owe to Sir Benjamin Baker in a large measure the modern facilities for travel conferred upon them by the so-called tube railways, since it was mainly in consequence of the improved systems of working, especially the pneumatic shield introduced by this engineer that these railways have been carried to successful completion."

On the evening of June 12th the members of the class of 1907 in engineering of the Polytechnic Institute of Brooklyn received their diplomas. Six degrees in electrical engineering were conferred by the president. James Melin Wiley achieved great success by taking degrees both in electrical and mechanical engineering and also by being the valedictorian of his class and winning the Alfred Raymond prize. The address of the evening was delivered by Walter C. Kerr of Westinghouse, Church, Kerr & Co. It was announced that the three retiring professors would be entitled to generous pensions by the grant of the Carnegie Foundation for the Advancement of Teaching. Prof. Brainerd Kellogg, professor of English and philosophy and dean of the faculty, resigned, with a

record of 49 years as a teacher of young men. Both Professors Lador and Hertzberg have also served many years at the Polytechnic.

B. B. Winchester, who has been superintendent of the New York and Long Island Traction Company, with headquarters at Hempstead, L. I., has been transferred to the central office of the company at Long Island City. He is succeeded as superintendent by Mr. J. P. Kineon.

Announcement has been made of the resignation of Ernest J. Bechtel as superintendent of the lighting department of the Toledo Railways and Light Company, Toledo, Ohio. Mr. Bechtel will become consulting engineer for the firm of Hodenpyl, Walbridge & Co. of New York. He has been superintendent of the lighting department of the Toledo company for 13 years, and under his supervision the power house in Toledo has become one of the best equipped plants in the country. Mr. Bechtel left for New York June 15th. He was presented a 32-degree Masonic watch-charm, set with a solitaire diamond, on behalf of the employes and management of the Toledo company.

Bion J. Arnold made an excellent address to the graduates of Armour Institute of Technology on June 14th, his subject being "The Electrical Age and the Beginner." He enumerated some of the things electricity has done and is expected to do and specified the qualities requisite to success in engineering. Mr. Arnold referred to the work of rehabilitating the street-railway systems of Chicago and said that when this work in which he and his associates are engaged in is completed Chicago will have the best street-railway system in the world, operating entirely by electricity and eventually, no doubt, employing a double-deck system of subways in the Loop district.

Charles R. Maunsell, a well-known and well-liked central-station man of the West, died in Denver on June 17th, the cause of death being pulmonary tuberculosis. Mr. Maunsell was perhaps best known as the manager of the Edison Electric Illuminating Company of Topeka, Kan., in which position he did good work in building up that property, but he was also a familiar figure in electrical circles in Chicago, having been successively connected with the Chicago Telephone Company, the old Chicago Arc Light and Power Company and an electric-light station on the North Side now merged in the Commonwealth Electric Company. He was an authority on district heating, having prepared a report on the subject for the National Electric Light Association. Mr. Maunsell lost his wife a short time ago. He was an alert and able central-station manager and a man of likable personality. His death is sincerely regretted.

Prof. Adam F. W. Paulsen, director of the Danish Meteorological Institute—the national weather service of Denmark—died January 11, 1907, at the age of 74. Professor Paulsen was especially interested in two important projects—the study of the aurora and the establishment of telegraphic communication between Europe and Iceland for meteorological purposes. The cable to Iceland became an accomplished fact shortly before his death and is a lasting monument to his memory. Paulsen's investigations of the aurora date from the international polar expeditions of 1882-1883, in which he took part. In 1899-1900 he led an expedition to Northern Iceland for the special purpose of studying the aurora. The results of the latter expedition included some remarkable photographs of auroral spectra, and new measurements of the altitude of the rayless auroral arch, indicating that it occurred at not less than four or five hundred kilometers from the earth's surface. At this height the atmosphere must be so rarefied that ordinary electrical discharges would be impossible. In a paper published a few months before his death Paulsen reached the conclusion that the cause of the aurora is to be sought in an immense ionization and negative electrification of the upper layers of the atmosphere, produced by cathode rays emitted from the sun.

ELECTRIC LIGHTING.

It is reported that the city of Dallas, Tex., will erect a municipal electric-light plant.

The town of Shullsburg, Wis., will vote $12,000 in bonds for an electric-lighting plant.

The Merkel (Texas) Light and Power Company has been incorporated with a capital stock of $100,000.

The Loup Valley Electric Company is trying to get a contract to light the town of Ord, Neb., for five years.

It is proposed to establish an electric-lighting plant at Mukden, Manchuria, with a possibility also of constructing an electric-railway line in that city. The necessary $100,000, it is reported, will be furnished by Japanese and Chinese capitalists.

According to the report of the president of the West Indian Electric Company, the big earthquake at Kingston, Jamaica, only cost the company $15,000. The report shows the gross earnings of this company to be $165,776 for the year ended December 31st last, being an increase of $26,013, or 18½ per cent. The net earnings amounted to $87,251, an increase of $17,623, or 25.31 per cent., and the net income to $50,924, an increase of $16,682, or 32.75 per cent., and showing 6.36 per cent. on capital stock. This is the best year the company has ever had. The company is controlled by Montreal men.

ELECTRIC RAILWAYS.

It is proposed to construct an electric railway from Tacoma, Wash., to Vancouver, B. C. A deal involving more than $1,000,000 is reported to have been closed in which Stone and Webster of Boston are said to be interested.

Simultaneous with the inauguration of the summer train schedule on the Cœur d'Alene division of the Inland Empire electric-railway system in Idaho and Washington the new extension of the line to Liberty Lake was opened a few days ago. The Cœur d'Alene division has 42 miles of track, the extension from Liberty Lake junction on the main line to the lake being a fraction over two miles.

The United States Civil Service Commission announces an examination on July 17, 18, 19, 1907, at places mentioned in a list printed thereon to secure eligibles from which to make certification to fill a vacancy in the position of electrical engineer and draftsman in the supervising architect's office at $1,200 per annum, and several vacancies in this position as they may occur during the period of eligibility at salaries ranging from $1,200 to $1,600 per annum. As no eligibles were secured as the result of the examination held in March for this position, qualified persons are urged to enter this examination.

PUBLICATIONS.

An interesting pamplet describing the new Engineering Societies' Building in New York, with an historical sketch of the origin of the enterprise and pictures of the building, has been published by the dedication exercises committee. The text was written, it is believed, by Mr. T. C. Martin.

The Universal Manufacturing Company, 204-206 East Illinois Street, Chicago, is sending out an attractive folder on the Universal flat-rate controller. The device is designed to prevent consumers from using more current than they pay for. The company asserts that, besides taking the place of an expensive meter, the controller will be found to be an important factor in reducing office expenses by permitting the services of an inspector, reader and repairer to be dispensed with. A description of the apparatus may be had for the asking.

One of the most complete catalogues of electric railway and mine supplies is that just published by the Ohio Brass Company of Mansfield, Ohio. It is catalogue No. 7, constituting a book of nearly 600 pages illustrating and describing a large and complete line of supplies used in the construction and operation of electric railways and mines. This company designs, manufactures and deals in a perfected line of appliances used in the construction and operation of the above-mentioned properties as well as lighting and power plants. The present catalogue is valuable in that it places before the engineer and operator in a careful and intelligent way the things he needs every day. Besides the articles listed the catalogue gives some valuable tables, formulæ and other information in Section X. The other nine sections are devoted, respectively, to rigid and flexible pole braces, catenary construction; trolley wire, hangers, pull-overs, guard wires, insulators, etc.; trolley ears, clamps, splicers, section insulators, cross-overs, etc.; rail bonds, bonding tools, clamps and sleeves, channel pins, etc.; material for third-rail installations; car equipment specialties and supplies; construction material and supplies, and track and linemen's tools.

Bulletins Nos. 4493, 4498, 4499, 4501, 4502, 4503, 4508, 4510 and 4511 have recently been issued by the General Electric Company, Schenectady, N. Y. The first-named bulletin is devoted to a description of the parts of R controllers. Bulletin 4498 treats of Thomson single-phase high-torque induction wattmeters, of which the General Electric Company manufactures three types. Cast grid rheostats, type CG, are treated in bulletin 4499. These rheostats consist of a series of grids supported on insulated rods between cast end pieces. Two styles are made. The electrification of the West Jersey and Seashore Railroad is the subject of bulletin 4501. In bulletin 4502 G. E. knife-blade lever switches, type L, form D-12, are described and illustrated. CQ generators and balance sets are described in bulletin 4503. These machines are adapted for supplying current for use in small isolated lighting or power plants and for any purpose requiring small belt-driven direct-current generators. Bulletin 4508 deals with commutating-pole railway motors. These motors are designed to meet the conditions due to the gradual increase of operating voltages on direct-current electric railways, especially on large systems or interurban roads, on which the requirements largely relate to the commutation and non-flashing properties of the motor. Electrically operated, ratchet-driven rheostat switches form the subject of bulletin 4510. Types of lightning arresters for 1907 are given in bulletin 4511. They are designed to meet the following requirements: To discharge potentials moderately higher than the potential of the circuit protected; to restrain the flow of the dynamic current across the gaps and to extinguish the arc when normal potential is restored; to discharge high potentials covering a wide range of frequency, and to prevent excessive rises of potential between lines as well as between lines and ground.

Bulletin No. 57, issued by the Bristol Company, Waterbury, Conn., contains a description of the company's recording voltmeter which is applicable for use on either direct or alternating-current circuits, irrespective of the rate of alternations. The instrument is constructed upon the electric balance principle without the employment of permanent magnets. The essential parts consist of two coils mounted side by side, one stationary and the other mounted upon steel knife edges. A pen which receives its motion from the movable coil makes a permanent record in ink upon a revolving chart. Friction being reduced to a minimum by the steel knife edge supports, the instrument responds to slight variations in voltage. Type 8, portable form, weighs 11 pounds. The voltmeter is also furnished in switchboard form for any range desired.

The Leeds & Northrup Company, Philadelphia, has issued its 1907 catalogue, in which are described electrical measuring instruments and scientific electrical apparatus manufactured by the company. The first few pages of the catalogue are devoted to a detailed description of the concern's manufacturing facilities. Several new designs and a few new principles in electrical measurement are given. The company's line of standards of resistance, capacity, inductance, temperature, etc., has been enlarged, and all its standards are checked by the National Bureau of Standards at Washington. Among the products listed may be mentioned standard mica condensers; a high-potential condenser having a capacity of about 0.023 microfarad and guaranteed to stand a continuous discharge of seven-eighths inch across a parallel gap; Kelvin galvanometers of various resistances; D'Arsonval and other galvanometers of various types and sensibilities; reading telescopes; slide wire or meter bridges; standard resistances; apparatus for measuring low resistances; resistance boxes; decade sets with four coils to the decade; Wheatstone bridges; dial rheostats; keys for electrical testing; portable testing sets; cable-testing apparatus; Hoopes' conductivity bridge; potentiometer; electro-dynamometers, including the Rowland type; self and mutual-induction apparatus; Reichsanstalt precision photometer; standard incandescent lamps; high-frequency apparatus, temperature indicators and thermometer bulbs. The following new instruments are catalogued for the first time: No. 2400 portable telescope galvanometer; No. 4305 Kelvin bridge; direct-reading ohmmeter; dial decade portable testing set; No. 5420 fault finder; No. 5365 bridge for locating faults in power circuits; No. 7000 alternating or direct-current comparator; No. 5313 alternating-current generator and speed-controlling apparatus; resistance thermometers and temperature indicators.

SOCIETIES AND SCHOOLS.

The Association of Edison Illuminating Companies will hold its convention of this year at Virginia Hot Springs early in September.

The twenty-sixth convention of the Association of Railway Telegraph Superintendents was announced to be held at Atlantic City on June 19th and 20th.

The annual convention of the Street Railway Association of the state of New York will be held at the Hotel Champlain, Lake Champlain, N. Y., on June 25th and 26th.

TELEGRAPH.

Two new telegraph lines will shortly be erected in Siam, Asia. One of the lines will run between Battambang and Bac Prea, while the other will be constructed from Kratt to Chantabun.

The net revenue of the Western Union Telegraph Company for the quarter ending June 30th, it is estimated, will be $1,650,000. For the quarter ended March 31st the net revenue was $1,509,700, at which time the total surplus amounted $16,953,105. Deducting from the present quarter interest on the bonded debt and a 1¼ per cent. dividend will leave the surplus $17,019,893.

The Telepost Company is the name of a new Independent telegraph company incorporated with a capital stock of $18,000,000 under the laws of the state of Maine. The company proposes to transmit 50 words by telegraph and deliver the message through the postoffice for 25 cents, this message to be known as a telepost. It is also proposed to send a telegram of 25 words delivered

by messenger service for 25 cents. Five cents for each additional 10 words in each case will be charged. For news service the rates will be one-half cent a word for occasional service and one third cent a word for regular customers. The company owns all patents and rights in the system of rapid automatic telegraphy invented by Patrick B. Delany. The Delany system was awarded the gold medal by the Franklin Institute at the Pan-American Exposition at Buffalo and the St. Louis World's Fair.

MISCELLANEOUS.

The Chicago and Alton Railroad is experimenting with a device invented by S. R. Wright of Rochester, N. Y., designed to enable a dispatcher to guard against the carelessness of operators or train crews. By an electrical device it permits the dispatcher to drop the semaphore arm or blade to the "stop" position, regardless of the presence of the operator.

Mr. Hiorth of Christiania, Norway, has invented a system of treating low-grade iron ores in an electric smelter, with graphite as a reducing medium instead of coal. He has been awarded a prize for his invention by the Iron and Steel Institute. There are large quantities of graphite and low-grade ores in Norway, and the existence of waterpower makes the invention a valuable one if it can be worked well on a large scale.

Prompted by the demand for better steel rails to make railroading safer, the Carnegie Steel Company will operate open hearth furnaces exclusively at the Edgar Thomson Works at Braddock, Pa., its largest plant. The number of accidents due to defective rails resulted in the railroads making a concerted fight for a better grade than the Bessemer quality of steel furnished. The Bethlehem Steel Company has also begun the open-hearth manufacture of rails. The cost of the product to the manufacturers is not greater than at present, and the liability of the new product to break is decreased to a minimum.

TRADE NEWS.

The Seattle (Wash.) office of the Allis-Chalmers Company, which is in charge of G. W. Pulver, district manager, has been moved to 115 Jackson Street.

George H. Rowe of Chicago, consulting electrical engineer, formerly located in the Fisher Building, has moved his office to room 1708 Commercial National Bank Building.

It is reported that Marshall Field & Co. of Chicago, who have been experimenting for some time to ascertain the best system of illumination for their mammoth retail stores, have entered into contract with the Nernst Lamp Company for Nernst lamps aggregating 10,000 glower units to be delivered by September 1st. This is a large order and, resulting from the careful and scientific investigation of Marshall Field & Co., is certainly a triumph for the Nernst lamp.

The Curtis Advertising Company of Detroit, Mich., had a variety of attractive souvenirs, cards, etc., at the Washington electric-light convention. Among other things was a clever legal-appearing "summons" which was issued instead of a stereotyped invitation requesting members and visitors to the convention to call at the company's booth. The souvenir postal cards designed and given away by the Curtis company attracted favorable attention. Some of the cards were very clever. One, entitled "100 per cent. overload," showed a gentleman leaning against a lamp post in a state of blissful inebriety. The Curtis company is doing high class work in uplifting the standard of advertising used by central stations.

The Cooper Hewitt Electric Company has recently opened a district sales office at 66 State Street, Albany, N. Y., manager, Mr. S. H. Knapp. This office will handle the selling of Cooper Hewitt mercury vapor lamps in the northern and eastern part of New York state.

The Manhattan Electric Range Company, 150 Nassau Street, New York city, is now manufacturing a type of electric range adapted for restaurant or kitchen use. Its top is heated by resistance wires placed below the surface of the metal. Two doors conceal a broiler, and an oven and salamander are situated in the center of the range. Each compartment is controlled by a separate switch, the entire appliance being protected by reliable fuses. The range is designed to receive direct or alternating current at from 50 to 220 volts.

On June 1st Mr. Arthur O. Einstein opened an office and storerooms at 103 West Adams Street, Chicago, as electrical manufacturers' agent. He will carry in stock the goods of those he represents, having at present a line of knife switches and enclosed fuses manufactured by the Trio Manufacturing Company of Rock Island, Ill. Other lines will be added. Mr. Einstein has had 12 years' experience as traveling salesman in the Central States, his last position being that of sales manager for the Chicago branch of the Manhattan Electrical Supply Company. He is well fitted for the business he has chosen.

The Cutler-Hammer Manufacturing Company of Milwaukee has purchased the Wirt Electric Company of Philadelphia, and will continue the manufacture of Wirt apparatus. Pending the incorporation in the Cutler-Hammer catalogue of apparatus of the Wirt type, the current Wirt catalogue should be used. Particular attention is called to the very complete line of battery-charging rheostats developed by the Wirt company, and to the Wirt field rheostats, which in 1902 were awarded the John Scott medal on recommendation of the Franklin Institute of Pennsylvania. Bulletins covering these lines or any other lines of Wirt apparatus will be furnished on application.

BUSINESS.

H. M. Byllesby & Co. have been retained as consulting and supervising engineers by the Mobile and Ohio Railroad Company for the rehabilitation and electrification of its general repair shops at Whistler, Ala.

The E. H. Abadie Company of St. Louis, engineer and contractor for general service plants, including electric light, power and railway, as well as steam heating, is engaged in much work that will interest the electrical fraternity. At the head of the company is E. H. Abadie, who is well known to electrical men through his former connection with the Wagner company of St. Louis and other electrical enterprises. The Abadie Company has a large and efficient corps of expert engineers and is rapidly forging to the front in its special field.

J. E. Haschke has become intersted in the Auto Buggy Works of 598 West Monroe Street, Chicago. This company is making a business of equipping buggis, wagons, etc., with the Haschke storage battery. Mr. Haschke is an old storage-battery and automobile manufacturer and his present battery is said to possess many points of merit. It is light and economical and is said to be a battery having an extremely high efficiency and constancy of voltage combined with low internal resistance, in which the possibility of a short-circuit is entirely eliminated. The battery is manufactured by the Haschke Storage Battery Company of Chicago.

Secretary E. H. Heilstedt of the Chicago Mica Company of Valparaiso, Ind., is distributing from the company's office a clever line of advertising blotters on which is displayed particularly the merits of Micabond and other mica products of the company. Mr. Heilstedt is a far-seeing advertiser, as is evident by the success of his sales department and the rapid increase in the company's already large factory at Valparaiso.

The W. C. Sterling & Son Company of Monroe, Mich., announces the establishment of a pole yard in Monroe. It will be a branch yard, the principal one being at Bay City, where the company has 130,000 poles, making it the largest yard in the state, it is said. The yards at Monroe were made necessary because of the impossibility of getting enough cars at Bay City to ship in and out the large cargoes of timber and poles. The various Sterling firms also have large yards at Boyne Falls, West Branch, Cass City and Pinconning, besides smaller ones scattered through the northern part of the state. They have timber lands, mills or yards in 19 counties besides Monroe.

Owing to the demands of increased business, the Holophane company (sales department) has recently enlarged its office. It now occupies the eighth and ninth floors of the Glackner Building, 227 Fulton Street, New York city. The engineering department of this concern is composed of some of the best-known illuminating engineers in this country. The company has just opened a branch office at 157 Minna Street, San Francisco, Cal., under the management of Mr. F. H. Poss, who is well known to the trade on the Pacific Coast. The company intends to carry a large line of globes and reflectors at this office, which will enable it to make prompt deliveries, this being in keeping with the well-known policy of the Holophane company. Only standard packages will be sold.

The storage-battery department of the Westinghouse Machine Company, East Pittsburg, Pa., has issued a particularly interesting booklet on the Westinghouse storage battery, a partial description of which was given in the Western Electrician of March 16th last. The company, which is now prepared to contract for complete storage-battery installations for any class of service, has always advocated pure lead plate formed by the electrolytic or Planté process for both positive and negative plates, and it has found that when life is required in a battery plate the Planté is par excellence the process to be employed. The company says that it has solved the question of shrinkage in capacity, characteristic of the early Westinghouse negative and the Planté negative, and after much experimenting has succeeded in overcoming this fault by producing a Planté negative that has in addition to long life the function of maintaining its initial and rated capacity. The negative now used is said to be practically indestructible under normal conditions of battery service. The positive as well as the negative plate of the Westinghouse battery is made of pure lead without tin, antimony or other alloy, the grid having the density of rolled lead. A new system of regulation, including the sensitive Westinghouse storage-battery regulator, when used in connection with the company's storage battery and booster, will permit of the continuous operation of generating units at practically constant load, which can be fixed at the most economical point or varied instantly at will by one permanent adjustment. The regulator is adapted to either direct or alternating current, the alternating-current line being regulated through the medium of a rotary converter.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 11, 1907.

856,216. Game Apparatus. David G. Black, Brooklyn, N. Y. Application filed February 15, 1907.

The apparatus is provided with a chamber into which balls are to be driven. Electric contacts are respectively engaged by the balls of different game values.

856,242. Self-propelled Vehicle Truck. Rodolphus Fuller, Detroit, Mich. Application filed July 2, 1906.

The truck is designed to carry an electric motor for operating the vehicle.

856,260. Telephone Apparatus. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed April 9, 1903.

[illegible] in combination with a back board, [illegible] the mounting plate secured [illegible] secured to a projection integral with the [illegible] secured to the plate, a terminal block secured to the plate, and a stop integral with the plate and extending therefrom above the terminal block, the board in the [illegible] being limited by the stop and the terminal block.

856,273. Railway Switching System. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 20, 1905.

A system of electric signaling embraces a source of energy, a controller, motor or solenoid, and a single circuit between the cabin and signal, and in which indication is given by breaking the circuit adjacent to the signal.

856,275. High-tension Electric Fixture. Albert S. Marten, East Orange, N. J., assignor to the Tea Tray Company, Newark, N. J. Application filed November 27, 1903.

An electric light fixture is described.

856,277. Electrolytic Tank. John F. Miller, Trail, British Columbia, Canada. Application filed February 6, 1906.

The tank comprises side walls built up of a number of longitudinal sections placed edge to edge and formed with registering vertical openings.

856,290. Signaling Mechanism. Walter A. Pearce, London, England. Application filed November 28, 1906.

The mechanism comprises a signal rod and an operating rod, electrically controlled means comprising a magnet interposed between the rods for transmitting motion from one to the other, and a circuit controller for the electrically controlled means connected to the operating means whereby upon a preliminary movement of the operating rod the circuit controller is moved to close a circuit through the magnet of the electrically controlled means.

856,292. Safety Fuse. William J. Phelps, Detroit, Mich. Application filed May 4, 1903.

A fuse strip is inclosed within a closed casing. Means connected to the inner surface of the casing act automatically upon the disruption of the fuse for indicating the disrupted condition of the strip.

856,293. Trolley Pole Controller. Andrew L. Prentiss, Buffalo, N. Y. Application filed September 24, 1906.

In connection with the pole are a pressure cylinder containing a piston, means for connecting the pole with the piston, and valve mechanism controlling the passage of the pressure fluid to and from the cylinder.

856,321. Electrical Contact Joint. Reinhold H. Wappler, New York, N. Y. Application filed June 21, 1906.

The joint comprises pressure plates, electrical connections therefor, a substantially spherical member mounted intermediate of the pressure plates, the member being provided upon opposite sides with contact surfaces insulated from each other, and electrical connections for the contact surfaces.

856,324. Railway Switch-operating and Signaling System. Asbury G. Wilson, Wilkinsburg, Pa.,

assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed September 6, 1905.

An apparatus for moving a part or appliance for controlling the passage of cars or vehicles along a railway includes an electric motor, a lever, a mechanism for indicating that the apparatus has operated, comprising an electromagnetic device which is not responsive to the current to the motor to release the lever, a source of current supply common to both the motor and indicating mechanisms, and an interrupter for changing the character of the current to have it operate the electromagnetic device.

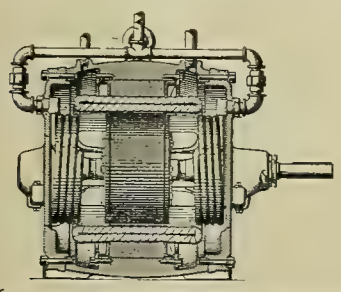
856,328. Thermostatic Apparatus. Edward F. Woodman, Boston, Mass. Application filed November 17, 1906.

In a thermostatic circuit-controlling device are circuit-changing means adapted to be included in an electric circuit, a controller therefor comprises a button-like member of fusible material, and a connected shank to cooperate with the means, and an exposed glass casing for and having a contracted portion loosely engaged by the member to maintain it in position to maintain the circuit-changing means inactive until the shank and fusible member are separated by fusion of the latter, the fusible member acting to retain the casing in position until the member and shank are separated.

856,361. Apparatus for Electrochemically and Mechanically Purifying Liquids. Gustave L. Neiburg, Westpoint, Neb. Application filed May 25, 1906.

An electrolyte purifying device comprises an outer zinc tubular element and an inner copper element, each element being provided with appertures, the appertures of the copper elements being smaller than the appertures of the zinc element. The device is adapted to break the liquid up into a series of small subdivisions.

856,379. Means for Cooling Electric Motors. John B. Wiard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 16, 1906.



NO. 856,379.—MEANS FOR COOLING ELECTRIC MOTORS.

In a motor are a stator or field ring, bonnets secured to the ends thereof and forming therewith a closed casing, a rotor or armature mounted in bearings in the bonnets, tubular coils arranged to receive cooling fluid nested within the bonnets, and a fan device on the rotor or armature for creating a circulation of the air within the casing. (See cut.)

856,385. Insulating Covering or Sheathing for Contact-rail Conductors. William H. Baker, Lockport, N. Y., assignor of three-fifths to Jesse Peterson, Lockport, N. Y. Application filed March 21, 1906.

The covering or sheathing is formed in sections, each section having its upper wall at one end flared outward and the end covered by the adjacent end of the adjoining section.

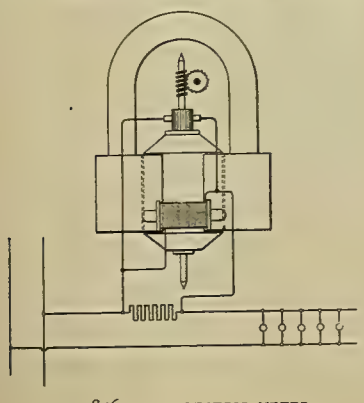
856,386. Automatic Calling Device. William O. Beck, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed June 4, 1906.

Combined with a circuit controller are manually operated means adapted to set the same, electromagnetic mechanism for operating the controller after the same is set, and switching mechanism, operated when the manual means is restored, for rendering operative the electromagnetic mechanism.

856,393. Inclosed Fuse. Robert C. Cole, Hartford, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed December 10, 1906.

The fuse has a tubular casing and a terminal therefor comprising an end closure for the casing, a backing plate laid against the end wall of the closure and a projecting contact member adapted to bind the plate and closure together.

856,412. Electric Meter. Arthur J. Martin, Rugby, England, assignor to the General Electric Company. Application filed November 2, 1906.



NO. 856,412.—ELECTRIC METER.

The meter described comprises a field magnet of substantially constant strength, a rotatable armature, connections for supplying to the armature a voltage proportional to the load current, a registering train driven by the armature, a field winding supplied with current proportional to the load current, and a magnetic circuit for the field winding acting upon the armature and arranged to be saturated at a fraction of full load. (See cut.)

856,414. Dynamo-electric Machine. Charles A. Mudge, New York, N. Y., assignor to the Electro-Dynamic Company, Bayonne, N. J. Application filed August 24, 1906.

The machine has main poles and interpoles, the main pole faces being symmetrically spaced about the periphery of the armature, while their cores are unsymmetrically spaced, thereby allowing space for the coils of the interpoles.

856,417. Electrical Controller for Steam Plants. John A. Olson, Minneapolis, Minn. Application filed March 20, 1905.

The apparatus comprises a reversible electric motor and circuit connections thereto involving a motor reversing switch, a pivoted tappet lever having a limited movement with respect to but operative on the reversing switch lever at the limits of its movement, and a spring pressed "kicker" operated by the motor and operating on the tappet lever when moved to either side of a dead center.

856,422. Gear Case. William J. Reich, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 2, 1905.

A gear case for electric-railway motors comprises side and peripheral plates of sheet metal and a relatively thick reinforcing plate riveted to each thin side plate along both of its edges.

856,423. Ventilating Dynamo-electric Machines. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 1, 1905.

In a dynamo-electric machine are a rotating shaft, a bearing therefor, a core or body carried by the shaft, fan blades secured to the body adjacent the bearing, and a shield carried by the core and overhanging the bearing.

856,424. Controlling an Electric Candy Spinning Machine. Albert D. Robinson, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 6, 1905.

The controlling means described comprises in combination with the driving motor and the heater, a switch and circuit connections whereby the motor must be started first, and then the heater cut into parallel circuit therewith.

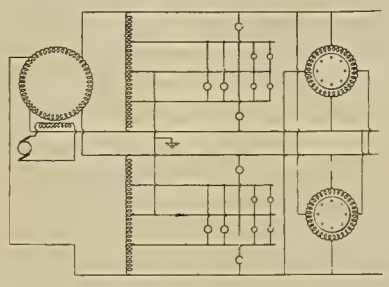
856,425. Circuit-breaker. Benjamin P. Rucker, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 22, 1904.

In a circuit-breaker, combined with stationary contact terminal jaws, is a pivotally mounted tubular member comprising an insulating body portion and contact terminal bands which are electrically connected by means of the circuit-breaker tripping coil and are adapted to engage the jaws.

856,429. Commutator Brush. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

A carbon brush has a cylindrical hole in its outer end and a double-web woven conductor, one end of which projects into the hole at an angle to its body portion, and a pin that projects into the bent end of the woven conductor to clamp it in position.

856,430. System of Electrical Distribution. Simon B. Storer, Syracuse, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 23, 1904.



NO. 856,430.—SYSTEM OF ELECTRICAL DISTRIBUTION.

The system described comprises a two-phase generator, auto-transformers having their terminals connected to the maximum potential armature points corresponding to the respective phases and having their middle points connected together and grounded, and distributing conductors connected to the middle points, to the extremities and to points intermediate the middle points and the extremities of the auto-transformer windings. (See cut.)

856,433. Centrifugal Switch for Electric Motors. Knut Tornberg, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 10, 1905.

A centrifugally actuated switch is carried by the motor armature comprising a centrifugally movable member. A leaf spring is secured at one end to the member and extends in a substantially circumferential direction. There are a contact carried at the free end of the spring, a slide adapted to be traversed by the contact and to restrain it against centrifugal force, and a contact connected to the armature winding of the motor and forming a portion of the slide.

856,440. Block-signal System. Elmer F. Bliss, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1906.

In combination with an electric railway having both rails conductively continuous for all currents are normally open-circuited sources of alternating current connected at intervals across the rails, adjacent sources being of different character, electromagnets for closing the circuits of the sources, a normally open contact in series with a number of the magnets arranged to be closed by a moving train, and signal-controlling devices responsive to the currents supplied to the rails by the sources.

856,448. Control System for Electric Vehicles. William Cooper, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1906.

In an electric vehicle combined with electric driving motors, and a number of governing switches for the motors, is a differential relay adapted to effect the opening of the switches and provided with similar opposing coils severally connected to the motor armatures.

856,465. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 3, 1906.

In combination with an electric railway having both rails conductively continuous for all currents are sources of alternating current connected across the rails at intervals, adjacent sources being of different phase, and signal-controlling relays connected singly across the rails between the sources, each relay being responsive to control a signal only when supplied with current from both adjacent sources.

856,466. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 11, 1907.

A system similar to that described in the preceding patent is covered.

856,467. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 10, 1907.

In an electrically-operated railway are track rails divided to form signal blocks, inductive windings cross-connecting the rails at both ends of each block and forming with the rails a permanently closed track circuit for each block, and connections between the circuits of adjacent blocks adapted to form a return path for the power current.

856,475. Production of Calcium Alloys. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. Application filed March 30, 1905.

The process described consists in electrolyzing molten calcium chloride in the presence of a cathode of fused zinc whereby is produced an alloy of calcium and zinc.

856,476. Electrical Controller. George Laird and John P. Todd, Manchester, England, assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 4, 1905.

In combination with a source of electrical energy, a translating device and a circuit controller therefor, are a circuit-breaking means comprising a main switch, an actuating coil therefor, an auxiliary switch in the circuit of the coil, an actuating coil for the auxiliary switch that is in circuit with the main switch, and a governing switch for the circuit of the main switch actuating coil, the governing switch constituting part of the circuit controller and being closed only when the controller is in its initial position.

856,477. Alternating-current Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 27, 1904.

An induction motor has two rotor windings or sets of short-circuited rotor windings, one of high resistance and the other of low resistance, and means connected with the stator winding for suppressing the generation of currents in the low-resistance winding at starting and for permitting the creation of currents when running.

856,483. Automatic Gas Feed for Vacuum Tube Lamps. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed May 8, 1906.

In combination are a vacuum tube lamp, a selenium cell exposed to the action of the light of the lamp, a valve through which gas may be fed to the lamp, and means responsive to variations in the resistance of the cell for controlling the action of the valve.

856,484. Automatic Gas Feed for Vacuum Tubes. Daniel M. Moore, Newark, N J, assignor to the Moore Electrical Co., New York, N. Y. Application filed May 8, 1906.

Combined with a vacuum tube are an electrically heated thermostat connected to the circuit of the tube, and means controlled in their action by the thermostat for supplying gas to the tube.

856,488. Insulator. Charles L. Peirce, Jr., Chicago, Ill., assignor to the Peirce Specialty Company, Chicago, Ill. Application filed January 29, 1906.

Details are described.

856,497. Illuminating Mirror. Arthur D. Southam and Horace C. Hides, Hartford, Conn. Application filed December 21, 1905.

The mirror described comprises a mirror glass opaque throughout except at two points on opposite edges thereof, a frame for the glass, a lamp chamber formed in the frame in the rear of the mirror glass, electric lamps supported in the chamber, circuit wires conneced to the lamps, means for making and breaking the circuit, and a reflector back of the lamps adapted to throw the light forward through the mirror glass at opposite edges thereof.

856,504. Keyboard Telegraph Transmitter. Richard Wolters, Düsseldorf, Germany. Application filed December 5, 1906.

The device comprises a spring-influenced key, a contact rail, a contact slide pivoted to the key and adapted

[illegible] the [illegible] spring on [illegible] to engage the nose.

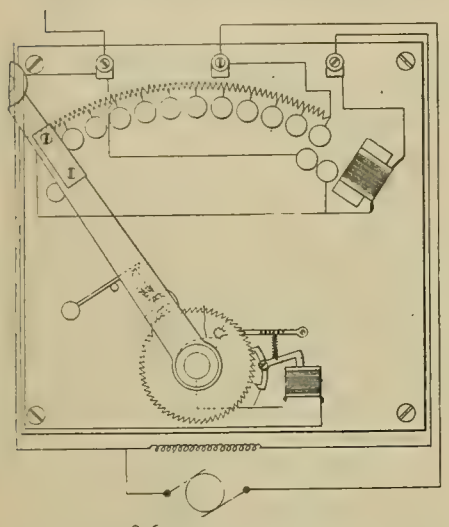
856,511. Signaling System. George H. Bowen, Boston, Mass., assignor to the Boston Automatic Fire Alarm Company, Boston, Mass. Application filed December 26, 1905.

The system comprises a movable circuit controller, a motor to move it step by step, a second circuit controller operated by the motor, a time movement, an auxiliary motor, a circuit controller operated by the auxiliary motor, and means operated by the time movement to cause the auxiliary motor to move its circuit controller in unison with the second motor operated circuit controller.

856,535. Trolley Pole for Conducting Electric Current to Vehicles. Robert Lindsay and John Lindsay, Dunedin, New Zealand. Application filed June 26, 1905.

Details are described.

856,540. Starter for Electric Motors. William C. Mayo and John Houlehan, El Paso, Tex., assignors of one-third to George E. Briggs, El Paso, Tex. Application filed February 11, 1907.



NO. 856,540.—MOTOR STARTER.

The device has a propelling means for the starting switch having a constant tendency to move it across the steps of the starting resistance in succession, a detent controlling the movement of the switch arm, and an electromagnetic controlling device for the detent sensitive to variations in the starting current to permit a movement of the switch arm in accordance with the variations of the starting current. (See cut.)

856,553. Means for Recording Sounds. Wayne L. Stilwell, Millersburg, Ohio. Application filed February 19, 1907.

In a sound recording mechanism are a sound box, a diaphragm carried thereby, an electric lamp and electric circuit terminals carried by the sound box and connected with the lamp, an opaque shield for the lamp having a light opening and an arm attached to the diaphragm. There is a light-directing member having an opening for projecting a beam of light upon a photo-sensitive surface and carried by the arm, the light-projecting member being constrained by the movement of the diaphragm to move with relation to the photo-sensitive surface to cause the light beam to travel in a sinuous path corresponding to sound waves.

856,566. Windings for Electrical Apparatus. Miner Barcus, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 31, 1906.

The winding comprises a number of sections each composed of a number of insulated strands arranged one outside the other, the inner strands of each section being connected to form a stranded conductor common to all of these sections and the outer strands being connected to form a number of conductors, each common to a portion only of the sections.

856,570. Telephone System. Frank B. Cook and James G. Nolen, Chicago, Ill., Nolen being assignor to Cook. Application filed February 2, 1903. Renewed May 17, 1905.

Combined are a subscriber's line circuit, means under the control of the subscriber for causing a flow of current in the line circuit, a visual signal associated with the line at the central station, and a thermal device for controlling the display of the signal, the device being in turn under the control of the subscriber.

856,583. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 8, 1906.

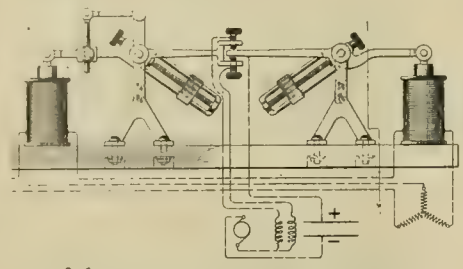
In combination with an electrically operated road having both rails conductively continuous for all currents are transformers and signal-controlling relays connected to the rails, and normally open switch-contacts in circuit with the transformers arranged to be closed by an approaching train.

856,602. Electric Sparking Plug. Charles E. Reed, Jr., Chicago, Ill. Application filed February 27, 1907.

In a sparking plug are combined a body having a tubular neck forming the sparking chamber, an upper electrode projecting into the chamber, an annular support for a lower electrode forming the open base of the chamber, a lower electrode on the support in vertical alignment with the upper electrode, and a valved port in the body leading to the chamber.

856,604. Electric Self-playing Violin. Henry K. Sandell, Chicago, Ill., assignor to the Mills Novelty Company, Chicago, Ill. Application filed February 27, 1906.

In a self-playing instrument, combined with a string, are a sounding device including an electromagnet, a fingering device including an electromagnet, an electric circuit including the magnets in series and having a branch, a picker device, including an electromagnet in the branch, a circuit opening and closing device, and connections whereby the sounding device magnet may be short-circuited, comprising normally separated contact bars and means for bringing them into contact when the picker device is operated.



NO. 856,741.—LOAD EQUALIZER FOR GENERATORS.

856,640. Outlet Box. Samuel E. Huntting, San Francisco, Cal. Application filed April 12, 1906.

An outlet-box for push-buttons and switches is described.

856,661. Machine for Making Wire Glass. Arno Shuman, Connellsville, Pa., assignor to the Continuous Glass Press Company, a corporation of Pennsylvania. Application filed August 15, 1905.

In the machine described are an electromagnetic device arranged in advance of the roller (the latter being used for rolling the glass upon a table) for magnetically supporting and guiding the wire mesh above the table while the glass is being rolled over it. Electromagnetic devices are carried by a carriage, and there are means for adjusting the electromagnetic devices on the carriage.

856,666. Support for Electric Switchboards. Romaine L. Warner, Rockford, Ill., administratrix of C. Frederick Warner, deceased. Application filed October 26, 1905.

The support consists of two side posts, each formed from cylindrical tubing and provided with attaching feet supporting brackets being provided for the switchboard proper.

856,670. Block-signal System. Charles C. Anthony, Philadelphia, Pa. Application filed November 28, 1906.

The system includes an electromagnetic device, the energization of which permits the actuation of the signal.

856,680. Rotary Dressing Implement. Charles E. Campbell, Lynn, Mass. Application filed August 4, 1905.

The apparatus comprises in part a rotary brush, a motor, a flexible shaft connected with the motor and the brush, and a source of liquid.

856,716. Photographic Printing Machine. Hervey H. McIntire, South Bend, Ind. Application filed July 6, 1905.

The machine comprises a case, a lamp in the case, a switch, means for operating the switch to light the lamp, an electric circuit, a timing device arranged to make and break the circuit, and an electromagnet in the circuit adapted to release the switch operating means and extinguish the light.

856,717. Timing Device. Hervey H. McIntire, South Bend, Ind. Application filed July 6, 1905.

In combination are a motor, a circuit-closer operated by the motor, a scale, an indicator movable over the scale and having a stop arranged in the path of the circuit-closer, an electric conductor connected with the indicator, an electric conductor connected with the circuit-closer, and a lever having an arm projecting in the path of the circuit-closer and adapted to disengage the latter from the indicator.

856,722. Automatic Gripcord Adjuster. Otto Pedersen, Chicago Heights, Ill. Application filed February 9, 1907.

An adjustable electric-light support is described.

856,727. Means for Releasing and Leading Animals from Stables. Arthur T. Ruthven, Topeka, Kan. Application filed August 21, 1906.

In combination with means for holding and leading animals are a single motor for effecting the operation of both the holding and leading means, an electrically operated detent for holding the motor against movement, and a heat-controlled circuit-closer co-operating with the detent.

856,736. Electrical Heater and Expansion Coil. Milton H. Shoenberg, San Francisco, Cal., assignor to the Consolidated Electric Appliance Companies, Ltd., San Francisco, Cal. Application filed September 13, 1906.

In an electric heater are an exterior tube, an elastic insulating sheet expanded to fit closely within the tube, an electrical resistant coil expanded to fit the interior of the insulating sheet and retain it in close contact with the tube, and connections whereby an electric current may be passed through the coil.

856,737. Electric Controller. Richard Van R. Sill, Newark, N. J., assignor of two-thirds to Alphonzo E. Pelham, New York, N. Y. Application filed March 6, 1907.

The controller comprises a vertically disposed shaft under the control of the operator, and segmental contact plates secured on the shaft.

856,741. Load Equalizer for Generators. Severn D. Sprong, Brooklyn, N. Y., assignor of one-half to the Metropolitan Engineering Company. Application filed March 26, 1906.

In combination with each unit of a number of generating units are two solenoids in series circuit with the unit, a movable circuit terminal actuated by one of the solenoids, a movable circuit terminal actuated by the other solenoid and disposed in proximity to the first terminal, a motor in circuit with the terminals and controlling the unit and means for mechanically connecting any number less than all, of the circuit terminals actuated by one set of corresponding solenoids. (See cut.)

856,755. Electric Lamp Socket. Joseph Amon, New York, N. Y. Application filed March 1, 1906.

Details are described.

856,782. Third-rail Cover for Electric Railways. William F. Kemper, Chicago, Ill. Application filed January 21, 1907.

Combined with a conductor rail are brackets secured thereto and supported thereon and projected beside the same, and a series of cover strips over the rail. Supporting bolts secured to the strips are slidable laterally in the brackets to cover or uncover the rail.

856,794. Piano Player. Robert Morgan, Ellsworth, Kan., assignor of one-half to Emile E. Kolochney, Ellsworth, Kan. Application filed January 30, 1906.

An electromagnet employed to operate the strikers is connected with a battery.

856,801. Insulator. Charles L. Peirce, Jr., Chicago, Ill., assignor to the Peirce Specialty Company, Chicago, Ill. Application filed January 29, 1906.

Details are described.

856,807. Electric Heater. Joseph S. Reynolds, Santa Barbara, Cal. Application filed January 30, 1907.

Combined are a heat-resisting plate provided with apertures, and a wire provided with portions extending through the apertures and clenched so as to hold the wire in engagement with the plate.

856,837. Telegraph Apparatus. Victor C. Balding, Little Rock, Ark. Application filed March 12, 1906.

In the apparatus, in combination with a key and sounder, the sounder comprising two electromagnets each having armatures and contact levers, are a supporting frame connected to and operated by the levers and a perforating instrument carried by the frame.

856,921. Electric Fire Alarm. Isaac M. Simons, Youngstown, Ohio. Application filed February 26, 1907.

Line wires connect the contact members of a circuit closer with an electric circuit, including the annunciator, bell and battery.

856,924. Fire and Burglar Alarm. Bernard Staub, New York, N. Y. Application filed September 14, 1906.

An annunciator comprises in combination a series of rotatable disks, means connected to the disks and leading to distant points for controlling the disks, means for tending to displace the disks, an electric circuit containing a source of energy and a translating device, and a contact device controlled by the disks and adapted to close the electric circuit on the displacement of either of the disks.

856,933. Electrical Interrupter and Rectifier. Harold A. Yarnell, Los Angeles, Cal., assignor to the Pacific Wireless Telegraph Company, Los Angeles, Cal. Application filed June 16, 1905.

The device comprises a liquid, a shell with a perforated end immersed in the liquid, an electrode in the shell with its end projecting through the perforation in the shell and a tube outside of the shell, the lower end of which has arms which support a cone, upon which cone the lower end of the electrode rests. Means are provided for securing vertical relative adjustment between the tube and shell whereby the effective contact area of the lower end of the electrode may be regulated.

856,944. Hygrometer for Regulating Humidifying and Heating Systems. Stuart W. Cramer, Charlotte, N. C. Application filed March 9, 1906.

The instrument consists of a dry bulb thermometer and a wet bulb thermometer electrically connected in combination with a source of electrical energy, and means for indicating differences in resistances of the thermometers according to a predetermined scale.

856,961. Speed Governor for Armature Shafts. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed August 20, 1903.

In combination with a shaft adapted to be connected with the armature of a dynamo, are rotary actuating means for the shaft, embracing a speed governing device operated by the armature reaction and acting to regulate the rate of movement, which is transmitted to the shaft.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on June 17, 1907:

430,128. Telephone. J. H. Irwin, Morton, Pa.
430,147. Electric Car. L. Pfingst, Boston, Mass.
430,175. Combined Fire-alarm Telegraph and Gas-lighting Device. C. H. Crockett and C. C. Allen, Boston, Mass.
430,208. Electric Railway. R. M. Hunter, Philadelphia, Pa.
430,263. Signal for Electric Railways. E. M. Bentley, Washington, D. C.
430,279. Voltaic Battery. T. A. Edison, Llewellyn Park, N. J.
430,297. Underground Electric Cable. W. R. Patterson, Chicago, Ill.
430,317. Vehicle Axle. J. G. Kenyon, Port Kenyon, Cal.
430,327. Regulator for Dynamo-electric Machines. E. Thomson, Lynn, Mass.
430,328. Alternating-current Motor. E. Thomson, Lynn, Mass.
430,326. Electromagnetic Cut-out for Electric Lamps. E. Thomson and E. W. Rice, Jr., Lynn, Mass.
430,329. Electric Railway. M. J. Wightman, Hartford, Conn.
430,453. Process of Melting or Reducing Metals by Electricity. T. L. Willson, Brooklyn, N. Y.
430,461. Means for Preventing Boiler Incrustation. W. B. Bull, Quincy, Ill.
430,462. Electric Incrustation Preventer. W. B. Bull, Quincy, Ill.
430,487. Electric Crane. A. J. Shaw, Milwaukee, Wis.
430,515. Electric Railway. D. B. Devore, United States Army.
430,580. Electric Railway. R. M. Hunter, Philadelphia, Pa.

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Electric Sewage Pumping Plant at Salem, Mass.

By F. M. Feiker.

Year by year the cities' problem of sewage disposal becomes more important, and all successful answers to the question are of unusual interest. Therefore, a synopsis of the conditions leading to the establishment of the recently completed sewage-disposal plant at Salem, Mass., should be worthy of the attention of all interested in civic improvements.

In 1900 a commission was appointed by the Salem City Council to investigate methods of sewage disposal, as the existing situation had developed into a nuisance. The sewage from the neighboring town of Peabody emptied into the North River, which runs through the heart of Salem, while the waste of the latter city was discharged into the same river as well as into the inner bay at the river's mouth.

It was essential that this method of disposing of the waste so near the city be stopped and that the sewage be discharged at an outfall at sea. Plans were therefore formulated to converge the many branch sewers into one main 72-inch trunk line, and to carry this pipe line under the bay to an outfall point at Great Haste Island. Since Salem is practically at sea level, it was necessary that pumps be employed to force the sewage out to sea.

The location of the pumping station was fixed at a point on Salem Neck on the main land, making the length of pipe (9,700 feet) from the shore to the outfall point on Great Haste Island as short as possible. It was decided to terminate the 72-inch trunk sewer at the pumping station in a shallow well dropping but one foot below mean low tidewater. Since this well had no storage capacity, practically all the sewage had to be taken care of as fast as it accumulated.

Further conditions had to be considered. The outfall main dipped under the ship channel that ran between Salem Neck and Great Haste Island and had a "V" or pocket at this point in which solids tended to accumulate. In order to scour the pipe the pumps had to discharge through it at a rate of six feet per second, or 19,000,000 gallons every 24 hours. This duty, however, was demanded for only two hours out of every 24, while the ordinary flow was estimated at not more than 6,000,000 gallons per 24 hours. For the greater part of the time, therefore, the pumps were to be considerably underworked. The varying height of the tide also had to be taken into consideration, as between mean low and mean high water there was a difference of 11 feet.

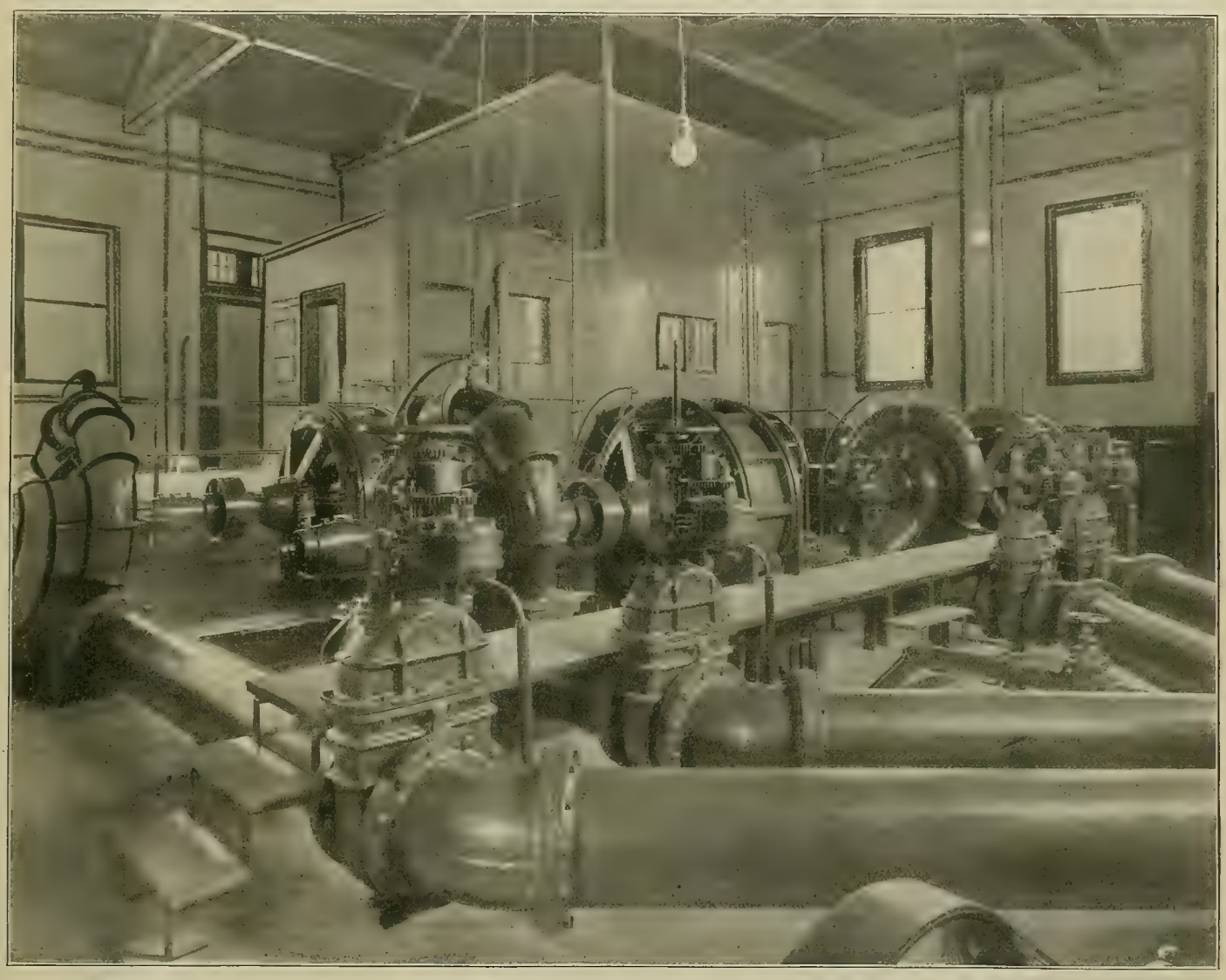
The engineering problem resolved itself into the disposal of 6,000,000 gallons of sewage during 22 hours, and of 19,000,000 gallons during the remaining two hours of every 24, against minimum heads when discharging at the rate of 6,000,000 gallons, varying from seven to 18 feet, according to the height of the tide, and against maximum heads corresponding to the larger and more rapid discharges varying from 49 to 60 feet.

Three motive powers for driving the pumps were considered by the commission—the steam engine, the gas engine and the electric motor. Realizing the permanence of the installation, careful attention was given to all of the merits of each of these motive powers on the basis of cost of operation and of maintenance as well as first cost, with the result that the electrical equipment shown in the accompanying illustrations was finally selected.

The commission obtained proposals from representative builders of steam, electric motor and gas-engine-driven pumps. The engineering requirements were the same for each case. There were required a unit or units having three guaranteed duties as follows: Six million gallons per 24 hours against a head of 18 feet; 12,000,000 gallons against a head of 35 feet, and 19,000,000 gallons against a head of 60 feet.

The gas-engine builders proposed a separate unit for each head on account of the limited speed range of this engine, but the first cost was so high that they submitted a plan following the suggestion of the induction motor drive, namely, the installation of four three-speed units having a capacity each of 6,333,333 gallons. The plan provided for combining these units to give three duties—a duty of 6,333,333 gallons per 24 hours, obtained by one unit running at 300 revolutions per minute and pumping against a head of 18 feet; a duty of 12,666,666 gallons per 24 hours, obtained by two units running at 450 revolutions per minute against a head of 35 feet, and a duty of 19,000,000 gallons per 24 hours obtained by three units running at 600 revolutions per minute against a head of 60 feet. The fourth unit was held as a reserve.

The steam-pump manufacturers proposed to obtain the required duty by installing two cross-compound units, each of 9,000,000 gallons capacity per 24 hours, obtaining the speed required for the lowest duty by operating one unit with one cyl-



ELECTRIC SEWAGE PUMPING PLANT AT SALEM, MASS., SHOWING CENTRIFUGAL PUMPS DIRECT-CONNECTED TO INDUCTION MOTORS.

inder cut out and the higher duties by using both cylinders and adjusting the cut-off.

A comparison of the three methods of drive proposed for the pumping plant, taking into consideration first cost, floor space and operating costs, resulted as follows:

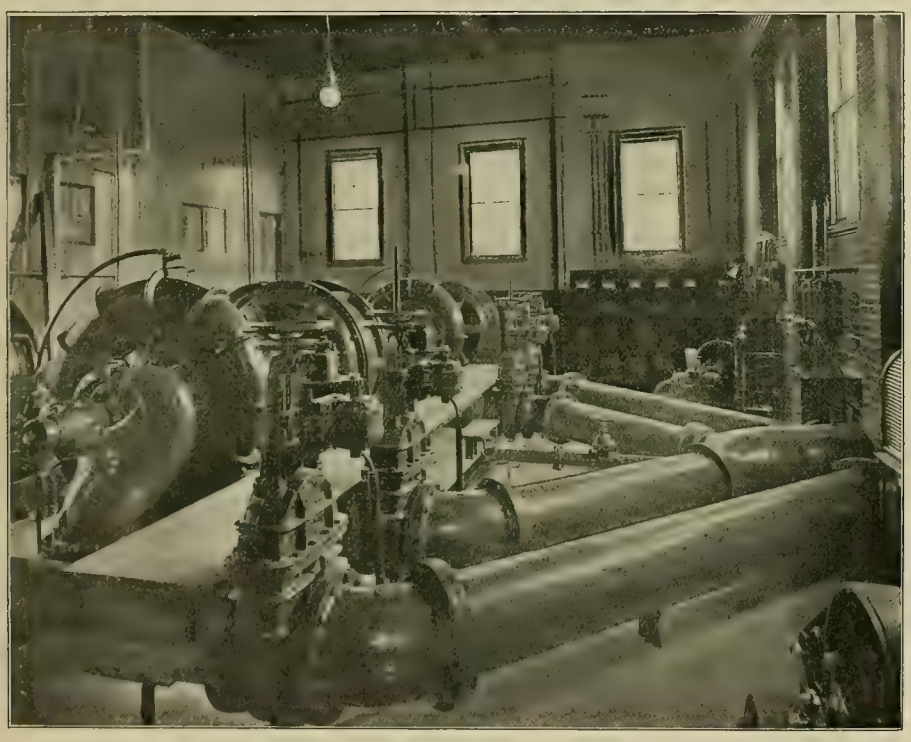
	Electric.	Gas.	Steam.
First cost	1	2	3
Floor space	1	3	5
Operating cost per year	$14,000 (Current at 1¼c per horse-power-hour.)	$15,000 (Gas at 75c per M.)	$21,000 (Coal at $4 per ton.)

In figuring the operating costs all station expenses were taken into account on a 16-hour basis. Moreover, because of the desirability of the power business the central-station company which supplied the power felt justified in making the low rate of 1¼ cents per horsepower-hour. No power, it was stipulated, would be taken during the time of peak load at the station, and the maximum power demand for flushing the sewer was to be made only at times of valley load.

The excellent showing of the electrical system on the basis outlined above, together with other more obvious advantages of flexibility of this method, decided the commission to adopt electric drive.

The general arrangement of the electrical apparatus finally installed is shown in the accompanying illustrations. Four 14-inch, volute, horizontal centrifugal pumps are installed, each pump direct-connected to a 12-pole, 125-horsepower, 2,080-volt induction motor. The motors are equipped with a controller for changing the pole combination, so that speeds of 300, 450 and 600 revolutions per minute can be obtained. A starting compensator is grouped with each motor to bring it up to the lowest speed (300 revolutions per minute) at which the controller will act.

ELECTRIC SEWAGE PUMPING PLANT AT SALEM, MASS.



INTERIOR VIEW OF ELECTRIC SEWAGE PUMPING PLANT AT SALEM, MASS., SHOWING SWITCHBOARD.

The controlling switchboard consists of six panels, one incoming line panel, four motor panels and one combination priming pump and lighting panel. All the operating mechanism, except the four starting compensators (located at their respective motors), is concentrated at the switchboard. In this way, after the motors are in operation, the pumping is controlled from a single point. Each of the 14-inch valves in the four discharge pipes is driven by a small induction motor controlled from the switchboard. The complete electrical equipment was furnished by the General Electric Company.

Two dry-air vacuum pumps are each direct-connected to a 5½-horsepower, slow-speed, 110-volt induction motor. These motors and the lighting circuits in the building are run from the same transformers.

The priming system deserves mention, since the valve control is centralized at the switchboard. All four priming pipes, from the main pumps, lead into a trunk pipe back of the switchboard, and the corresponding valves are all located on the subbase of the priming pump and lighting panel. The trunk pipe leads into a drum, out of the top of which the air is exhausted by either one of the dry air pumps; the two air-pump valve-stems being brought to the switchboard so that the valve of the idle pump may be closed. Water is prevented from coming over into the dry-air pump, through any chance or neglect, by a ball-float arrangement connected to a two-part balanced valve.

Aside from the tabulated argument in favor of electricity, shown in the foregoing, as a motive power in this pumping plant, the following advantages have made themselves strongly felt: Simplicity of operation in starting and running; freedom from danger of complete shutdown for repairs; ease of handling the station from one point; the large combination of units available (since all four induction motors are duplicates, so that any three can run at the time of maximum demand); noiselessness; cleanliness and minimum attendance.

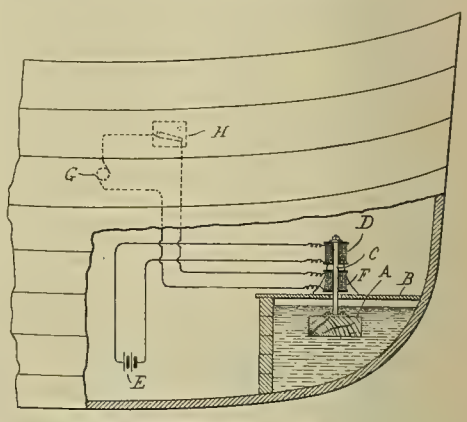
Conditions in Oshkosh.

A report on electrical conditions at Oshkosh, Wis., made for the insurance interests, shows that current for light and power purposes is supplied by the Oshkosh Gas Light Company. All primary circuits are 2,300 volts, 60-cycle, three-phase, feeding to 230 and 115-volt secondary system; 230 volts is used for power and Nernst lamps and 115 volts for other lighting purposes. In general the interior wiring, which has been installed recently, shows an effort on the part of the contractors to abide by the rules and requirements of the National Electrical Code. The city electrician acts as electrical inspector and examines all new equipments. A city ordinance has adopted the National code as the standard for electrical construction. A municipal inspector is provided for under the ordinance and is not supposed to pass any installation that does not conform with the rules and requirements of the Code.

The Wisconsin Telephone Company, Oshkosh Gas Light Company and the Winnebago Traction Company all use the same poles in some parts of the business district. The Winnebago Traction Company also has a No. 14 galvanized bare iron wire suspended from trolley spans. This conductor is used for signal service by the street railway and carries a voltage of 500 volts. This company runs a current through the business district carrying a voltage of 6,600 volts, which is a feeder for a sub-station several miles out of the city. This circuit is on the same poles with telephone, telegraph and lighting wires. Electric current for light or power purposes is used in about 30 per cent. of buildings in the business district.

The Art of Submarine Signaling.

In the specification of a patent covering a transmitter for systems of submarine signaling Mr. Lucien I. Blake of Boston, the inventor, makes some interesting statements concerning sound vibrations transmitted or received through water in the art of submarine signaling. The present application is directed specifically to the use of consonant material in connection with a sound producer, and in explanation of the nature and principle of the invention which forms the subject of the patent, Mr. Blake says:



TRANSMITTER FOR SUBMARINE SIGNALING.

"Consonant materials are characterized by a cellular or fibrous structure and high molecular elasticity. Steel and glass, for example, though highly elastic, are granular or crystalline, not cellular in molecular structure, and are not appreciably consonant. White pine wood, on the other hand, is highly consonant. Resonance, as distinguished from consonance, depends upon the shape and size of cavities, and upon the 'free' vibrations of the medium within the cavities, and not upon the composition of the material which bounds them."

Applying the use of consonant material as a sound intensifier to submarine signaling the accompanying drawing represents a portion of the bow of a vessel partly in section, with the transmitter immersed in a tank therein, and the necessary electric circuits in diagram. A block or mass of consonant material (A) is immersed in the body of water through which sound signals are to be transmitted. The block is immersed in the water with which a tank (B) in the peak of the vessel is more or less filled, but, as is now well known, says Mr. Blake, when such a tank is formed in part by the walls of the vessel the sound is conveyed as readily as though the sound producer were in the water outside of the vessel.

The block is supported in the tank by means of a rod or bar (C) of magnetic material. Surrounding this bar is a coil (D), through which is passed a direct current from any suitable source, as from a battery (E), and imparting a constant magnetization to the bar. In addition to this coil is a coil (F), included in the circuit of any suitable generator of alternating currents (G), and including a circuit controller (H) located at some convenient point on the vessel. By means of such controller the alternating current is passed through coil (F) at the desired intervals for the purpose of setting the bar (C) into molecular vibration.

When it is desired to transmit signals the controller is operated to make and break the alternating-current circuit according to any prearranged code. The vibrations thus imparted to the bar and intensified by the mass of consonant material (A), are transmitted through the ship's sides and the water to great distances. Any suitable sound receiver sensitive to molecular vibrations may be employed in the usual way to render such signals audible.

In the practical use of this invention, Mr. Blake says that California white pine, or, in general, wood similar to white pine and free from resinous substances, is the best consonant material for the purpose.

In all of the applications of the invention when carried out with due regard to the principle here illustrated the consonant material acts as a powerful reinforcer of the sound vibrations which may

be imparted to it and by it to the water. Its molecular action in such case is clearly distinguishable from the molar or segmental action upon which bells, whistles or ordinary sound-producing devices depend, and very greatly improved results are said to be secured by its use.

Improvements in Edison's Secondary Battery.

To simplify the mechanical construction of storage batteries and at the same time improve their operation and increase their efficiency is the avowed object of two inventions by Thomas A. Edison, upon which patents have recently been granted by the United States Patent Office. Patent No. 852,-

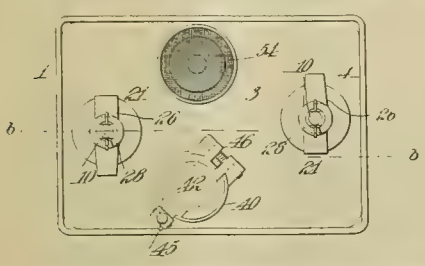


FIG. 1. PLAN VIEW OF CELL OF EDISON STORAGE BATTERY.

424 relates to general improvements designed for use in storage batteries wherein insoluble active materials are employed in an alkaline electrolyte, especially batteries of the type invented by Mr. Edison. Patent No. 850,913 covers a division of the first application and relates to a relief valve and gas separator for the battery receptacle.

Fig. 1 is a plan view of the complete cell. Fig. 2 shows an improved separator for mechanically separating the plates; it is a horizontal section on line (a) (a) of Fig. 3, which itself is a vertical sectional view on line (b) (b) of Fig. 1. Fig. 4 shows a preferred form of insulating support for the plates, being a section on line (c) (c) of Fig. 3. Fig. 5 is side elevation, partly in section, showing the relief valve and gas separator applied to a storage battery.

The containing vessel or can is generally rectangular, as shown, being formed preferably of very thin sheet steel which has been carefully nickel-plated, so as to prevent oxidation, particularly in an alkaline solution. The bottom (2) is secured in place by an interlocking joint so as to make a water-tight joint even if solder is not used. The top (3), Fig. 3, is provided with an upturned flange (4) having a return flange (5) so as to receive the upper end of the can. After the top has been placed in position, solder may be applied to the joint between the bottom of the flange (5) and the upper end of the can so as to make a perfectly tight joint.

All four sides of the can are preferably formed with corrugations (6) struck out of the metal in the form of connected waves. The corrugations are interrupted at the corners of the can (see Figs. 2 and 3), whereby panels of corrugations entirely surrounded by plane metal are formed in

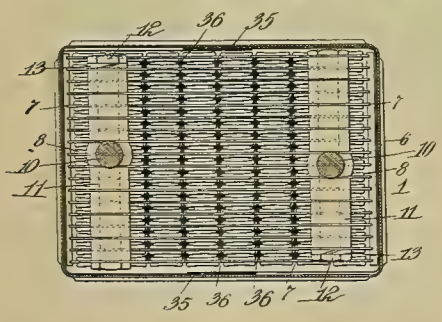


FIG. 2. IMPROVED SEPARATOR FOR BATTERY PLATES.

the walls of the can. By corrugating the can in this way it is materially strengthened against compressing and bulging strains.

The grids (7), Fig. 3, are substantially like those described in prior Edison patents, and carry a plurality of pockets (8) containing the active material. The sides of the pockets are concaved as shown, so that when any swelling of the active material takes place the bulging of the pockets will not progress materially beyond a straight line. If the pockets are not concaved, excessive bulging tends to bring the pockets of adjacent plates into dangerous proximity with one another to increase the possibility of short-circuiting when they are placed close together to save using an excess of electrolyte. This feature of concaving the pockets of a storage-battery plate is described in a patent granted to Mr. Edison on March 24, 1903. It is said that electrolytically active nickel swells or bulges to a much greater extent than the iron.

Corresponding plates of the battery are connected together and are mounted on bolts (9), which pass also through the eye of a proper conductor (10) for the external circuit. The plates of each set are separated by washers, and all the plates are held rigidly together, a hardened split spring washer of ordinary construction being employed on each bolt for locking the nut and preventing accidental loosening thereof.

The hard-rubber nut (21) is provided with an hexagonal recess (24) therein, with which engages the correspondingly shaped portion (25) of a terminal (26), the latter fitting over the tapered outer end of the conductor (10), and being held in place by a nut which is locked from rotation by a split washer. By means of this construction the conductor will not only be secured in position in such a way as to prevent creeping of the solution around the same, but will at the same time be effectively insulated from the corresponding conductor for the other plates.

At their bottom the plates are received on a suitable insulating support, the preferred construction of which is indicated in Figs. 3 and 4. This support comprises the parallel bars (29) having saw slots in their upper faces, as shown, and made

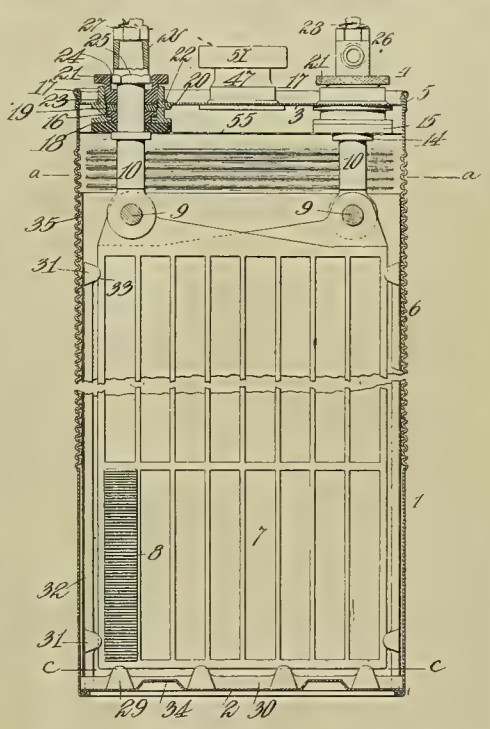


FIG. 3. VERTICAL SECTION OF COMPLETE CELL OF EDISON STORAGE BATTERY.

essentially U-shaped in cross-section, with the shallower bars (30) connecting the same, the whole being made of one piece and preferably of hard rubber. The several plates are forced tightly downward to engage the slots in this insulating support by the adjusting effect of the nut (21), so that the plates are prevented from longitudinal movement. The insulating bars (29) extend transversely to the plates, and the connecting bars (30) are made purposely shallower to prevent the accumulation of active material thereon, which would otherwise tend to short-circuit the plates.

In order properly to space the electrode plates at the sides to prevent them from accidentally short-circuiting the cell, use is made of spacing bars (31) formed with slots therein, with which

FIG. 4. INSULATING SUPPORT FOR BATTERY PLATES.

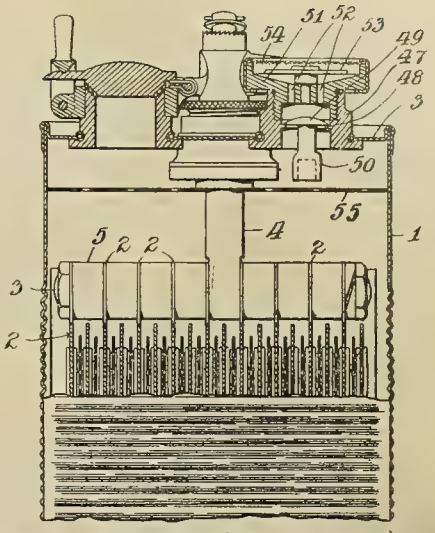


FIG. 5. SIDE ELEVATION (PARTLY IN SECTION) OF EDISON STORAGE BATTERY.

the electrode plates engage. These bars are connected together by vertical shallower bars (33), the whole being preferably cast of hard rubber in one piece. Preferably the bottom (2) of the can is provided with a number of struck-up bosses (34), forming sockets or recesses on the under side of the cell, in order that the latter may be properly supported in a suitable tray or crate.

In order to prevent the possibility of short-circuits between the plates by coming accidentally in contact with the side of the can, the interior of the can may be lined with a sheet (35) of hard rubber, and in order to prevent the plates from engaging one another, separating rods or bars (36), essentially star-shaped in cross-section, may be utilized, as shown in Fig. 2, the bars being mounted in the vertical channels formed between adjacent pockets, so that each bar engages the corners of four adjacent pockets, as shown.

In the operation of storage batteries employing either alkaline or acid electrolytes, gases are generated, due ordinarily to overcharging, which results in the decomposition of water, and these gases are highly explosive. The gases as they leave the solution carry with them mechanically entrained globules of the solution in the form of a very fine spray, which is objectionable, as it covers the battery and adjacent parts with a film of acid or alkaline solution, as the case may be. In the invention covered by the second patent provision is made for the escape of these gases, which may be generated in objectionable quantity, while at the same time effecting the complete separation of any globules which may be mechanically entrained therewith, so that the gases are no longer noxious. Provision is also made for preventing the ignition of any gases within the cell from outside influences, to thereby overcome the possibility of an explosion taking place. In the top plate or cover (3), Fig. 5, is secured a neck (47), carrying a valve seat (48), with which co-operates a small puppet or check valve (49), having a weighted stem (50), the valve being made preferably of hard rubber. Screw-threaded into the neck is a casing (51), having vent openings (52) therein, and above the vent openings is interposed a small dash-plate (53), which spreads and attenuates the escaping gases. The top of the casing is provided with a gauze (54), which operates like the gauze of a safety lamp to prevent the passage of the flame into the cell and the consequent ignition of any explosive gases therein. Such a contingency is further removed by the fact that the dash-plate causes any gases which may escape from the cell to be diffused and diluted, so as to therefore burn with difficulty.

Being projected from the cell with relative rapidity, the escaping gases, carrying with them the fine spray of solution, are projected against the deposited film of the solution on the inside of the bore of the cap (51) at the edges of the valve with sufficient force to overcome the surface tension of the film to thereby cause the mechanically entrained globules to coalesce with the film and be therefore effectively separated from the escaping gases. Consequently the escaping gases will be relieved of their objectionable character and will be no longer irritative. As soon as the rush of gas from the cell has taken place the weight of the puppet valve closes the latter and keeps the cell sealed until sufficient gas pressure has accumulated to cause these operations to be repeated.

Protecting Telephones from High-potential Transmission Lines.

The accompanying drawings show the details of a telephone transformer adapted to be interposed between a telephone circuit and the conductors running to an individual telephone to insure protection from accidental contact with high-potential transmission wires where telephone wires are carried near a transmission line. A patent has been granted on the device to the inventor, John J. Frank of Schenectady, N. Y., who has assigned it to the General Electric Company.

The inventor points out that in modern high-tension transmission practice it is common custom to connect the various stations and power house of a system by telephone. Frequently the telephone wires are carried on the poles which carry

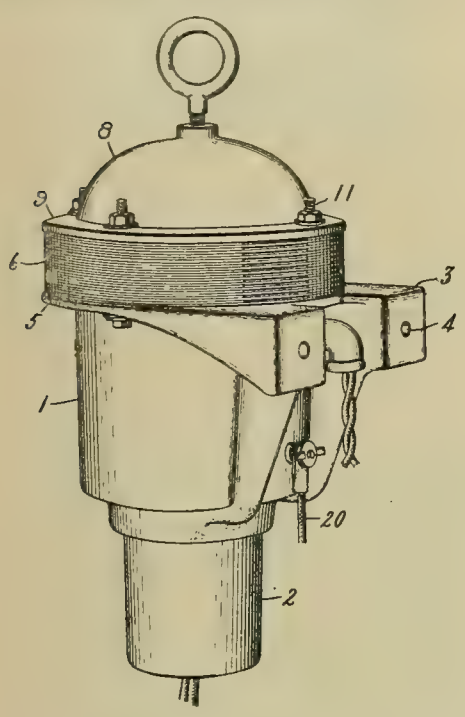


FIG. 1. TRANSFORMER TO PROTECT TELEPHONE LINE.

the high-tension transmission wires, and unless some means of protection is provided an accidental contact between the two sets of wires is liable to result fatally to a person using the telephone, or at least cause serious damage to the apparatus. The telephone transformer was designed to afford such protection.

Fig. 1 is a perspective view of the transformer. The cup-shaped cast-iron member (1) has an axially disposed opening at its lower end in which is located a cylindrical bushing (2) of insulating material. The lower edge of the core (6), which is cylindrical in outline, is supported on the flange (5), from which it is separated by suitable insulating washers. A second cup-shaped member (8) is supported from the upper side of the core.

The core is composed of laminæ (12) of the form shown in full lines in Fig. 3, which is a plan view illustrating the core structure. Referring to the sectional view of the transformer, Fig. 2, the windings of the transformer comprise a secondary coil (13) which surrounds the middle tongues of the punchings, and a primary coil (14) which surrounds the coil (13). The terminals (15) of the coil (14) which are connected to the line circuit pass out through the bore in the insulating bushing (2). The terminals (16) of the coil (13) pass laterally out of the member (1) through an elbow pipe section (17). The coils are insulated from each other by cylindrical line member (18) of suitable insulating material, and the windings are surrounded and separated from the core by insulation (19).

The adjacent punchings (12) are reversed with respect to each other, so that the sections of the core by the line (4) (4), Fig. 2, have in them a thickness of iron half that of the portion of the core surrounded by the windings. The core, due to the large overlap of the E-shaped members that compose it, has a low magnetic reluctance and consequently requires only a small magnetizing current, so that only a small current is needed for ringing, while by forming the laminations of high-resistance steel, losses are relatively small with the high-frequency talking currents. The construction is very compact and the core and windings are well protected from mechanical injury and from the weather. If desired, the frame (1) may be connected to earth by a conductor at (20).

Speed of Morse Telegraphy.

By D. McNicol.

In connection with the recent discussion in the press of the cost of operation of telegraphs it was stated that the number of telegrams handled per man-hour at the present time compares unfavorably with everyday performances 10, 15 or 20 years ago. The inference was that operators are slower now than formerly and that the number of telegrams sent and received by each operator shows an average much lower than was the standard years ago.

Further consideration of the causes which have undoubtedly brought about an increase in the cost of operation brings to light the fact that the

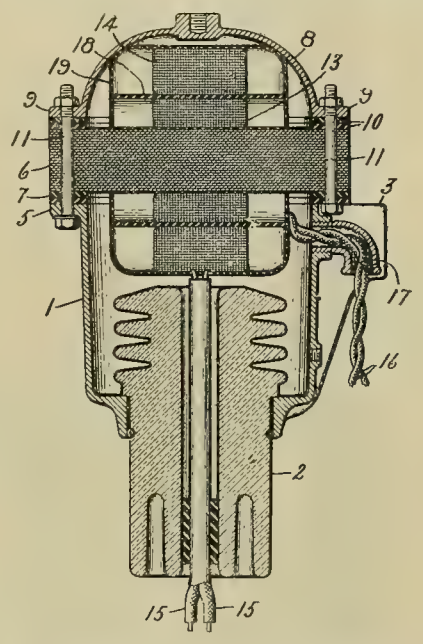


FIG. 2. CROSS-SECTION OF TELEPHONE TRANSFORMER

great increase in the number of "code" or "cipher" telegrams handled has made it incumbent upon telegraphers to send at slow speed in order to insure accuracy. Fifteen years ago a cipher telegram was the exception, but nowadays the plain-language telegram constitutes only about half of the business handled.

It is common knowledge to operators that where 75 messages an hour can be maintained on the bonus circuits with plain-language telegrams, everyday practice shows that with code messages a speed of 35 messages an hour is the best that can be maintained when due attention is given to accuracy. The average code telegram containing 15 or 20 words gives the business firm using such code the benefit of from 50 to 100 words, but the telegraph company has a loss almost in inverse proportion to the saving effected by the user of the code, and the telegraph operator must in turn work slower and get into bad repute as a speed-maker.

The statement that operators are slower now than formerly is worth more than passing notice; for if true, then telegraphers as a class are deteriorating in ability. There is, however, considerable doubt that such is the case, and a comparison of records properly authenticated and extending over a period of 25 years shows that instead of becoming slower the American operator has, like all other workers in this progressive land, advanced in ability as well as in knowledge. By ability is meant the physical capability of being competent to send Morse characters at a high rate of speed and with reasonable accuracy.

According to telegraph records, on February 19, 1868, Operator R. I. Hutchinson of New York sent to Operator "Nick" Snyder of Philadelphia 1,352 words of press matter in 30 minutes, an average of 45 words a minute.

On February 8th, in the same year, E. M. Shape of Milwaukee sent to Operator E. Curry at St. Paul, Minn., a long press special at the rate of 44 words a minute.

On May 8, 1868, Operator "Pat" Burns sent to Walter P. Phillips 2,700 words in one hour, an average of 45 words a minute. For this excellent performance of receiving on the part of Phillips, Professor Morse, the inventor of the telegraph, presented him with an especially engraved gold pen.

At the Bunnell contest, held August 22, 1881, William Waugh won first prize by sending 500 words in 11 minutes 14½ seconds, the fastest time in any one minute being 50 words.

At the Bunnell contest of August 17, 1884, Waugh again won first place by sending 500 words of excellent Morse in 11 minutes and 27 seconds, or a little over 43 words a minute.

On the same day W. M. Gibson sent the same matter in 24 seconds less time, but made a number of errors.

A tournament held in New York in the spring of 1893 gave first prize to Catlin, who sent 248 words in five minutes, or 49 3-5 words a minute.

Up to this time the attendance at telegraph tournaments was comparatively small, and the entries few, prizes being generally recaptured by a few phenomenal experts.

At Madison Square Garden, New York, May 14, 1898, a tournament was held at which there were 60 entries, and these mostly from the large cities on the Atlantic Coast. On this occasion the prize was won by the sending of 254 words of perfect Morse in five minutes, or 50 4-5 words a minute. At the same time G. W. Conkling sent 345 words of press matter (code) in five minutes with but two errors, average 69 words a minute.

At Atlanta, Ga., March 1, 1902 (all senders using plain Bunnell keys), C. W. White of Rich-

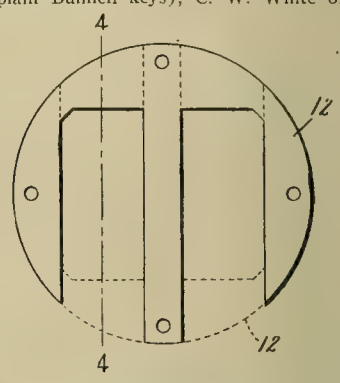


FIG. 3. PLAN VIEW OF CORE STRUCTURE OF TELEPHONE TRANSFORMER.

mond sent to H. V. Emanuel 101 ten-word messages in an hour, the receiver using a typewriter. On the same day McClintic sent 251 words of straight Morse in five minutes.

At the American telegraphers' tournament held at Philadelphia on October 30 and 31, 1903, Conkling (using Yetman) sent ten-word telegrams at the rate of 106 an hour.

Again, at the Madison Square Garden on December 14, 1904, McClintic sent 58 words a minute, using Yetman transmitter, and received 50 telegrams in 31 minutes, and also sent 25 ten-word messages in 13 minutes flat.

At the last tournament, held in Boston June 29, 1906, D. J. Ellington sent 350 words of perfect Morse in eight minutes. And a host of new names were added to the list of rapid telegraphers. In the later contests the entries have been numerous, as compared with the contests held years ago.

From the above it would seem plain that the present-day telegrapher is, if anything, a more rapid workman than was his father or his grandfather.

It is, of course, true that the bursts of speed developed at tournaments prompt the critic to ask why the speed in actual practice is so far below that shown at contests; but for that matter about all contests are expected to show is that operators of the present are generally as capable of doing rapid work as were the operators of the past under similar conditions.

"Electric Theaters" in Atlanta.

At Atlanta, Ga., recently a new ordinance for the installation and regulation of so-called electric theaters was considered. Very little objection was made to the ordinance, which provides for the safety of the audience in that exits must be plainly marked and that the auditorium shall not be left in total darkness at any time even when the show is going on. The operating booth or lamphouse must be of fireproof construction and built so that in case of fire the booth will be practically air-tight. The construction and operation of these theaters will be under the supervision of the building inspector and city electrician, and electric wiring must be strictly in accordance with the National Electrical Code.

Central-station Characteristics of Lincoln, Neb.

By A. G. Wessling.

Lincoln is not only the capital of Nebraska, but it is a prosperous city whose inhabitants believe in keeping up to date. This fact is strongly impressed upon one who reaches the city after dark by the liberal use which is made of electric lights for advertising purposes and for decorative effect. The principal street is spanned for the entire length of the business district by arches carrying rows of incandescent lamps. Bright show windows and illuminated signs add their brilliancy and make the street almost as bright as day. Nor is this extra lighting confined entirely to the main street. Some very effective signs are located on side streets, where the darker background sets them off to advantage.

Among the chief instrumentalities in this general adoption of electricity is the Lincoln Gas and Electric Light Company, whose power house is very briefly described in this article. This company has been in operation for such a length of time that some of its apparatus is now considered old-fashioned. The growth of the business has required the addition of new machines of the latest types. As a result the power house contains an assortment of miscellaneous machines whose satisfactory operation requires more careful attention than does a power station in which all the units are of the same type and make

But the men in charge of the plant understand their work and are furnishing satisfactory service and at the same time are making improvements for the purpose of providing for future growth in accordance with the best present practice and of keeping the plant up to its highest efficiency.

The engine room shows the development which has taken place in central-station practice since this power house was originally built. At that time generators were of the belted type and comparatively small in size. Two of the old generators are still in use, as are the original engines, and the line shaft from which the generators were driven.

These engines are placed at opposite ends of the room and belted to jack-shafts, which are connected to the ends of the line shaft by friction-clutch couplings. A similar friction clutch near the middle of the line shaft divides it into sections. Clutch pulleys are used on the line shaft to allow the individual generators to be cut out of service.

The machines now connected to the line shaft include two 150-kilowatt alternators and one 75-kilowatt alternator wound for 2,300 volts, 60 cycles, three-phase; also one 150-kilowatt generator and one 100-kilowatt machine, both built for 550-volt and direct current. Another 150-kilowatt alternator is belted directly to a high-speed engine. The alternators mentioned displaced a number of smaller generators, and thus made room for several engine-type machines.

The larger of the more modern sets consists of an Allis-Chalmers Corliss cross-compound engine with cylinders 16 and 32 by 35 inches, running at 120 revolutions per minute, carrying on its shaft the rotors of two Allis-Chalmers generators. One of these is an alternator rated at 230 kilowatts, 2,300 volts, three-phase, 60-cycle, and the other a direct-current machine rated at 250 kilowatts, 550 volts. The remaining set consists of a 125-kilowatt unit used only for lighting purposes. The lighting circuits are so arranged that they can be connected to one phase of any generator; the power load is divided between the three-phase alternators and the direct-current 550-volt generators.

The boiler room is at present the scene of improvement. There are five boilers arranged in a row parallel with the engine room, making the piping direct and as short as possible. Two of the boilers, rated at 250 horsepower each, were built by the Caldwell Company; the third is rated at 350 horsepower, and was built by the Babcock & Wilcox Company, while the other two, rated at 150 horsepower and 250 horsepower, respectively, were built by the Heine Company. The furnace of the Babcock & Wilcox boiler is provided with three Jones automatic stokers, in the middle one of which breeze is used, while slack is the fuel supplied to the others. The 150-horsepower Heine boiler uses gas-house tar for fuel, which is burned in a special burner supplied with a steam jet, producing a fan-shaped spray in the furnace. The other boilers are hand-fired, but are soon to be provided with automatic stokers. Forced draft is produced by an engine-driven blower built by the B. F. Sturtevant Company. An automatic regulator controls the blower in such a way as to maintain the pressure at 130 pounds. Two new blowers, built by the American Blower Company, are now being installed.

Coal is delivered to the boiler-room floor by cars on a spur track running parallel with boilers just outside of the building. As indicated by its name, the company supplies both gas and electricity, and the gas works are separated from the electric generating station only by the spur track just mentioned. Fuel may therefore be delivered to either plant as desired. The track is so placed that it can be elevated so as to drop the coal into storage bins, should future growth justify the expense of providing such an arrangement.

Three of the Pictures Illustrate Street Illumination. The Fourth shows an Alternator and Direct-current Generator on One Engine Shaft in Power House.

CENTRAL-STATION CHARACTERISTICS OF LINCOLN, NEBRASKA.

A Berlin concern has a new electric-light bath cabinet in which effort is made to have as few incandescent lamps as possible, but by use of hyperbolic mirrors to direct a larger amount of the radiant heat so produced upon the body of the patient. It is found that profuse perspiration is produced by the action of the radiant heat at temperatures far below that required in the Turkish or even the ordinary electric-light bath, which has become so popular with the practitioner of electro-therapeutics. By using reflectors and fewer lamps in the new cabinet, a lower temperature is secured and more use made of the purely radiant heat in which the chief medical efficacy is said to reside.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Society for the Promotion of Engineering Education (annual meeting), Case School of Applied Science, Cleveland, O., July 1st to 3d.

Vermont and New Hampshire Independent Telephone Association (fifth convention), Bradford, Vt., July 9th and 10th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society (first annual convention), Boston, July 30th and 31st.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

PUMPING operations on a large scale are conducted to a constantly increasing extent by electric power, although modern heavy-duty steam pumps are economical machines as steam engines go. Recently the Western Electrician described the electrically operated waterworks at Schenectady, and in this issue Mr. F. M. Feiker contributes an instructive article on the electric sewage pumping plant in Salem, Mass. The comparison of electric, gas and steam drive calculated for this plant will be found especially interesting.

WITH THIS ISSUE Volume XL. of the Western Electrician is concluded. It is worthy of remark that the half-yearly volume contains 586 large three-column pages of "reading matter" (meaning thereby the literary contents as distinguished from the advertising pages, although both are good reading matter)—the largest number of reading pages ever published by the Western Electrician in one volume. We hope that our readers will agree with us that the quality of the material presented has kept pace with the betterment in quanity. It is expected that the Index of Volume XL. will be issued next week.

AN IMPORTANT decision has been handed down by the Indiana Supreme Court, by which it is held that an interurban electric-railway company has the right, under statutory law, to condemn a right-of-way for an overhead transmission line, even where such transmission does not follow the line of the railway but extends across country from a power house to a leased line. This is a valuable right for the interurban company to possess, and the decision will attract attention not only in Indiana but in other states. The company affected by this decision was the Indianapolis and Cincinnati Traction Company, with power house at Rushville, Ind.

IN VIEW of the unrest among commercial telegraphers in the United States Mr. McNicol's article on "Speed of Morse Telegraphy" on another page is of especial timeliness. The author shows that it is not true to assume, as apparently has been done, that the operators of today are slower than those of a generation ago. Conditions have changed, and nowadays about half the messages are sent in code or cipher, whereas fifteen years ago plain-language telegrams were used almost altogether. Code messages are necessarily handled more slowly than open messages, and thus the speed of the operator, on superficial examination, may seem to have decreased. But in reality the average operator of today is not only at least actually as rapid as his predecessor but he transmits a greatly increased amount of matter by reason of sending in codes where one word may stand for half a dozen when the message is written out or translated.

IN THE electric-light business as in others it is highly desirable that customers should be satisfied that they get their money's worth. Therefore the importance of the question, "What is the best method of securing the people's confidence in electric meters?" is obvious. This question is one of those in the Question Box presented at the recent convention of the National Electric Light Association, and it received several answers. One of these was by Mr. Douglass Burnett of Baltimore, and we direct the attention of central-station men to it.

Mr. Burnett suggested that whenever a radical change takes place in the amount of the monthly meter reading, someone should go to the premises and inquire if there has been any change in the use of current; and to this end every bill rendered should be examined as to reasonableness by comparing the amount of current consumption shown on the meter with that for previous periods. Comparison should also be made, in the event of question, with the record of the same month of the previous year. The chief bookkeeper should then order a test of the meter if it appears to him desirable. With these precautions, inquiries or questions from the customer can be intelligently answered in the event of question being raised, and the company will have the assurance that its bills are being rendered correctly.

Meters should be tested, says Mr. Burnett, at regular intervals of, say, not less than once a year, or once in 1,000,000 revolutions of the armature. The customers' bills should contain from time to time, particularly in the autumn months, instructions on reading meters. Very large customers using current for business purposes should be requested to take their own meter readings at the opening and at the closing of each business day and to figure out the current consumption for each of such periods; any change in the meter reading will thus be checked up almost as soon as it takes place, and abnormal conditions, such as heavy Saturday night burning (if the readings are taken at a certain time each afternoon or evening), will be understood. Special meter tests should be made when a customer's complaint, after investigation, shows the advisability of such a test. Meter tests should not be taken at random, because in such cases they serve to discredit the company's opinion of the meter, and the customer is dissatisfied when a test has been ordered and the meter is found correct.

We may add that complaints of the inaccuracy of electric meters on customers' premises are not as numerous as they once were, and with the improvement in the meters themselves and with growing enlightenment and reciprocal courtesy on the part of both the company and the consumer, such complaints should soon become almost entirely a thing of the past.

EDISON lavishes great care and attention on the details of his inventions, and this characteristic is well shown in the case of his storage battery. This secondary cell, particularly designed for use on automobiles, was first described in a paper read before the American Institute of Electrical Engineers by Dr. A. E. Kennelly six years ago last month. But up to the present time, if we are correctly informed, the new battery has not been offered for sale, or at any rate its sale has not been actively pushed. During this period the great inventor has been engaged, amid many other duties, in improving the cell and the methods of making it, and a great deal has been published about the apparatus in the daily papers which was no doubt wholly unauthorized. Edison possesses the great gift of patience, and he is no doubt determined that when the new cell is put on the market—a time which is probably near at hand—it shall be at least worthy of his name, although he cannot be held responsible for all the newspaper claims made for it. A large number of patents relating to this storage battery have been issued to the inventor, and two of the latest are described in this issue.

IN A RECENT paper before the New York Electrical Society Dr. C. J. H. Woodbury of Boston, discussing "The Influence of the Underwriters' Rules on Electrical Development," made some sensible comments on the National Electrical Code. He points out that the "Code is fundamentally a consensus of intelligent opinion and not a bureaucratic ukase. It stands as a composite of the experiences of more persons than was ever given to a question of applied science." Again, "It is to be expected that the Code will apply only to conditions bearing on safety against the fire hazard as measured by the final results of experience, for academic provisions which add to cost of installation without contributing to safety cannot be otherwise than a detriment to its purpose."

Some electrical men, on some particular occasions, are tempted to believe that some certain rule or rules of the Code are too drastic; but it is well to remember always that this compilation of rules for electrical construction is not something apart from or hostile to the electrical industry, but is rather an absolute necessity in the development of the art. It was made with the co-operation of electrical men for electrical men, and all enlightened electrical engineers, central-station men, contractors and others engaged in the business should heartily support it, while at the same time keenly watching its development, so that it shall always stand, as it does now, for high-class construction which is practicable and never for mere theories.

Commercial Telegraphers May Call a General Strike.

The threatened general strike of Western Union and Postal telegraph operators, members of the Commercial Telegraphers' Union, has been averted so far through the good offices of Charles P. Neill, United States Commissioner of Labor, who received a conciliatory letter from President Clowry of the Western Union regarding the grievances of the employes. While the dispute has not yet been settled, the strike has been confined to San Francisco and Oakland, Cal., where the union operators have been called out. Recognition of the telegraphers' union is one of the demands of the men. In San Francisco and Oakland the principal demand is for a temporary local increase of 25 per cent. in wages, as it is asserted that the conditions of living make such an increase necessary.

It has been announced that so long as no attempt is made to bring in operators from outside points the present strike will not be carried to other cities. However, there has been talk of a general strike to bring about adjustment of certain grievances claimed by the telegraphers, and it is possible that the California strike may lead to a general walkout.

The general question between the operators and the Postal Telegraph Company appears to be the eight-hour day, as against the present nine-hour day. As to the question between the operators and the Western Union, it appears to be, in addition to the eight-hour controversy, the point that the Western Union Company is not living up to its promise of a 10 per cent. raise to the operators, the latter claiming that a certain number have not received the benefit of the raise.

The letter of Colonel Clowry to Commissioner Neill denying any discrimination against employes and suggesting a plan of arbitration has been accepted by the leaders of the telegraphers for the present. In the meantime the local California strike continues, causing some difficulty in handling western telegraph business to the two companies involved.

The latest phase of the strike in San Francisco and Oakland is an appeal to President Roosevelt requesting that he institute an investigation to determine if the telegraph companies have entered into a conspiracy in restraint of trade in violation of the Sherman anti-trust law.

Annual Meeting of the National Electrical Trades Association.

The eighth annual meeting of the National Electrical Trades Association was held at the Chicago room, Great Northern Hotel, Thursday, June 20, 1907.

There were present representatives from the membership in the Boston, New York, Philadelphia, San Francisco and Chicago associations. The membership of these combined organizations now totals 380, and the year just past has been one of great success.

The association, as is generally known, is organized for the co-operative exchange of credit information. The manufacturers and jobbers composing its membership report to the central office the names of customers who are tardy in making their payments, and if after notices from the association such customers do not pay the claims for which they are reported the information is distributed among practically every manufacturer and jobber in the electrical and kindred lines in every state in the Union.

Incidentally, the forms of the association thus employed enforce collection when other means fail, and since the establishment of the national association there has been collected more than $2,500,000 by this agency.

The officers elected for the ensuing year were as follows: President, John Dale of the Dale Company, New York; vice-president, Charles M. Wilkins of Patrick, Carter & Wilkins, Philadelphia; secretary and general counsel, Frederic P. Vose, Marquette Building, Chicago.

The next meeting will be held in Philadelphia.

Central-station Demonstration in Philadelphia.

The Philadelphia Electric Company is now occupying its new building at Tenth and Chestnut streets, Philadelphia. The building is seven stories high and is of fireproof construction. Immediately beneath the display room in the basement is a room of corresponding size for exhibiting various types of electric motors, together with a number of more important mechanical devices operated by electricity. The remainder of the basement is given to the power installation necessary to supply the building. There is also a dark room in the basement where all the various types of electric lighting will be exhibited in such a manner as to display their special and varied advantages for the purpose of comparison. In various rooms and apartments the different methods of illumination have been carefully worked out and installed, so that an inquiry as to any particular method of illumination may be immediately answered by a practical demonstration.

Irish International Exhibition.

The Irish International Exhibition is now in full operation at Dublin. While the buildings and exhibits are not planned upon the mammoth scale of some recent world's fairs, such care and taste has been shown in the selection of the installations that the result is pleasing and creditable to the Emerald Isle.

The Palace of Mechanical Art takes the place of the usual machinery and electrical buildings, and contains the power plant of the exposition. The plant is divided into two parts, half being gas and half steam driven. The boilers are by Babcock & Wilcox, supplying steam at a pressure of 150 pounds with 120° F. superheat. As a result of the mechanical stoking, effected by chain grates of close-link pattern and capable of three speeds, very little smoke is produced.

In their order along the gallery, the first generating unit is a 400-kilowatt Westinghouse machine furnishing lighting current at 220 volts, direct-connected to a high-speed enclosed Combe-Barbour steam engine, which runs without perceptible vibration. The next set is of the slow-speed type, with both cylinders fitted with Corliss valves.

Next is a 400-horsepower gas engine of simple design, which drives a Siemens dynamo by belt. A 180-horsepower Crossley engine drives a General Electric 220-volt dynamo. The switchboard is also from the General Electric Company, made to the requirements of Mr. Dashwood, to whom much credit is due. Each unit normally supplies its own defined load, but there is no difficulty in paralleling any of the machines.

The grounds are illuminated by 400 ordinary arc lamps and 120 flaming arcs, besides numerous gas lamps of the Welsbach, Kieth and Sugg high-pressure systems. The buildings are outlined by incandescent electric lamps, and the central pavilion has 6,000 white and 6,000 ruby lamps, giving a pleasing and variable color scheme.

Many motors are in use for a variety of manufacturing and domestic purposes.

There are two telephone systems, all of Ericsson apparatus. All the clocks on the grounds are electrically controlled by a master pendulum.

William Coates & Son of Dublin are the electrical contractors. P. S. Sheardown, engineer of the Dublin Tramways Company, and George Marshall Harris, E. E., were in charge of the installation as consulting engineer and resident engineer, respectively. The foregoing facts are obtained from the London Electrical Review.

Indiana Interurbans May Condemn Lands for Transmission Lines.

The Indiana Supreme Court has rendered an important decision relative to the right of an interurban railway company to condemn a right-of-way across farms for a transmission line from its power house to another or leased interurban line. The question was raised by the condemnation of a way from the power house in Rushville of the Indianapolis and Cincinnati Traction Company across the country and farms to the road from Greensburg to Indianapolis which the company operates under lease.

L. H. Mull objected to having the high-voltage wires cross his field and appealed to the Circuit Court, where a decision was recorded against him. He then appealed to the Supreme Court, where it was held that the power conferred on interurban railroads by acts of 1903, to condemn lands for uses appurtenant to all roads "acquired" by them includes power to condemn a right-of-way for a transmission line of poles and wires appurtenant to a leased line.

The act of 1903 is held constitutional, and the right of condemnation is not affected by the fact that the transmission line extends across country from a power house on the road leading east through Rushville to the road leading southeast to Greensburg. The rule that a lawful business or structure is never a nuisance per se applies to a high-voltage electric line built across a farm by authority of law.

Electric Sign Complained of as a Nuisance.

Frederick Kuhmmell of South Bend, Ind., has filed suit in the Circuit Court against the Oliver Chilled Plow Works, in which he asks $5,000 damages and a perpetual injunction against the defendants and against the keeping, maintaining and operating of a mammoth electric sign 200 feet long, which has been in operation only a few days on the warehouse of the plant. He says the sign which has more than 4,000 incandescent lights and requires 165 horsepower, "turns night into day, produces ill health and discomfort to himself and family, shakes his house (!) and induces boys and men to congregate about his premises, play ball all night and indulge in loud talk and riotous revelry."

Notes of Wiring Inspection.

At Iola, Kan., an ordinance regulating the installation and maintenance of electrical wiring has been adopted by the City Council and is now being enforced.

The City Council of Waco, Texas, has just adopted the National Electrical Code by ordinance and created the office of city electrical inspector, and will soon appoint an inspector on a monthly salary. The city will charge fees for inspections, with a view of making the position a self-sustaining one, the same as is now being done in San Antonio, Houston and El Paso.

As a result of the municipal election held recently at Springfield, Ill., a new city electrician has been appointed. He has declared for the National Electrical Code as the standard for wiring, and its provisions will be enforced. The new inspector has had considerable experience both as an inspector and a practical wireman, and every indication points to an up-to-date method of electrical supervision.

It is reported that the Wisconsin Electrical Contractors' Association endeavored to persuade the Legislature of that state to adopt a state license law requiring all electrical contractors in cities of 10,000 population or over to take out a state master-electrician's license. The judiciary committee, to which the bill was referred, postponed action indefinitely on the ground that these matters should be left in the hands of the various municipalities.

Last summer Peoria Heights, a small suburb of Peoria, Ill., adopted an electrical inspection ordinance which is now being enforced by an electrician employed by one of the large clothing stores in Peoria, who resides in the village and is able to take care of inspection work largely after business hours. The inspector is usually guided by practices which prevail at Peoria. The remuneration of the inspector depends upon the fees collected. The plan has worked satisfactorily so far.

Seattle Engineers Visit Spokane, Wash.

A party of electrical engineers from the Seattle (Wash.) branch of the American Institute of Electrical Engineers, following the annual state meeting in Seattle recently, made a trip to Spokane at the invitation of several Spokane electrical engineers to examine the different electric plants in the city, and especially the single-phase system of transmission employed by the Inland Empire system. J. B. Ingersoll of the Inland Empire Company and J. B. Fisken of the Washington Water Power Company accompanied them to explain the mechanism of the plants.

An informal meeting was held in the evening, at which a paper on "Single-phase Electric Railways" was to have been read by Mr. Ingersoll, but he was unable to be present. The meeting was then spent in a discussion of the plants visited during the day. C. E. Magnusson, professor of electrical engineering at the University of Washington, was chosen delegate to the national convention at Niagara Falls.

The party, in charge of W. F. Zimmerman of the Inland line, took a trip on the Spokane and Inland as far as Waverly.

Those making the trip from Seattle were: C. E. Magnusson, professor of electrical engineering in the University of Washington; W. S. Wheeler, secretary of the Seattle branch; G. W. Pulver, Allis-Chalmers Company; A. C. Babson, General Electric Company; C. Remschell, Allis-Chalmers Company; A. L. Snyder and C. A. Sears, Seattle Electric Company; Fred G. Simpson, Kilvern-Clarke Company, and H. R. Stevens of the A. S. Downey Company of Seattle.

Electrical engineers in Spokane have no local branch of the national organization, most of them being members of the Seattle branch, while some are members of eastern branches. All electrical engineers in the state of Washington, with those from Portland and Vancouver, constitute the Seattle branch. The single-phase system as used by the Inland Empire lines was considered by the Seattle men to be a complete success.

Wisconsin Public Utilities Bill.

The Wisconsin Legislature has passed a public utilities bill similar in its provisions to that enacted in the state of New York. It provides that all concerns, private or public, supplying water, electric light, power, heat, telephone service, or any other such convenience to the people, must be operated under a set of books which will show the allowance for depreciation and other such details.

Municipal plants must make allowance for the tax paid by private concerns in making rates for service and such rates must be sufficient to continue the concern on a profit-paying basis. All the corporations included in the act are under the control of the railway commission, and the bill includes every public utility except electric railways.

The bill gives the railway commission power to fix rates for all service by public-utility corporations, and all franchises now existent are made exclusive.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXII.—Central Stations.

Boilers.

The variety of types of boilers on the market is far too numerous to be considered in detail. Boilers vary very widely in floor space occupied, in the expense of setting required, and in their general construction. Broadly, all of them may be classified as fire-tube boilers or water-tube boilers. In the former, the water is contained in the shell of the boiler, and is heated by the passage of the furnace gases through the tubes. In the latter the water circulates through the tubes, and the furnace gases pass along the outside of the tubes.

The fire-tube boilers occupy the most space and are not well adapted to the high steam pressures generally used today, nor are they capable of being readily forced in case of heavy loads. The water-tube boilers are most generally used in large-sized stations using high steam pressure. They require comparatively expensive settings, and are more difficult to clean than the fire-tube types, but they have the ability to make steam rapidly, have a good circulation of water and are particularly adapted to high pressures, as, on account of their mechanical construction, a dangerous explosion is almost impossible.

In any plant, it is advisable to make the boilers each of as large capacity as is consistent with the character of the load upon the station. Large boiler units tend to economy in first cost, as they avoid the complexity of steam piping, which is required for a larger number of small units. There is probably but little difference in efficiency in a large number of the best makes of boilers, but there are certain characteristics which will decide the adaptability of a certain kind of boiler for a certain class of service.

The relation of the area of heating surface to that of the grate surface should be very carefully considered, and depends very largely upon the class of fuel which is to be burned. A poor grade of fuel of low calorific value will require a much larger grate area than a high grade of anthracite coal, and a furnace of sufficient area for the latter would be entirely inadequate for the former. The boilers should be located as near as possible to the engines, but the boiler room and engine room should be separated by a fire wall, and no exposed openings should be left between the two rooms, as it is important to keep the dust and dirt of the boiler room entirely cut off from the engines and electrical machinery.

As with all apparatus in the central station, care should be taken to provide sufficient extra units so that one or more of them, depending upon the size of the plant, can be shut down for cleaning or repairs and still leave ample capacity to care for the maximum demand of the station.

The feed-water pumps should be located in an accessible position in the boiler room and should be installed in duplicate.

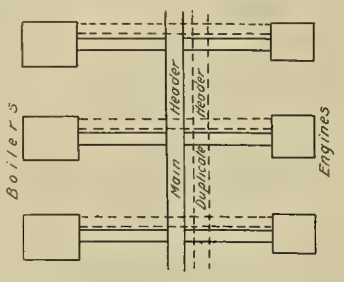
Piping.

The system of steam piping to be adopted may seem at first glance to be a secondary consideration, but in reality it is one of the most important features in the design of a station, and should be very carefully considered before the location of either the boilers or engines is decided upon. It is possible to design an almost unlimited number of piping systems, but there will be but comparatively few designs which are both economical in installation and efficient in operation. The most important point to be considered in the piping system is to have the path of the steam from the boilers to the engines as short and direct as possible, and it is also important to design it so that all, or nearly all, of the boilers can supply steam to any of the engines.

Another important consideration is to arrange the piping so that in case of a leak or burst pipe, the damaged section may be cut out for repairs without cutting off the steam supply to any of the engines. This latter consideration means that duplicate paths for the steam between the boilers and engines should be provided. It is also desirable to limit the number of large gate valves, on account of their initial cost and the additional points for leakage and repairs which they present.

Expansion and contraction play a very important part in steam piping, and the variation in length of pipes when they are cold and when they are carrying from 125 to 150 pounds of steam is considerable, often amounting to from two to 2½ inches per hundred feet. In order to permit this expansion without straining the joints or breaking some part of the piping, the whole system must be somewhat flexible. It is to overcome trouble from expansion that long steel or copper bends are frequently employed, which permit of considerable distortion without severely straining either the pipes or the joints.

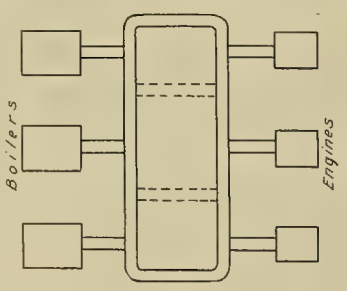
An arrangement of the boilers and engines very much in vogue is to locate them in two parallel rows on either side of a fire wall, and to suspend the main steam header upon the partition wall back of the boilers. The piping from the boiler



Dotted Lines Show System in Duplicate.
SYSTEM OF PIPING WITH SINGLE STRAIGHT HEADER.

outlet is carried back to the steam header, and another branch passes through the wall and down to the engines. This arrangement is illustrated herewith, from which it will be seen that any boiler can be used to supply any engine, or any of the boilers can be shut down without interfering with the rest of the system. To provide against accidents to pipes and shutting down for repairs, it would be necessary to install this system of piping in duplicate, which means considerable expense, both on account of the amount of piping and the number of large valves which are required.

Another system frequently used is known as the ring system, which is also illustrated herewith, from which it will be seen that the steam has two paths between the boiler and the engines. This system enables any section of piping to be shut down by closing two valves. If cross-connections are used, as indicated by the dotted lines, the size of the main pipes may be considerably reduced, and although more valves are required, they are of a smaller size. It will be noticed, however, that it will be more difficult to provide for expansion. A system of piping should be fastened rigidly at one point only, and supported throughout its length in such a way as to permit the necessary motion due to expansion and con-



RING SYSTEM OF STEAM PIPING.

traction. The usual means of support are rollers attached to suitable brackets.

In designing the piping, it is profitable to select such sizes of pipe that the velocity of the flow of the steam will not be too great. This velocity may be anywhere from 60 to 150 feet per second, but the smaller figure is much preferable.

In high-pressure piping the joints require very careful attention, and flange joints are preferable in all cases. The method of attaching the flanges to the pipes should be carefully considered. For ordinary pressures it is sufficient to screw the flanges on the ends of the pipes and caulk them on the inside, so as to make them steam-tight. For high-pressure steam, however, it is almost impossible to make a steam-tight joint in this way, and it is decidedly preferable to have the flanges welded on the pipes.

The piping system should be very thoroughly covered with lagging, so as to hold the heat and prevent condensation of steam in the pipes as much as possible. The loss of power due to condensation in bare pipes, especially if they be of considerable length, is very considerable.

The use of gate valves is also to be recommended for all pipes except those of small diameter. The gate valve offers a perfectly free and unobstructed passage to the steam, and can be closed tight so as to prevent any passage of steam. Other patterns of valves offer more or less resistance to the passage of steam on account of the change of direction of the steam flowing through them. It is also frequently impossible to close a globe valve entirely tight, and if some foreign matter has settled upon the valve seat, even a slight escape of steam through the valve would be sufficient to keep the pipe beyond at such a high temperature that it would be very difficult to make repairs upon it.

All of the pipes should be designed to slope toward the boiler, so that the condensed steam will tend to return back to the boilers instead of passing over into the engine cylinders. Just before the steam passes to the engine, it should pass through a steam separator, which allows only dry steam to get through, and separates out all water of condensation.

[To be continued.]

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

The Two C's.

C. S., South Chicago: What is the meaning of the two C's in The C & C Electric Company?

Answer.

The C & C Company was named, a number of years ago, after the two gentlemen who were the original incorporators, or at any rate the moving spirits in the enterprise—Professor F. B. Crocker and Mr. Charles Curtis.

Three-phase Transmission.

J. B. H., St. Louis: Can you give me a good formula for calculating the circular mils per conductor for three-phase, four-wire transmission and illustrate it by solving a transmission problem, assuming practical conditions?

Answer.

This information can be obtained from a textbook on the subject. There are several works of this character. A recent one is "Electrical Transmission of Water Power," by Alton D. Adams of Worcester, Mass.

Care of Electric Elevators.

F. F., St. Paul, Minn.: I would like to know if there is a book on the market treating of the operation and care of electric elevators.

Answer.

The subject is touched upon briefly in the various books concerning the care of electrical machinery, but the Western Electrician is unacquainted with any book devoted exclusively to this branch of work. Perhaps a book for operators of electric elevators upon the plan of those written for the instruction of motormen would be an acceptable addition to technical literature. If such a work exists the Western Electrican would like to be informed of the fact.

An Electrical Degree.

H. D., Chicago: What is an electrical degree?

Answer.

The term "electrical degree" is used in connection with alternating-current machinery, or in analyzing alternating-current phenomena, to denote the 360th part of the space or time interval during which the current goes through a cycle of values.

In a bipolar generator the current goes through a cycle of values for each revolution of the armature. If a mark is made on the frame of the machine at the instant the current is zero and another made when the armature has turned half a revolution the current will have zero value again at the second mark and will have passed through 180 electrical degrees. In this case the armature turns through an angle of 180 angular degrees also, and an electrical degree is traversed in the same time as an angular degree. In a four-pole machine two electrical degrees are traversed during one angular degree.

In general the current passes through 360° of a cycle while the armature is revolving from one positive (or negative) pole to the next positive (or negative) pole. In a machine having a large

number of poles, therefore, a small fraction of an armature revolution corresponds with a considerable change in the instantaneous current value, i. e., the traversing of a number of electrical degrees.

The treatment of alternating currents mathematically involves the use of the equivalent sine wave in any particular problem to be solved. The value of a current is expressible in terms which are functions of an angle, the degrees of which are 360ths of a cycle. The electrical degree is therefore a very useful conception from a practical as well as a theoretical point of view.

A New Form of Polyphase Integrating Wattmeter.

By H. W. Young.

The importance of accurately metering alternating-current power service will at once appeal to those interested in the sale of power, and some of the recent developments in polyphase meters should be of interst to central-station managers.

The polyphase meter described herein has been

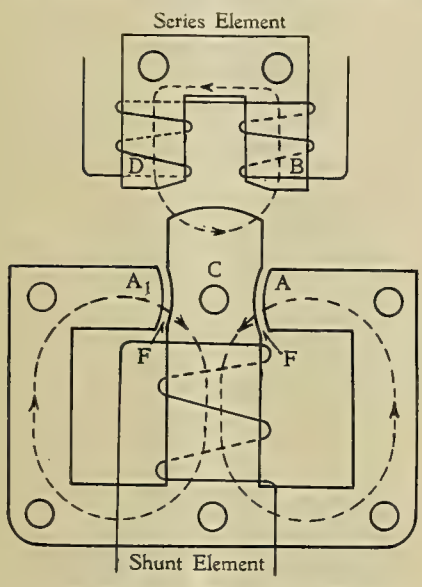


FIG. 1. NEW POLYPHASE INTEGRATING WATTMETER.—RELATION OF SHUNT AND SERIES FIELDS.

designed to meet every condition arising in the field and in many respects is a decided improvement over the designs heretofore used. In reality it consists of two single-phase measuring elements so arranged as to actuate a common shaft and registering mechanism.

Principle of Operation.—Each element of the wattmeter is in principle and operation analogous to a single-phase induction motor having a stationary shunt and series winding so related and located as to produce a rotating field acting upon a closed rotable secondary. In the induction meter the secondary consists of a light aluminum disk.

The shunt winding, consisting of a large number of turns of fine wire wound on a laminated iron core, is highly inductive and its current lags approximately 90 degrees behind the impressed or line voltage. The series winding, consisting of but a few turns of comparatively heavy wire, has low self-induction, and on non-inductive load (such as incandescent lamps alone) the current producing the series magnetic field will be in phase with the impressed or line voltage; thus the magnetic field produced by the shunt winding will lag approximately 90 degrees behind that of the series winding on a non-inductive load.

With this relation of the two fields at the instant of time when the current in the series coil is greatest the current in the shunt coil is the least. If it were not for the iron loss and small resistance or copper loss in the shunt circuit the angle would be exactly 90 degrees.

During a portion of each alternation of the circuit the series coil helps the flux of one pole of the shunt field, opposing the other, and during another portion of the alternation it has the opposite effect, these reactions being combined in such a way as to give a general shifting of the lines of force in one direction, that is, producing a rotating field.

Rotating Field.—That the shunt and series fields combine to form a rotating field may be more clearly understood by tracing the action or relation of these two fields for a complete cycle by one-quarter periods of the same. Referring to Fig. 1 and noting that the two poles of the shunt-coil magnet are designated by the letters (A), (A') and (C), and the poles of the series-coil magnet by (B) and (D), it will be observed that a clear statement of the relation of the fields by one-quarter periods is given in the table (Fig. 2). The signs given in this table represent the instantaneous magnetic values of the poles indicated.

It will be observed from this table that both the positive and negative signs move constantly to the left, indicating a shifting of the field in this direction, the process being repeated during each cycle.

Driving Torque.—This continuous motion of the field induces eddy currents in the aluminum disk, which react to produce driving torque and rotation in the same manner as in the rotor of an induction motor.

The rotary field being a combination of the series and shunt fields, the torque on the moving element or disk will be directly proportional to the energy flowing in the circuit.

Retarding Torque.—With a driving torque proportional to the energy flowing in the circuit it is necessary, in order to obtain steady rotation, for a retarding torque to be provided which will be proportional to the driving torque.

A controlling force varying directly with the speed is obtained by causing the aluminum disks to pass between the poles of permanent magnets whose fields induce Foucault or eddy currents in the disk. The interaction between the field of these eddy currents and the fields of the permanent magnets produce a retarding torque varying directly with the speed of the disk.

With such an arrangement of driving and retarding torques a rotation is produced which is always proportional in speed to the driving torques and, therefore, to the energy passing through the operating coils.

Wattmeters on Inductive Circuits.—Assuming that the current producing the shunt field lags exactly 90 degrees behind the line voltage, and neglecting for the moment the iron loss and resistance loss in the circuit, it will be seen that when the load is non-inductive (such as offered by incandescent lamps) the current of the series coil will be in phase with the line voltage and the shunt and series fields will differ in phase by exactly 90 degrees. From the table in Fig. 2 it will be seen that this gives a maximum pull on the disk.

If, however, the load is purely inductive, having zero power factor, the current in the series coil will lag 90 degrees behind the line voltage and will be in phase with the current in the shunt coil. Under these conditions the relation between the fields for each one-quarter period of a complete cycle is shown in the following table:

	When A is	B is	C is	D is	A' is
At start	+	+	−	−	+
At ¼ period	o	o	o	o	o
At ½ period	−		+	+	−
At ¾ period	o	o	o	o	o
At full period	+	+	−		+

As no progression or shifting of the field occurs, consequently there is no rotation of the disk,

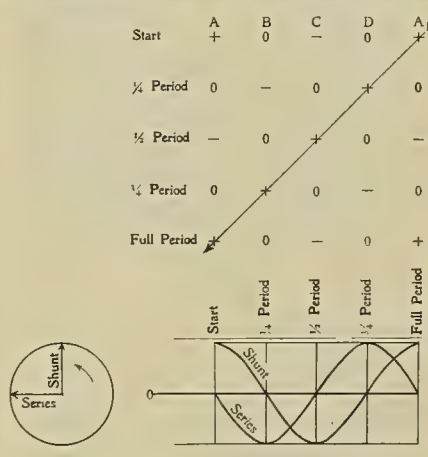


FIG. 2. NEW POLYPHASE INTEGRATING WATTMETER.—TABLE GIVING RELATION OF FIELDS BY ONE-QUARTER PERIODS.

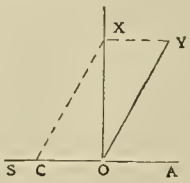
and the meter will not record when the current in both the series and shunt coils is 90 degrees out of phase with the impressed voltage; hence, the meter will record the true power whether the load be inductive or non-inductive.

Power-factor Compensation.—In the preceding diagram (Fig. 1) it was demonstrated that for correct registration on any power factor, exactly 90 degrees phase relation between the shunt and series fields must be obtained. Consequently, compensation must be made for the small decrease of this angle caused by the copper and iron losses in the shunt circuit.

This compensation is obtained by placing an adjustable short-circuited turn (or secondary) of conducting material around the projecting pole of the shunt electromagnet, producing an induced magnetic field, which, acting with the shunt magnetic field, produces a resultant field lagging behind the field of the series coil. By varying the position of this short-circuited turn (or secondary) the compensation necessary to obtain the exact 90-degree phase relation may be obtained. This method of securing the resultant field can be better understood by referring to Fig. 3, in which—

(OA) represents the voltage of shunt coils.

(OY) represents current passing through.



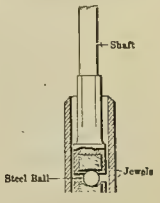


Fig. 3. Diagram of Resultant Field. Fig. 5. Ball Bearing.
NEW POLYPHASE INTEGRATING WATTMETER

(YOA) represents angle less than 90 degrees, due to iron and copper losses in shunt coils.

(OS) represents induced voltage of short-circuited turn (K) and exactly opposite in phase relation to that of (OA), but very small in value; the current passing through the short-circuited turn being in phase and equal to approximately (OC).

This current (OC) and main current (OY) have a combined magnetizing effect on the iron core, which effect is found by forming the parallelogram (OCXY), when (OX) is the resultant effect now practically at right angles to the impressed electromotive force of the circuit. By changing the position of the short-circuited turn, the magnetism of the shunt field can be shifted back to the proper angle, giving the 90-degree phase relation and adjusting the meter so as to read correctly under all conditions of power factor.

Minimizing Effect of Voltage Variations.—It is essential that induction meters be capable of operating over a wide voltage variation without impairment of accuracy, and in the meter under discussion freedom from error, due to voltage variations, is accomplished by the design of the shunt magnetic circuit. By referring to Fig. 1 it will be seen that the shunt magnetic circuit is so arranged that the greater portion of the magnetic lines generated by the shunt winding are shunted across the narrow air-gaps (FF) and do not pass through the disk, thus cutting or damping its action. While the exact leakage across the gaps cannot be exactly determined, it is a large proportion of the total flux generated, so that a comparatively wide variation from the normal voltage has practically no effect on the meter's registration, owing to the small percentage of damping flux which is affected.

Actual tests show that a range of voltage from 50 to 125 per cent. of normal is possible without any appreciable shunt damping, and consequently the meter will accurately measure the energy flowing in a circuit over this extreme voltage range.

Heavy rises in voltage will not cause creeping on potential alone—a feature not possessed by many of the older forms of meters.

Full-load Adjustment.—The full-load speed, in common with practically all forms of induction meters, is at any given load controlled by the permanent magnets, a movement in from the edge of disk increasing the speed, and a movement out toward the edge decreasing the speed.

The permanent magnets are mounted on common supports which closely fit into machined grooves at either side of the main casting and are secured in position by four heavy binding screws. By this form of mounting a positive alignment in relation to the disk is secured, and if it becomes necessary or desirable to change the meter calibration the adjustment can be easily and quickly made.

This method of magnet support and adjustment is considered superior to designs employing two separately adjustable magnets for each element. Again, this method of binding screws is more

positive that can be secured by a method employing screws at the bottom of magnet retaining shoes, owing to the danger of altering the magnet position when the screws are drawn down home.

Heavy jars or shocks, due to shipment or accident, will therefore have no detrimental shifting effect on the magnet position, as is possible with magnets which depend solely upon screws for maintaining them in position.

Light-load Adjustment.—The light-load adjustment (see Fig. 4) is accomplished by the use of a

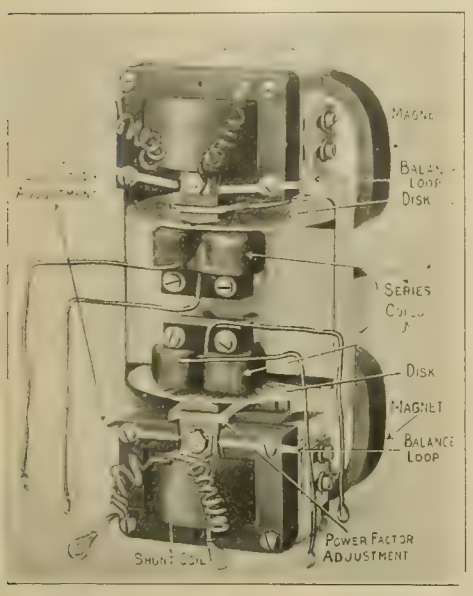


FIG. 4. VARIOUS ELEMENTS OF POLYPHASE INTEGRATING WATTMETER.

small copper loop short-circuited on itself and located in the air-gap of the shunt electromagnetic circuit. This loop is so located in relation to the disk that its induced magnetic force acts to produce a torque sufficient to overcome the static friction of the moving element, which is thus poised or held in a position ready to respond instantly to any magnetic field generated by current passing through the series field.

A most important feature of this light-load compensating device is that it has no appreciable effect on the full-load point of the calibration curve and has no effect whatever on the field of the series coils.

With some of the older forms of light-load compensating devices located near the series coils some such effect is noticeable, and with shunt

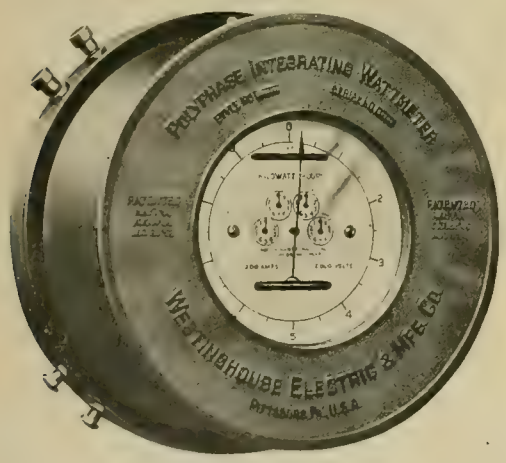


FIG. 6. SWITCHBOARD SERVICE METER.

circuit of the meter open, creeping of the disk would occur on series field alone.

Creeping of Meters.—A fault common to many of the older forms of meters was "creeping" on potential alone—that is, the meter disk would slowly revolve when there was no connected load.

Creeping (which may be in either a forward or backward direction) may be due to one or a combination of several causes as follows:

First—The electrical design may be such that it is electrically unbalanced, and a comparatively slight rise in potential may, by its reaction on the light-load compensating device, generate a sufficient magnetic field to produce a turning torque without any current in the series field. Magnetic unbalancing of the shunt field produces a condition very sensitive to variation in voltage, wave form or vibration, and any change or increase from the normal in these conditions tends to further distort the already unbalanced condition and cause creeping.

Second—The meter may be in a location subject to extreme vibration, which would tend to cause creeping, especially if the meter was inherently subject to this by reason of facts pointed out in the preceding paragraph.

Third—Owing to improper mechanical design, introducing excessive friction in the moving parts, it may be necessary to set the light-load adjustment so far in advance toward the "fast" position that the meter is rendered extremely susceptible to changes in voltage or to external vibration.

Any or all of the points mentioned above may assist in this tendency to creep, but the tendency to creep may be eliminated by proper design, construction and adjustment.

The meter illustrated is especially free from this disturbing factor of creeping, owing to its electrical and mechanical design, which is such that the initial relation of the various measuring elements to each other are not subject to change, due to shipment or handling.

Registering Mechanism.—The registering mechanism is provided with an additional set of gears actuating a long indicating pointer shown in the illustration.

This form of register and dial construction is different from previous forms used for switchboard service in that it has a long pointer moving ten times as fast as the pointer of the first small dial. This fast speed, combined with the large circumference of circle and area of traveling, enables the operator to obtain closer hourly readings than can possibly be obtained with the usual form of register construction.

Lower Bearing.—To overcome the well-known weakness of the ordinary pivot or step form of bearing, a ball bearing (Fig. 5) has been developed and has resulted in a combination which permits the meter to give and maintain a degree of accuracy impossible to obtain with the older form of bearings.

The Measure of Worth.—The real "measure of worth" of a meter is its ability to register accurately at both light and heavy loads; maintain this accuracy for long periods of time with minimum attention and expense; be absolutely reliable; have low internal losses; be independent of normal

FIG. 7. HOUSE SERVICE METER.

variations of temperature, wave form, power factor or voltage; be free from external magnetic disturbances or abnormal vibration; start at very light loads; have large overload capacity.

A meter should also be of light, compact and strong mechanical construction, be easily installed and not of a type requiring removing of the cover to make adjustments during installation. It should have high insulation between case and measuring element, direct reading dials, and if possible all the meters of various capacities should run at the same full-load speed.

Figs. 6 and 7 show the exterior appearance of the meter described.

Mount Ayr, Iowa, contemplates installing an electric-light plant.

Satisfactory Electric Power Bill for London Doubtful.

Under date of June 15th the London correspondent of the Western Electrician gives the following account of the first few days' consideration of the electric power bill in London:

The London County Council electric power bill has now been before a committee of the House of Commons for two days, and the proceedings have only served to emphasize the intricacies of the problem. It may really be said that no one will ever devise a truly satisfactory electric power bill for the metropolis, the bar to progress being the borough councils, the bringing into existence of which in 1900 was undoubtedly a grave legislative error.

Last year a progressive county council introduced a bill for working an electrical undertaking at first hand. It was met with violent opposition from every quarter possible. This year a moderate county council introduces a measure to lease the actual powers under the bill, and so not to risk the ratepayers' money, but the opposition is not one whit the less. What half-way course there is no one seems able to suggest. The best description of the position is that it is a "stalemate."

When the House of Commons, much against the will of a large number of its members, allowed the bill to go before a committee—mainly composed of progressives and opposed to the ruling policy of the London County Council—there was an instruction to the committee that the terms of any lease were to be submitted to Parliament either in the present or a subsequent bill. The County Council has interpreted this instruction by inserting a clause defining certain things, such as a sliding scale of dividends, a potential period during which the lease shall exist, and so on, laying it down as practically impossible to do more if it is to have any freedom of bargain.

The committee on the third day has definitely laid it down that the instruction in question means that a draft lease is to be submitted with the present bill. This brought the proceedings to an ending on the third day, for the legal and other advisers of the County Council were obviously taken by surprise. An adjournment has been made for two days for the matter to be thought over. Applications from three directions have been made to the council to open up negotiations for a lease in the event of the present bill passing.

$2,600 in Prizes for an Electrical Solicitor's Handbook.

The following extract from a paper by Mr. R. S. Hale of Boston, on "The Value and Use of a Solicitor's Handbook" will be of interest to those who are already competing for the prizes as well as to others who may now contemplate doing so.

The paper above referred to was presented on the commercial programme of the National Electric Light Association at Washington, D. C., on June 7, 1907.

"I want now to make a brief announcement of a change in plans in connection with the prize contest for the best electrical solicitor's handbook. The Co-operative Electrical Development Association wrote to all of those who had manifested an interest in the proposed contest last April to find out how they felt about an extension of time in which to submit the competing books.

"By general agreement the time was set for October 1st next, and all of the competitors must have their work turned in to the Co-operative Electrical Development Association, Cleveland, Ohio, by that time.

"I am sure you all appreciate the value of this contest to central stations and others, because of the stimulating of interest everywhere and a fixing of the minds of a great many agents upon the details of their own handbooks, through a desire to think up some way by which they could get into this contest.

"I hold in my hands a New York draft for $2,600, which represents the total amount to be awarded in prizes to the successful competitors in this handbook contest. The money will be placed in a bank, where it will draw interest until the time the awards are made in October, so that the winners will not only get their prize money but interest on it as well."

Those interested in this subject will be furnished promptly a pamphlet giving full details and particulars upon application to the Co-operative Electrical Development Association, Cleveland, Ohio.

No Decrease in Business Here.

No cry of "dull times" disturbs the equanimity of Allis-Chalmers Company, the business of which continues to show a steady gain. During the month of May this company shipped from its works 553 cars of machinery, which was a gain of 20 cars over the record established for April. In April the aggregate weight of shipments was 21,680,847 pounds, while for the month of May the figure had risen to 23,772,242 pounds, making a total by weight for the two months of 45,463,089 pounds. Cars bearing this enormous quantity of machinery, if coupled in one train, would have covered a distance of about eight miles.

Novel Multiplex Lamp.

A new electrical device in the form of an electric lamp and an attachment which fits the gas pipes of standard automobile headlights, searchlights and gas lamps having a three-eighth-inch pipe, has just been placed on the market by the Royal Battery Company of New York. The lamp, here illustrated, is the invention of H. Gernsback, general manager of the company, and is called the

MULTIPLEX LAMP AND GAS-PIPE ATTACHMENT.

"Multiplex" lamp. It is the combination of four incandescent lamps into one.

A number of filaments burn in parallel simultaneously, each filament giving (on six volts) about four candlepower, or with a reflector behind, eight candlepower. If one filament should burn out or break, three would still be left to give service. The socket or attachment has a set-screw at the upper part which tightens the bulb and makes unscrewing—due to the vibration of engine—an impossibility.

The lamp itself is fed from the ignition storage battery or dynamo. The six-volt lamp with reflector behind gives about 32 candlepower on 1½ amperes; the eight-volt lamp gives about 34 candlepower on 1¼ amperes. Specially treated filaments are used, and it is asserted that the lamp will last for 250 to 300 hours before it will burn out.

For installing the device no tools but a screwdriver are needed. Two lamps can be put in position in three minutes ready for use. The attachment is interchangeable with the gas system; that is, the gas burner can be used again if desired, no alterations on searchlights being needed.

Garner Mechanical Ventilator.

The mechanical ventilator here shown, made by the Garner Ventilating Company, 115 Dearborn Street, Chicago, is a self-contained outfit designed for installation directly within the area to be ven-

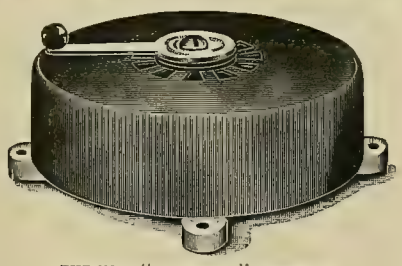
GARNER MECHANICAL VENTILATOR.

tilated. The fresh air supply is drawn into and discharged from the device by means of a fan of the centrifugal type, which insures certain ventilation at all times, regardless of the varying conditions of the weather.

The device contains steam coils for tempering or warming the incoming air during the winter season, and is provided also with means for filtering the air before it is delivered into the room or rooms to be ventilated. The fan is driven by an electric motor. The air supply is usually taken from the lower sash of a window connecting with the area to be ventilated, but should this be found impracticable, connection can be made with the outer air by means of an air duct from a lower floor, or with any convenient point of air supply. In new or old buildings, where ventilation is needed and it is found to be impractical or too expensive to conceal air ducts and install a system of ventilation in the regular way, this apparatus appeals to architects and engineers who are called upon to provide fresh air for the occupants of offices, class rooms, lodge halls, theaters, etc. The device is portable, and one or more units can be used, to suit the requirements. It is 30 by 30 by 47 inches in sizes, is built of metal and is ornamental in appearance.

The New "National" Rheostat.

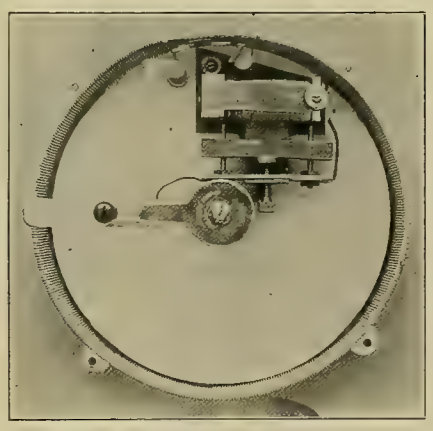
The accompanying cuts show the construction and appearance of the new rheostat of the National Rheostat Company, 115 Franklin Street, Chicago, which is designed to give a very close control of the current. The rheostat arm is pivoted with its



THE NEW "NATIONAL" RHEOSTAT.

contact end resting on the ring-shaped coil of resistance wire, having about 400 turns. Thus the range of the apparatus is divided into 400 steps, securing close regulation, and insuring against sparking between steps, since the voltage drop between successive turns is small.

For motor controllers, there are mounted within the case, and secure from interference, devices designed to open the circuit on over or under load. Sparking at the time of overload break is minimized by arranging the overload coils to act as a magnetic blowout. The overload may be set to operate for any current. A valuable feature is the



"NATIONAL" RHEOSTAT WITH COVER REMOVED.

combination of both line and overload break into a single device inside the cover.

The manufacturer declares that with this apparatus the advantages of variable speed may be secured from an ordinary stock motor, and that the form of construction is such that the device may be built with capacities equal to those of any other controller.

In the application of this rheostat to starting-box duty, binding posts for field and armature connections are provided on the case. As the lever is advanced from the stop position, full current is immediately thrown into the fields and the armature resistance is gradually cut out. On automatic opening by reason of line break or overload, the lever returns to the starting position.

Relation of National and State Electric-light Associations.

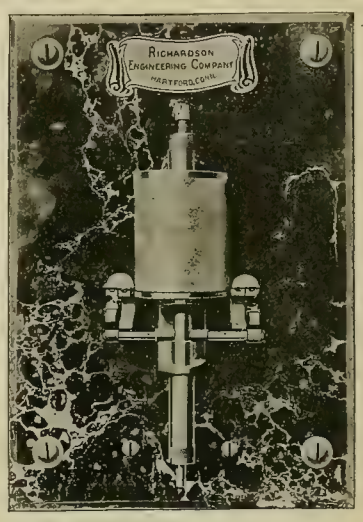
On behalf of S. R. Bradley, Jr., of Nyack, N. Y., chairman of the committee on relations with local associations, Charles D. Robinson presented the report of that committee at the recent Washington convention of the National Electric Light Association. The report of the committee showed that the committee had corresponded with the various state and territorial associations, with a view to general co-operation in matters of interest to the associations, and the committee recommended that the state associations should confine themselves in their work to matters of local and state interests, and leave the discussion of technical subjects to the main association. W. W. Freeman of Brooklyn moved that the report be received and the committee discharged, with thanks. This motion was carried.

Automatic Battery-charging Switch.

The automatic storage-battery charging switch illustrated herewith is designed to meet the demand for a reliable automatic circuit-breaker for charging lighting and ignition storage batteries. It may be used in charging a battery on large installations for electric lights, on launch electric-light plants, or for charging ignition batteries, either from 110-volt service or from a generator of proper size for the work.

The switch is manufactured by the Richardson Engineering Company, Hartford, Conn., which has spent years in developing and perfecting it. The operation of the switch is to make connection automatically between the generator or source of current and the storage battery only when the voltage is high enough to charge the battery, and to disconnect the circuit automatically when the voltage falls too low. Each switch is furnished for specific voltage, or for charging a specific number of cells of storage battery, and must be ordered and used for that number only. A series coil is employed to assist the voltage-selecting coil after the contact has been made. This insures a good strong contact, thus preventing the burning of the clips.

Each breaker is provided with carbon contacts



AUTOMATIC BATTERY CHARGING SWITCH.

on each side to take the arc when the circuit breaks, although the current at this time is so low as to reduce this arcing to a minimum. Adjustments are provided on the bottom of the breaker so that it may be set to be released within certain reasonable limits of voltage and current. There is also an adjustment at the top for limiting the pull of the breaker.

All of the parts are jigged and are interchangeable. The coils also are interchangeable, and can be substituted for different voltages. Renewal of parts is made so simple that a novice may handle the breaker, and get good results from it. The contacts which carry current are of special spring bronze with a maximum carrying capacity and long life. In the larger circuit-breakers they are made up in units. The very large breakers furnished for heavy currents consist of two coils, one coil operating the larger one which carries the heavy arm conducting the current. These contacts are made of specially constructed spring clips of heavy bronze, the proper number of clips being added according to the current.

Each switch is mounted on an enameled slate base with connections and terminals marked, the slate being drilled for mounting. The switch may be taken off from the base and remounted wherever desired.

Electric Railways Increasing in Mexico.

A syndicate of wealthy Chinese residents of Mexico, headed by Dr. J. W. Lim of Torreon, has obtained a concession to build an interurban electric railway to run from Torreon to the town of Matamoros, a distance of about 10 miles. It is planned to extend the road to other towns in the Laguna district later on. The survey for the proposed road is now being made by Lineberg & Rone of Torreon.

Another company of Chinese is building an electric street-railway system in Torreon. That city was the first in Mexico to build an electric line and it has done such a profitable business that it has attracted competition.

Another concern, the Compania Ferrocarril Electrico de Lerdo á Torreon, operates an electric railway that runs from Torreon to Lerdo, a distance of seven miles. It passes through the town

of Gomez Palacio, where many large manufacturing plants are situated. This latter company is preparing to make important improvements. Its large iron bridge over the Nazas River is to be reconstructed. Additional rolling stock has also been ordered.

The Laguna district, of which Torreon is the industrial and commercial center, is perhaps the richest agricultural region in Mexico. It is irrigated by the water from the Nazas River and is dotted with fine farms and prosperous, growing towns. The electric-railway development of the district is attracting much attention throughout Mexico. The progress in this line shown there is serving as an incentive for the establishment of other electrical enterprises in various parts of the country.

Telephone News From the Northwest.

A case is in court in Duluth to compel the Duluth Telephone Company to pay real estate taxes on property which is used for storage and which the company claims is exempt from taxes.

The North Star Telephone Company has been granted a ten-year franchise at Finlayson, Minn.

The Murray Farmers' Telephone Company of Bruce, Wis., has been incorporated by B. F. Brainerd and others with a capital of $5,000.

H. Fant will sell the telephone exchange at Thief River Falls, Minn., with toll lines to Midele River, Sandridge, Germantown and Plummer, to J. M. Bishop. The consideration agreed upon is $20,000.

The Nicollet County Telephone and Telegraph Company of St. Peter, Minn., has voted to increase its capital from $100,000 to $125,000. M. B. Johnson has been elected president and Dr. G. F. Merritt, secretary.

Walter M. Brittan and others have filed articles of incorporation for the Beloit (Wis.) Home Telephone Company with a capital of $150,000.

The Auburn Telephone Company has let the contract to James Carman for the erection of its new two-story brick exchange building at Auburn, Neb. The new switchboard will cost about $7,000.

The Mutual Telephone Company of Des Moines, Iowa, has let the electrical contract for its new East Side exchange to the Midland Electric Company.

The Rockwell (Iowa) Farmers' Telephone Company proposes to establish an exchange at Rockwell and to build lines to Mason City, Cartersville, Dougherty, Swaledale and Thornton.

The Low Moor (Iowa) Mutual Telephone Company has been incorporated, with T. H. Dann as president, and G. W. Powell, secretary; capital, $5,000.

Work has been commenced at Omaha, Neb., on the new office and exchange building for the Independent Telephone Company. The building will cost $50,000 and the switchboard and equipment about $240,000. R.

Indiana Telephone Items.

Mayor Hosey of Fort Wayne announces that he will defy the Home Telephone Company and take advantage of the right given the city in the franchise to use the Home Telephone Company's poles in constructing his municipal lighting plant. The mayor will open bids for the installation of the alternating-current plant next Monday and proposes to award the contract to the lowest and best bidder. The telegraph companies and the Central Union Telephone Company are equally interested and it is believed that the mayor will encounter trouble. Manager Moellering of the telephone company will ask that the city be enjoined from using the company's poles with a current which is so much subject to induction that it seriously interferes with telephone service. The Home Telephone Company is said to have spent $10,000 within the last year and a half trying to prevent induction on its toll line to Auburn which was paralleled by the alternating-current Fort Wayne branch of the Toledo and Chicago Interurban Company. Finally all the experts gave up the job and the telephone company removed the cause of the trouble by rebuilding 25 miles of line a mile distant from the trolley line. The Decatur Telephone Company, paralleled by the newly built Springfield and Fort Wayne road, which uses the alternating current, finds induction is so great that no conversation can be heard while the cars are moving.

The Germany Mutual Telephone Company of Fulton County has been incorporated to operate throughout Fulton County. The principal exchange will be in Germany. Isaac Babcock is president and Frank L. Leiter, secretary.

The Farmers' Mutual Telephone Company has been incorporated to construct a telephone system with principal exchange and office in Wolf Lake, Ind. Connections will be made with the farmers' system in Whitley County.

The Falmouth Mutual Telephone Company of Falmouth has increased its capital stock from $5,000 to $25,000. The additional capital will be invested in extending and improving the system and purchasing new instruments.

The Westland, Blue River and Carthage telephone companies have been consolidated and hereafter will be conducted under one management. These lines are used for local purposes only. Improvements will be made.

The Winona Telephone Company, owned by A. B. Diggs and Samuel R. Tomlinson of Winamac and W. S. Daniels of Knox, has purchased the Plymouth telephone exchange and all connecting farmers' and toll lines. The consideration is $30,000. The Plymouth exchange has 500 subscribers and toll lines connecting with South Bend, Argos, Bourbon, Bremen and Etna Green. The Winona Telephone Company now owns the exchange in the three county seat towns—Winamac, Knox and Plymouth—and also owns exchanges at Kewanna, Hamlet, Grass Creek and Monterey.

The Patrons' Mutual Telephone Company has effected a compromise with the Plymouth Telephone Company whereby the latter company agrees to construct all the lines through the farming districts contemplated by the Mutual company, and the latter will dissolve its organization.

The Central Union Telephone Company and the American Telephone and Telegraph Company have sent out notices that the discounts that have been allowed to large users of the toll lines in Indiana will be discontinued. The reason assigned for this is the large increase in the cost of labor, materials and other expenses incident to the service. The discounts were given to large users of the toll lines for toll service in Indiana, Ohio and Illinois by the Central Union Telephone Company, and for toll service to all points reached by the American Telephone and Telegraph Company. S.

GENERAL TELEPHONE NEWS.

The Midland Telephone Company of El Reno, Okla., has been organized by Allen Crumpach and others.

The Barry County Mutual Telephone Company of McDowell, Mo., has increased its capital stock from $5,000 to $10,000.

The Rockgrove (Ill.) Farmers' Mutual Telephone Company has been organized by L. E. Rote, William Frobe and others.

The Independent Telephone Company of Cestos, Okla., has been incorporated with a capital of $25,000. H. A. Seaton, J. W. Kerns and F. C. Hoyt are the incorporators.

The Aerial Transit and Telephone Company has been incorporated for $1,000,000 in the state of Delaware. Henry McCabe of Arcola, Ill., T. L. Galland and T. L. Galbreath of Charleston, Ill., are the incorporators.

The following-named telephone companies have recently been incorporated: Moorefield (Ark.) Telephone Company; Indian Creek (Texas) Telephone Company; El Reno (Okla.) Telephone Company, capital stock $100,000; Bagley (Iowa) Mutual Telephone Company; Ewing (Neb.) South Fork Telephone Company.

It is possible that the proposed franchise extension ordinance for the Chicago Telephone Company will be reported to the council by the committee at its last meeting before the summer vacation. An ordinance has been drafted, the general terms of which have been outlined in the Western Electrician. For some weeks the council committee on gas, oil and electric light has been holding meetings at which suggestions and objections are heard. Many amendments have been made to the original draft. It is said that a majority of the committee favors the granting of the present measured-service rate franchise.

The fifth convention of the Vermont and New Hampshire Independent Telephone Association will be held at Bradford, Vt., July 9th and 10th. Headquarters will be at Hotel Low. A number of interesting papers are on the programme, among which may be mentioned "Construction Above and Under Ground," by Herbert L. Moor, Barton Landing, Vt.; "Toll and Long-distance Business," by F. C. Gleason, Warren, N. H.; "Are Two Telephones a Burden to the People?" by W. E. Kinsman, Heath, Mass., and "Telephones vs. Allopathy," by Dr. O. D. Eastman, Woodsville. H. W. Buchanan of Barton Landing, Vt., is president, and G. W. Buzzell, St. Johnsbury, Vt., secretary and treasurer of the association.

The Board of Estimate of New York city, which, not long ago in the absence of the mayor, and while it was sitting as a committee of the whole, came out in favor of granting a franchise to the Atlantic Telephone Company, on June 21st as a full board referred the matter, after long discussion and considerable wrangling, to a committee composed of the controller, the corporation counsel and the chief engineer. This action means that there will be another series of hearings and that the whole matter will lie in abeyance for months in all probability. Mayor McClellan, who was not present when the board members voted in favor of the franchise, found what he thought was a grievous error in the resolution and form of contract as drawn. This error gave the new company the right to use manual as well as automatic instruments. He thought the company should be made to use only the automatic instruments.

CORRESPONDENCE.

Continental Europe.

Paris, June 9.—A railroad line of considerable importance in Switzerland, the Jura-Neuchatel road, is soon to adopt electric traction, and bids were asked for the changing over of the line some time ago. Five different electric construction firms have already sent in their plans for an electric system, and the matter is now awaiting decision. The state has already promised to purchase the line, but this will only be after the St. Gotthard line has come under the control of the government.

In the southeastern part of Paris there is an electric railway which is now in very successful operation, starting from a point near the Seine and proceeding south, then southeast along some of the main streets and boulevards of the left bank, and reaching the Versailles gate. From this point the cars run into the suburbs as far as Clamart. Within the city the cars run on the Thomson-Houston underground-conduit system for part of the way, and the trolley is used entirely in the suburbs. Double-decked cars, each fitted with two motors, are used.

A new company has been formed at Geneva, known as the Azote Company, for the purpose of operating electrochemical plants, especially with regard to the newly invented process for obtaining nitrogen and nitrous products from the air by means of the electric arc. Such products will find a ready market as fertilizers, and it is expected to compete actively with the fertilizers which are now in use. The company is capitalized at $400,000.

The Communal Council of Rome is now considering a project which has been submitted to it in regard to establishing a municipal electric plant on a large scale. It is claimed that such a municipal system will have many advantages, including the improvement of the electric-lighting service, profits to the treasury annually, and reduced rates to consumers. As regards the operation of such a plant by a private company, the offer of the Societa Anglo-Romana has been considered at the same time. It may yield a better profit, but the other advantages, it is asserted, will be less, since the municipality will be more or less excluded from sharing the future profits, which are expected to be great, and such a scheme also, it is argued, tends to create a monopoly, which does not exist at present. It is therefore not meeting with much favor. According to the project for a municipal plant, the work to be carried out at first for the erection of a central station and wiring would figure for $700,000, and the city would secure a large extent of ground for this purpose, erecting a building of some size. As to primary and secondary wiring, this would figure for about $400,000. Bids have been asked for the electrical outfit from a number of continental houses.

A large rolling mill in Austrian Silesia is now operated upon the electric system. Owing to the advantages which could be thus obtained, the transfer from the steam system was decided upon after the project presented to the company by the German Allgemeine Elektricitäts Gesellschaft. The main part of the plant consists of two heavy triple rolls and one double set of rolls, and at present they are operated very successfully by the motors. A central station which gives current for the whole plant contains a three-phase turbo-alternator of 3,000 kilowatts built by the Erste Brünner Machine Company and two groups of 1,250 kilowatts furnished by the Allgemeine firm.

Siam is coming in line with modern progress, and it is reported that the capital, Bangkok, is soon to have a telephone system, and will install a central station, commencing with 1,000 subscribers. Bids for the plant have been asked from several European and American firms. A. DE C.

Great Britain.

London, June 15.—As has been anticipated by all who have followed the matter closely, the managers of all the electric and tube railways in London have at last had to give way under the stress of increasing cheap fares and join hands together to bring about an increase. Thus in future our old friend, the twopenny tube, will after all abandon its uniform fare of four cents for any distance and charge six cents for the full single journey and pro rata for intermediate stations. The District and Metropolitan Railways have also come to the same conclusion, as also have the directors of the City and South London Railway. The move, so far, affects London railways only, but I predict an early extension to the tramways all over the country. Absurdly low fares are being charged in places, mainly owing to pressure brought to bear in various ways by socialistic local bodies. Recent meetings of tramway companies, however, indicate that the position is fast becoming intolerable, and if only, as is not improbable, the motor bus companies join the movement, a general increase of traveling fares throughout the kingdom is not an improbability. It will have a distinct influence upon the electrification of railways and tramways here.

The Moore tube lamp has now made its appearance in England for the first time, having been exhibited in London during the past week or two.

One of our most imaginative daily papers has christened it "the lamp that breathes."

A general revision of the legislation relating to smoke in London is proposed by the London County Council. It urges that more direct powers of control should be given to itself with a view to differentiating between black smoke and smoke not observable to the eye but which is nevertheless more dangerous from its chemical composition. Curiously enough the present London Public Health Act which governs the matter deals only with "black" smoke. This report has a special significance in view of the endeavors which are now made by the commissioner of works in London to secure the insertion of all electrical bills, special protection for public buildings, etc., from the damage which is possible from the chemical products of the furnaces of electrical generating stations.

The latest development in connection with the Johannesburg gas-engine undertaking is that the British contractors for the Oechelhauser gas engines have reported to the corporation that the gas engines will not comply with the necessary tests. Long accounts continue to appear in the daily papers here with regard to the matter.

C. A. Parsons & Co. have just completed an order for a 1,000-kilowatt turbo-alternator for the Randfontein Estates (Transvaal) in what is stated to be a record time for a large set of this nature. The machine was ordered on February 14th and was shipped on May 18th, a period of nine weeks. At full load, with a stop-valve pressure of 154 pounds per square inch, 130° F. superheat, a vacuum of 27.21 inches, and the barometer reading 29.63 inches, the steam consumption was 18.06 pounds per kilowatt-hour.

The Victorian State Railways will in all probability soon be converted to electric traction and the Hon. Thomas Bent, premier of that state, is over here in connection with the matter. The state is prepared to spend $15,000,000. He will probably also visit the United States. There is a good deal of British capital in Australia, but there exists here some uncertainty as to its security. Mr. Bent was entertained to luncheon last week and some questions were put to him on the point. Speaking for his own state he said that he would pass laws to make British capital more secure if this were demonstrated as necessary.

In his annual report the electrical engineer to the Barrow-on-Furness corporation attributes a decline in revenue to the increasing use of metallic-filament lamps.

The general tendency among municipal tramway committees here to largely adopt one-cent fares receives a setback almost every week. The latest manager to report definitely against the proposition is the manager at Glasgow, Mr. James Dalrymple. There are many one-cent fares on the London tramway system, however.

In order to meet the estimated expenditure during the next three years the engineering standards committee has found itself compelled to make an appeal for $10,000 per annum. All the leading engineering firms are being asked to make donations. It seems regrettable that some permanent source of income cannot be guaranteed the committee to maintain its valuable work in all branches of engineering. G.

Dominion of Canada.

Winnipeg, Man., June 22.—The British Columbia Telephone Company, through its office at Nelson, B. C., has made an offer to the ranchers on the north side of the west arm of Kootenay Lake to supply telephone service at the rate of 50 cents per month to each subscriber on condition the subscribers erect and maintain their own pole line. The company's exchange at Greenwood has been entirely rebuilt, new apparatus being installed, which includes a new switchboard, poles, wires and cables. It is probable that a new switchboard will shortly be installed at Nelson, as the capacity of the present board has been reached. Address Superintendent Kent, Victoria, B. C., for information.

The British Columbia Electric Street Railroad Company finds additional power necessary at Victoria, B. C. An engineer has been engaged to report on the matter, and is now at Victoria looking over the ground. It has been suggested that water be diverted from the Koksilah River by means of a pipe line. This would be utilized for maintaining the level at Shawinigan Lake; then from the latter body of water would be constructed an outlet to a point in the vicinity of Mill Bay, where the power house would be located. R. H. Sperling of Victoria, B. C., is superintendent of the project.

S. Cookson, treasurer of the town of North Battleford, Sask., will receive tenders until July 31st, 6 p. m., for the installation of waterworks, sewers and electric-light plants. Plans and specifications may be seen at the office of Mr. Cookson, also at the office of Willis Chipman, C. E., 163 Bay Street, Toronto, Ont.

The Strathcona Radial Railroad Company of Strathcona, Alb., is desirous of securing a franchise in Strathcona for the operation of an electric street-railway system. The company asks an exclusive franchise for 30 years and is agreeable to the city retaining the power to buy out the company at the end of that period. They agree to have cars in operation by November 1, 1908.

The ratepayers of Warman, Sask., have organized into a company for the purpose of installing a telephone system. Those interested in the management of the concern are J. McGill, F. C. Harrington, M. L. Strickland.

The Cranbrook (B. C.) Electric Light and Power Company has decided to build a power house at St. Mary's River. It will have a 700-kilowatt generator, 6,600 volts, with step-down transformers at Cranbrook to reduce the voltage to 2,250.

Frank Allen of Manitoba University, Winnipeg, Man., is advertising for a professor of civil engineering at a salary of $2,500 per annum. Applications must be received before July 10th. R.

New England.

Boston, June 22.—Two stockholders of the Metropolitan Home Telephone Company state that they never heard of Max Koehler of St. Louis, who, according to a news dispatch from Detroit, Mich., has bought the control of the Metropolitan Home company of this city. The dispatch stated that Koehler was associated with some of the company's stockholders. Koehler is quoted as saying that the new company will be organized next fall; that the Home company's franchise is legal, and that nearly $5,000,000 will be spent in construction work. It will be remembered that the Boston aldermen granted a blanket franchise to the Metropolitan Home company last December. Mayor Fitzgerald vetoed the franchise and the aldermen passed the franchise over the veto.

It is announced that the Boston and Worcester Street Railway Company will begin running freight and express cars between Boston and Worcester on October 1, 1907. If it cannot arrange to run these cars into the center of Boston over the Boston Elevated Railway Company's tracks, it will operate auto-trucks between Chestnut Hill and the center of the city. The cars will be run into Worcester over the Worcester Consolidated Street Railway Company's tracks.

The Train Dispatchers' Association of America is holding its twentieth annual convention at the Hotel Brunswick in this city. The association numbers 1,018 members, 64 having been admitted during the last year. The association is endeavoring to have the railroad companies adopt a uniform schedule of rules.

Governor Woodruff of Connecticut has sent a message to the General Assembly asking authority to appoint a commission of five to prepare statutes regulating the incorporation and prescribing the powers and privileges of public-service corporations.

The New York, New Haven and Hartford company has inaugurated electric-railway service between Norwich and Central Village, Conn., completing a continuous electric-car service between Norwich and Worcester. Steam-railroad tracks are used between Taftville and Central Village, an overhead trolley having been installed.

In the United States court at Hartford, Conn., the National Wire Corporation has been placed in involuntary bankruptcy.

The Providence (R. I.) Common Council has given the Home Telephone Company leave to withdraw its petition for a franchise and has granted the exclusive right to maintain and furnish telephone service in the city until December 1, 1913, to the Providence Telephone Company, the latter to pay a tax equal to three per cent. of its annual gross earnings. The company's rates must not exceed the schedule inserted in the new franchise. B.

New York.

New York City, June 22.—It has just come to light that when the Belmont tunnel from Forty-second Street to Long Island City is finished it will have no connection with the New York and Queens County trolley lines, but passengers will have to change to local cars and will have also to pay an additional fare for the passage through the tunnel. In Manhattan the tunnel will be far below the present subway and will have no connection with it. This news will have a very serious effect upon the present real-estate dealings in Long Island City and Queens Borough, as it has long been given out that but one fare would be charged. Mr. Belmont owns both the trolley lines and the tunnel, and it is said that a three-cent fare will be charged as at present.

After a little more than a year's controversy, the terms on which the Livingston Street (Brooklyn) franchise is to be granted have been agreed upon between city officials and representatives of the Brooklyn Rapid Transit Company. With this line in operation, cars from New York will run from the Brooklyn Bridge to Fulton, to Court, to Livingston, to Flatbush Avenue, to Lafayette Avenue and to Fulton Street, thus diverting most of the present congestion on lower Fulton Street. It is agreed in the franchise that the railroad company shall pay three per cent. for the first five years and five per cent. for the second five years of the gross earnings of the railroad company. Further, the president and treasurer of the railroad company are compelled to make a verified report to the controller of the gross amount of its receipts each year. The railroad cannot assign its rights to any other company without the consent of the city.

The Brooklyn Rapid Transit Company has decided to replace the steam turbine which broke down under mysterious circumstances some time ago in its Kent Avenue power station.

The annual banquet given to the ladies and wives of members of the Brooklyn Engineers' Club was held at the Hotel Manhattan, Manhattan Beach, recently. About 300 members and their friends were present, and the event was a notable one for the society. An excellent menu was prepared, and the music between the courses helped to add to the enjoyment. A number of speeches were given on matters closely pertaining to the club's business.

It is predicted that there will be a decrease in the present quotation of copper in the near future of two or three cents per pound. At any rate, the present price of copper bids fair to remain at the present rating for the current year. The United States Selling Company, which handles the output of the Amalgamated Copper Company and several other producers with a total output of about 400,000,000 pounds a year, has held its copper at about 25 cents, the price reached on the last large buying movement, about three months ago. It is believed that this price will be reduced to 22 or 22½ cents, in order to dispose of this year's production, as at the higher figure many customers were holding back their orders.

Plans have recently been made for the construction of a double-track electric road between Buffalo and Erie, Pa., and it is stated that this is believed to be connected with the effort of the Lake Shore (steam) Railroad to handle the increased traffic between Chicago, Toledo, Cleveland and Buffalo. About a year ago the Buffalo and Lake Erie Traction Company was formed to buy all of the traction lines and power plants between Buffalo and Erie. The road between Buffalo and Erie is to be laid with 90-pound rails and concrete ties for the operation of both passenger and freight cars, and will be completed probably within a year. The running time will be equal to that of the best local trains. It is expected that after the road is completed and in operation the Lake Shore will turn most of its local traffic over to the new road.

Twenty locomotives have just been completed at the Baldwin Locomotive Works for the French government in accordance with measurements in the metric system. The contract, which amounted to about $600,000, had been obtained from the Chemin de Fer d'Orleans. The railroad company furnished the drawings, and all dimensions were in the metric system. The Baldwin Locomotive Company started in to convert all of these dimensions to the English units, but found it produced such complications, both in the number of dimensions to be converted and the irregularity in the numbers reproduced, that there was nothing to do but to use this system. Standard scales, gauges and templates were produced and every workman received a metric rule graduated in millimeters. The work was difficult for the men at first, but after some use the opinion prevailed that this system was very simple in even the hands of common workmen. This marks one of the most successful attempts to introduce the metric system into this country. E. H. S.

Southeastern States.

Charlotte, N. C., June 22.—The complete electrical plant of the Norfolk Heat, Light and Power Company at Spray, N. C., has been purchased by the Rhode Island Company, the machinery being practically new, having been in operation about 10 weeks.

Columbus, Ga., has voted $100,000 bonds for a municipal electric-lighting plant.

The town of Cartersville, Ga., has completed the entire municipal ownership of public utilities by finishing a modern electric-lighting plant.

The Whitney Company, one of the largest electrical concerns in this country, will be ready to supply power within a radius of 40 miles or more by January 1, 1908. Forty per cent. of the available horsepower has already been disposed of and the plant, 14 miles from Salisbury, N. C., is the scene of the most unusual activity at this time, completing the immense work there.

A report from Baltimore says that a power company will be shortly formed by interests closely identified with the Blue Ridge Land Company to furnish power and lights to Monterey, Blue Ridge, Summer, Buena Vista and other towns.

The recent fight between the two lighting companies of Chattanooga is said to have brought about a materially increased efficiency and improvement of the two systems.

The North Georgia Electric Company of Gainesville, with a large power plant, has begun a contract for lighting the town of Buford, Ga. Most of the manufacturing enterprises of the town will also use electric power from the same source.

S. W. Divine is at the head of a new interest which promises to the people of West Chattanooga a long-sought electric street-railway service.

The town of Calhoun, Ga., will vote on July 8th on a $11,500 bond issue for a local electric-lighting outfit for the town.

The Greensboro (N. C.) Electric Company has

been granted the long-sought extension of franchise whereby interurban lines are promised to High Point and Winston-Salem, about 25 miles each way.

The North Georgia Electric Company has placed at its head Mr. D. W. Stewart of Xenia, Ohio, superseding General Warner.

W. J. Nalley of Atlanta, Ga., is preparing plans for an electrical development for the Paulding County Electric Company, organized with $25,000 capital by W. S. Loftus and others of Paulding County. L.

Ohio.

Toledo, June 22.—The Toledo Stove and Range Company has just installed the largest electric sign in the state of Ohio. The sign bears the firm name. It is 186 feet long, 17 feet high and the illuminated letters are six feet high.

Lima, Ohio, has decided that the Kelsey Schoepf syndicate is making too much money out of its lighting contract with the city, and accordingly plans are making for the installation of a municipal plant to cost about $30,000.

A subsidy of $10,000 has been voted to the promoters of the Toledo and Fort Wayne Electric Railway Company. The proposed line will pass from Fort Wayne through Maysville and Hicksville to Bryan. It is said that citizens of Maysville will advance the $10,000 on the strength of the subsidy, so that the money can be used in preliminary work.

A tour of investigation was recently made by representatives of the syndicate which is financing the proposed electric line from Bellefontaine to Toledo. Mansfield is making a strenuous effort to have the line diverted from Galion, after leaving Mt. Gilead, and pass through Mansfield.

The general board of directors of the Columbia Gas and Electric Company in Cleveland recently voted to issue at once $6,500,000 of the authorized $25,000,000 of bonds. Of this amount $3,500,000 will be applied to starting the work on the pipe line from the West Virginia gas fields to Covington, and the remainder will be used to furnish the guarantee fund in the Cincinnati, Newport and Covington Light and Traction lease, which will be consummated within a short time.

A report from Lima says that the Lima and Toledo traction system is dispensing with its fast limited service. The bi-hourly service on the Fort Wayne, Van Wert and Lima system has been discontinued, every car save four each day being made a local. The plea is made that trolleys must draw from local traffic, and that the day for the limited has not yet arrived, all limited cars of the system being run at a loss.

The Board of Public Service of St. Marys, Ohio, has just received bids for extensive improvements, including a motor house, pumps, motors, shafting, switchboard, piping, electric lights and other appliances. The contract has not yet been awarded.

The Columbia Gas and Electric Company of Cincinnati was recently incorporated with a capital stock of $100,000. Archibald S. White, Miller Outcalt, N. S. Keith, Smith Hickenlooper and T. R. Williams are named as incorporators.

The entire branch of the Lake Shore electric railway from Sandusky to Fremont, Ohio, will be in operation by July 1st. H. L. S.

Michigan.

Grand Rapids, June 22.—During the session of the Michigan Legislature just closed, there has been a great deal of legislation introduced affecting electric power and street-railway companies. In the main this has been favorable to the companies. The development of waterpower electricity in Michigan has but just commenced, and everything is being done to forward the movements along this line. Michigan cities, too, are interested in securing interurban roads, and while the system of taxation is not altogether favorable to such lines, concessions are being made which will improve conditions.

One of the most favorable measures, but one which unfortunately failed, was that of Senator Tuttle, amending the state banking act. The portion of the act amended refers to electric-railway securities. This provision as amended fixed definitely the amount of surplus earnings which a company must show, and provided for a 50 per cent. surplus earnings over and above the amount necessary to pay its operating expenses and interest on its bonds.

Another bill which has passed the Legislature will permit of the consolidation of street-railway, electric-light and power companies in a number of counties. This measure was introduced especially for the Upper Peninsula. It will result in the building of several interurban roads before snow flies. The Menominee Range Power and Development Company, with a capital stock of $200,000, has a franchise to light Iron River. It is the intention of the company to improve the waterpower in the vicinity of the town, and this may be one of the companies to build an electric road.

Another company is being formed, backed by William Holmes, a wealthy lumberman, to build an electric power plant at the Grand Rapids of the Menominee River. Power will be transmitted for industrial plants within a radius of 50 miles and will also be supplied to the homes of farmers.

The Legislature has also amended the charter of the city of Holland, giving the city the right to buy power for lighting purposes.

S. Phelps has secured a franchise for an electric-light plant in the village of Davison. The franchise provides that the village may purchase the plant at the expiration of any two-year period, the price to be fixed by the board of arbitration if necessary, otherwise the franchise runs for 30 years and may be renewed for a like period. Street lights are to be furnished at $60 a year for each lamp on a moonlight schedule. The plant is to be completed within six months.

The city of Battle Creek has amended its charter to permit of granting a 30-year franchise to the Michigan United Railway. L. W. B.

Indiana.

Indianapolis, June 22.—Interlocking devices, block signals and highway and street crossings—under the authority granted to the Indiana Railroad Commission by the amended law of 1907—are points on which the commission is seeking data through blanks it is sending out. It is supposed that the information gathered will be used as data in any proceedings with reference to the placing of the different safety devices. The blank asks for the number of grade, overhead and underground crossing on each line and the number protected by watchmen, gates, bell or otherwise. The interlocking blank asks for the number of such devices in which each road is concerned; the year constructed or rebuilt; whether it is mechanical or electrical; average daily train movement; the number of laborers employed, and the total number of their hours of labor; also the number of levers operated. The block signal blank concerns the number of miles of automatic block, number of miles of manual telegraph block; miles of controlled manual block, etc. In addition there is space for the railroad to outline the expenses of construction, maintenance and operation. In a short circular the commission says that all roads must obey the different laws passed by the last General Assembly. Engineers and motormen are warned not to run an engine or car over steam or electric railroad crossings without first coming to a full stop and seeing that no other engine or car is approaching, unless the crossing is protected by an approved interlocking device as provided by law. Some of the carriers are also said to violate the full-crew law recently enacted. It is said that in some cases porters are unlawfully required to do the work of flagmen, brakemen, etc.

New interest is being manifested in the Indianapolis, Huntington, Columbia City and Northwestern interurban road, which went into the hands of a receiver a few months ago. Benjamin Raupfer and Thomas R. Marshall state that the indebtedness of the company is but $18,000, while the property and work that has been done has cost more than $100,000. These gentlemen with the other stockholders and citizens of Columbia City expect to reorganize and buy the company's properties and rights at receiver's sale, which will be held in August. L. D. Wiest and other Indianapolis capitalists are interested in the construction of the line. If the local men succeed in buying the road at the receiver's sale they will build the road to Columbia City.

The first step toward the consolidation of the traction lines in Southern Indiana came late yesterday afternoon, when the Evansville and Mount Vernon and the Evansville and Eastern lines united. The consolidated line will be known as the Evansville Railway Company. The capital stock of the new company will be $1,000,000. The officers selected are: President, William L. Sonntag; vice-president, C. H. Batten of Cincinnati; secretary, F. W. Reitz; treasurer, Marcus S. Sonntag; president of the board of directors, William H. McCurdy. The consolidation, it is stated, means that in a short time St. Louis and Louisville will be connected by trolley lines.

That there will be an electric railroad in operation between Lake Michigan and the Kankakee River within a few months seems a probability. President R. P. Buffington of the Illinois Steel Company, accompanied by several men from the Crownpoint Business Men's Association, went over the ground over which the proposed road will be built and asked for a 60-day option on the property.

General Manager Gus Muhlhauser of the Evansville, Southern and Newport traction system celebrated the eighteenth anniversary of his connection with the road by taking a party of 20 of his personal friends on a trolley ride to Newport and Boonville on the evening of the 19th inst. The return trip was made in a large express car, in which supper was served on a large table extending the length of the car. Among the guests were F. J. Scholz, Captain Lee Howell, C. P. White, Henry Cook, Frank Schwegerman, A. J. Rutledge, Dr. W. A. Wheeler, C. A. Cunningham, W. B. McDonald, L. C. Shipherd, F. C. Larcey and others.

At a meeting of the Richmond City Council the members called on all classes of citizens to give support to the municipal light plant, which now is having a fight for its life as a result of competition begun by the private company. Every member of the council expressed himself against selling to the eastern syndicate, which now is planning to buy the city property.

The City Council and the Peru Heating Company of Peru have effected a compromise rate of 20 cents a cubic foot of heating space. The company insisted that at 18 cents it could not make expenses and asked for an ordinance permitting a rate of 25 cents a foot. The consumers remonstrated and the compromise rate resulted. S. S.

Illinois.

Peoria, June 22.—The secretary of state has licensed the Chicago and Western Traction Company. The capital stock is nominally $10,000. The road is to be built from Chicago through the counties of Cook and Lake to a point on the state line between Illinois and Wisconsin. The incorporators and first board of directors are H. R. Yaryan, Lewis E. Starr, Walter F. Wantke, Phillip R. Lynch and George W. Miller, all of Chicago.

E. H. Parker, who will establish an electric-light plant in Kilbourne, was in that village last week and secured enough promises from the business houses to use light to warrant him in building the plant.

The stockholders of the Sangamon Valley Traction Company held a meeting in Hillsboro this week and elected L. V. Hall manager of the company, and John B. Chalcomb as trustee of the mortgage and property of the company. The object of the company is to build north from Hillsboro and connect with the Rochester-Clear Lake interurban running on the same street.

The street-railway company in Springfield will lay a double track in Monroe Street to provide better facilities for handling the heavy traffic that at present is causing too much delay with the interurbans running on the same street.

Peoria telegraph operators will not strike in sympathy with the other telegraphers who have a grievance against the companies. Word has been received to this effect from the national president, who says that the strike will be confined to the cities where there are grievances.

The Illinois Traction Company has started a two-hour service between Decatur and Champaign, commencing at 5 a. m. This is the last road the company has built.

No objections were made to the plans of the Illinois Traction Company for a bridge across the Mississippi River at St. Louis by the army corps of the United States engineers this week. Engineer Modjeska states that work will be commenced within 60 days after the permit has been issued by the government, and that it will be completed within 18 months from time it is commenced. The bridge will be located about 4,000 feet below the Merchants' Bridge in North St. Louis. The central span will be 523 feet long, with a span on each end 521 feet long. The piers will be located same as the Merchants' Bridge, with a clearance above high-water mark of 50 feet. The bridge will be built to accommodate street cars, wagons and foot passengers. The width inside the trusses will be 26½ feet.

Seven of the big cars which are being built for the Peoria Railway for use in this city are about ready to leave the shops in St. Louis. The cars will be taken to Bloomington to receive the electrical equipment and then will be brought to this city. They are of the single-end type and are 43 feet long. The company will build loops at each end of Adams Street to accommodate the new cars. V. N.

Northwestern States.

Minneapolis, June 22.—Bonds for $11,000 have been voted at St. Charles, Minn., for the purpose of purchasing the local electric-light system.

All bids for the construction of a power house for the blind asylum at Bathgate, N. D., were rejected.

Official announcement has been made that on July 1st the La Crosse (Wis.) Water Power Company will close its option for the purchase of the plant of the Winona Railway and Light Company at Winona, Minn., and will bring in the power being developed at Hatfield, Wis. At that time A. V. Schroeder of Springfield, Ill., will become manager of the Winona plant.

The City Council is considering a proposition to purchase the Polar Star electric plant at Faribault, Minn.

Courtland F. Ames of Chicago has been awarded the contract for the construction of the proposed dam and installing machinery at Fergus Falls, Minn. The amount of the contract is $47,235. The plant is for lighting purposes.

The new interurban railway of the Newton and Northwestern Railway Company from Boone to Des Moines, Iowa, has been placed in operation.

The City Council at Virginia, Minn., has granted a franchise to the Mesaba Traction Company, to run for 25 years.

The street-railway power house at Duluth, Minn., was damaged by fire last week to the extent of about $10,000. R.

Mexico.

Mexico City, June 20.—The Mexican Light and Power Company is constructing another large storage reservoir at Necaxa, where its hydro-electric plant is situated. The construction of the dam has necessitated the removal of about 2,000,000 cubic yards of material. This is being done by hydraulic sluicing. The Los Reyes River has been diverted into the Necaxa basin, giving considerable additional water in case of need. The ultimate capacity of the two reservoirs will be 70,000,000 cubic meters and 26,000,000 cubic meters, respectively. There is also a small reservoir formed by the dam on the Tezcapa River. The company is installing two additional generators at Necaxa, each having a capacity of 8,200 horsepower. A portion of the hydraulic works for a second installation of six generating units of 10,000 horsepower each has been constructed. They will be situated at an elevation of 1,500 feet above the first power house, where the company will utilize a drop of 2,140 feet, thus using the same water twice over. This addition of 60,000 horsepower which is now being installed will make the plant of the Mexican Light and Power Company by far the largest in Mexico. It already has transmission lines running to Mexico City, El Oro and Puebla. It provides all of the lighting and electric power for these three places. The street-railway system in Mexico City is owned by the same interests, and power for the operation of the cars is supplied by the Necaxa plant.

The Monterey Railway, Light and Power Company, which purchased the two street-railway systems in Monterey more than a year ago, is making good progress in the work of rebuilding the several lines and converting them into electric transit. A number of extensions and new lines are also being built. The company will have expended about $2,000,000 in the improvement work when it is finished. The line which runs from Monterey to the suburban pleasure resort of Topo Chico will soon be finished. It will be placed in operation as soon as the power station is completed. The company is composed of a syndicate of Canadians, headed by William Mackenzie of Toronto.

The San Luis Potosi Tramways Company will build an electric railway from San Luis Potosi to the mining camp of Cerro de San Pedro, a distance of 14 miles. All of the mule-car lines of the company in San Luis Potosi are to be changed to electric traction. W. D. H.

Pacific Slope.

San Francisco, June 20.—The street-car strike seems to be on its last legs. The United Railroads has increased its service until cars are run on Sutter Street and several of the most important lines from 4 a. m. until midnight. This week there has been a recurrence of violence in a few cases, but no lives have been lost. Strike sympathizers have made a practice of pouring oil on the rails of the steepest section of the Fillmore Street Hill, where the grade of about 40 per cent. is overcome by means of a cable and drum, so that an ascending and a descending car on the double tracks balance each other. Then, by putting on current, the ascending electric car surmounts the hill. These cars ran away several times, but the passengers got off in time to prevent loss of life.

The soaping of tracks is continued on steep stretches of track throughout the city, but the motormen being on the lookout often apply the brakes in time to avoid disaster. The California Street Cable Railroad Company has profited by the enforced idleness of its cars, having put in new boilers and repaired the machinery in the power house. The Hyde Street line will in all probability be the first to be operated, as that line is in perfect condition.

Several of the new automobile omnibuses operated by the carmen's union have appeared on the streets and are crowded on every trip. The union expects to have a complete line the whole length of Van Ness Avenue before many days.

It is asserted by the Pacific States Telephone and Telegraph Company's officers that 124 of the 187 telephone linemen who went out on a sympathetic strike have returned to the company's employment.

Grand Vice-president Sullivan of the International Brotherhood of Electrical Workers has revoked the charter of Electrical Workers' Union No. 151 on telegraphic advices from President McNulty of the International Brotherhood, who is on his way to San Francisco. Pending his arrival nothing will be done toward forming a new union to replace Local 151.

The new plans of the electrical committee which has supervision of the municipal electric-lighting system of Alameda, Cal., call for the construction of a new fireproof building, the installing of a new generating unit, new boiler and extending the city service. The estimated cost is $58,000.

The San Francisco, Vallejo and Napa Valley Electric Railroad Company, which will complete its extension from Napa to St. Helena, Cal., in 90 days, wishes to build a further extension to Calistoga.

Men are at work driving water tunnels through solid rock on the Mono Power Company's new electric power-transmission plant on the Owens River in California. Hydraulic Engineer Leffingwell is in charge of the work. Leon M. Hall, the electrical engineer, is about ready to issue specifications for the initial installation, which will include three 2,500-kilowatt three-phase direct-connected generating units and two direct-connected exciter units. A unique feature of this plant is its location. It will be installed in a chamber 120 feet long, 24 feet wide and 14 feet in height, cut in the side of a 300-foot rock cliff, forming the river bank. A tunnel will conduct the water to within a few feet of the waterwheels. The floor of the plant is 19 feet above the level of the water in the Owens River. It is estimated that 12,900 horsepower will be generated at this plant, with a head of about 525 feet of water. The Owens River Power Company, controlled by the same financial interests, has a waterpower location further downstream on the river, where 12,600 horsepower will be developed later. A water tunnel 8,000 feet in length will be required to supply this plant. This project was financed three years ago, but the promoters of the Los Angeles water system attempted to usurp all of the prior water rights and retarded the carrying out of the power project. Recent rulings at Washington, D. C., prevented this monopolizing of water, and the company will run its lines into Nevada in record time. The citizens of Los Angeles voted this month to bond the city for $23,000,000, for the construction of their 240-mile conduit, but it will cost probably $6,000,000 more to complete the system.

The Heat, Light and Power Company has been incorporated, with a capital stock of $50,000, by A. J. Newbury and associates. The capital stock has been fully subscribed. Porterville, Cal., is the principal place of business.

A project for developing electric power on a large scale from the waters of the Colorado River is being promoted by mining men of Searchlight, Nev. Those interested assert that a very large hydro-electric plant could be built on the river and supply power for operating mines, mills and an electric road for Searchlight and all of Southern Nevada.

The Reno Power, Light and Water Company and the Truckee River General Electric Company are preparing to remodel their system of distribution in Reno, Nev., at an expense of over $30,000.

The merchant marine of the Pacific Coast has been very slow to avail itself of the advantages of wireless telegraphy. However, the Pacific Coast Steamship Company recently made a good beginning by having its two new steamers that were built on the Atlantic Coast, equipped with wireless apparatus. A telegram received June 18th from the station at Tatoosh, Wash., reported that one of these new passenger steamers, The President, had been heard of from a distance of 1,060 miles, or nearly half way from Puget Sound to Nome. The steamer is returning from its first voyage to Alaska. A.

PERSONAL.

L. V. Hall has been elected manager of the Sangamo Valley Traction Company, with headquarters at Hillsboro, Ill.

Joseph D. Crafton has succeeded James F. Davidson as superintendent of the United Railways Company of St. Louis, Mo.

Frank Arnold, formerly manager of the Oswego (N. Y.) Traction Company, is now general manager of the Fort Dodge, Des Moines and Southern Railway of Des Moines, Iowa.

Joseph Sidney Francis, chief engineer in Philadelphia for the American Telephone and Telegraph Company, and Miss Kate Winthrop Nelson, daughter of Mr. and Mrs. Frank Nelson of Calais, Me., were married in Boston, Mass., on June 19th.

Robert C. Martin, formerly electrical engineer with the National Board of Fire Underwriters, later electrical inspector with the Knoxville Insurance Exchange of Knoxville, Tenn., has been appointed electrical inspector for the city of La Crosse, Wis.

President William Christopher Robinson and Vice-president C. E. Corrigan of the National Metal Molding Company visited Chicago last week. Mr. Corrigan recently suffered a painful accident to his foot, but his indefatigable energy has kept him on the move, and now, beyond a slight limp, he is literally "on his feet again."

Mr. Morgan Brooks, professor of electrical engineering in the University of Illinois, who attended this week's convention of the American Institute of Electrical Engineers at Niagara Falls, N. Y., was independent of railroads in making the journey, for he made the trip from Urbana, Ill., to Niagara Falls, a distance of over 700 miles, by automobile.

George Gray Ward, vice-president of the Commercial Cable Company and of the Postal Telegraph-Cable Company, has been elected to succeed the late Charles F. Cutler in the directorate of the Washington Trust Company. Wall Street was interested to note that a Mackay Companies' man was put in the place left vacant by Mr. Cutler, who was chairman of the board in a number of the subsidiaries of the American Telephone and Telegraph Company.

Orville H. Ensign has been elected head of the department of electrical engineering of the University of Wisconsin. Professor Ensign has been chief electrical and mechanical engineer in the United States Reclamation Service for several years.

Charles Alfred Brown, a well-known electrician, committed suicide at his home in North Adams, Mass., on June 13th. He was born in Adams, Mass., in 1842. He invented several electrical appliances and was the leading electrician at Hoosac Tunnel when it was being built. While conducting some experiments in 1862 he was permanently blinded by an explosion.

E. D. Edmonston has recently joined the engineering staff of W. S. Barstow & Co. of New York city. Mr. Edmonston graduated from Lehigh University with the degree of E. E. in 1898 and has been connected with the Westinghouse Electric and Manufacturing Company, the Lackawanna Steel Company and the American Construction Company of New Orleans.

C. S. Baum, foreman of shop No. 9 of the General Electric Company at Schenectady, will be succeeded by O. W. Beebe. Mr. Baum was recently presented by the employes of the shop with a gold watch-fob and a diamond-studded locket, the latter containing the picture of one of his daughters, as a token of the good-will of his associates toward their superintendent.

Samuel B. McLenegan, the new manager of the Central California Traction Company, has assumed charge of the local railway in Stockton, Cal. Mr. McLenegan was for five years the general superintendent of the Huntington interurban system in Los Angeles and has been actively engaged in electric-railroad work for 15 years. He will try to finish the extension to Lodi so as to haul crops this fall.

Charles R. McKay has been appointed electrical engineer and superintendent of lighting of the Toledo Railways and Light Company of Toledo, Ohio, in place of E. J. Bechtel, who resigned recently to take a position in New York. Mr. McKay comes from the office of the General Electric Company in Cincinnati, where he has been engineer for a number of years. He will start upon his new duties July 1st.

Prof. Alexander Stewart Herschel, M. A., the noted astronomer, died on June 18th at the Observatory House, Slough, Bucks, England, where his grandfather, Sir William Herschel, and Sir John Herschel made most of their famous discoveries. Professor Herschel was a Fellow of the Royal Society and was a doctor of civil law. He was professor of physics and experimental philosophy at the Durham College of Science at Newcastle-on-Tyne.

Mr. Otto Ernest Osthoff was married in Chicago on June 15th to Miss Lillian Dow, daughter of Mr. and Mrs. Nathan Conant Dow; there was a reception at 3324 Rhodes Avenue. Mr. Osthoff is an enterprising and progressive young electrical engineer. Formerly he was connected as electrical engineer with Sipe & Sigler of Cleveland in the storage-battery business, with headquarters at Cleveland, and later he was district engineer at Chicago for the Electric Storage Battery Company. For the last four or five years Mr. Osthoff has been chief engineer and vice-president of H. M. Byllesby & Co., Chicago. The bride is a well-known and popular Chicago society girl.

ELECTRIC LIGHTING.

The Livingston (Tex.) Electric Light Company has been incorporated.

The town of Terrell, Texas, will install a municipal electric-light plant.

Marshall, Minn., will spend $17,000 in rebuilding its municipal electric-light plant.

The town of Marshall, Iowa, is considering the erection of an electric-light plant.

Seguin, Texas, will double the capacity of its municipal electric-light and power plant.

B. M. Stephenson will install an electric-light plant in Downs, Kan., which will cost $12,000.

An electric-lighting plant will probably be erected at Scottsboro, Ala., by prominent citizens of that town.

The Rockdale (Tex.) Water and Light Company has been incorporated with a capital stock of $50,000.

The electric-light-plant proposition is still before the City Council of Pond Creek, Okla. C. J. Roe is city clerk.

The Ordway (Colo.) Electric Light and Power Company has been incorporated with a capital stock of $20,000.

It is said that electric signs which overhang in State Street, Chicago, between Lake and Van Buren streets, are to be ordered removed within 60 days, and that the mayor will refuse to sign any more

permits for electric signs within the Loop district. For the present the signs on other streets will not be interfered with.

The Idaho Water and Electric Power Company of Boise, Idaho, has been incorporated with a capital stock of $50,000.

About 90 per cent. of the merchants in the business district of La Crosse, Wis., use electric current for lighting or power.

The Plymouth Lighting Company of Plymouth, Ind., has been capitalized at $100,000 by L. P. Kleitz, P. A. Neuffer and others.

The People's Gas and Electric Company of Savanna, Ill., has been incorporated for $80,000 by Frank Zinnel, A. P. Woodruff and others.

The city of Woodbury, N. J., will erect a municipal electric-light plant. The contract of the company now lighting the city will expire in about a year.

The Columbia Gas and Electric Company of Cincinnati has been capitalized at $100,000. Archibald S. White, N. S. Keith and others are the organizers.

The town of Washburn, Ill., will have an electric-lighting plant, to be erected by the Consolidated Electric and Manufacturing Company, an outside concern.

The city of Faribault, Minn., is contemplating taking over the electric-light plant of the Polar Star Electric Company there. The street lighting now costs $500 a month.

The General Electric and Improvement Company of Atlanta, Ga., has been organized by E. D. Thomas and M. M. Anderson of Atlanta. In addition to engaging in a general real estate and development business the company will manufacture and sell electric power and light.

W. W. Sames, A. E. McNeil and Owen McHugh are corresponding with engineers in regard to the cost of an electric-light plant and waterworks system for Hartshorn, Okla. As soon as an estimated cost is obtained, the City Council expects to issue bonds for the construction of same.

Stockholders of the Kansas City Railway and Light Company held their annual meeting in Jersey City this week. The company's report of earnings showed a balance of $1,049,000 after operating expenses and interest and taxes for the year ended May 31st, as compared with $921,000 in the preceding fiscal period. This is at the rate of about six per cent. on the outstanding common stock after the payment of five per cent. on the preferred.

Bids will be received by Rev. J. M. Carroll, president of the San Marcos Baptist Academy at San Marcos, Texas, until July 6th, for the erection and completion of a three-story cement-stone-trimmed brick building, 296 feet long by 151 feet deep. The proposal will include a power house, heating and lighting plant and plumbing for the academy to be erected at San Marcos. Plans and specifications may be secured from the architect, Milton W. Scott, Waco Loan and Trust Building, Waco, Texas.

ELECTRIC RAILWAYS.

A franchise has been granted to a company to construct and operate a street railway in Bisbee, Ariz.

It is proposed to construct an electric railway between the towns of McEwen and Ruskin, Tenn. A company is about to be formed with a capital stock of $100,000. Indiana capitalists are said to be interested in the enterprise.

The Citizens' Street Railway Company of Oklahoma City, Okla., has been capitalized for $100,000. The incorporators are J. J. Culbertson and J. S. LeClerq of Paris, Tex.; W. F. Harn, R. Q. Blakeney and J. F. Winans of Oklahoma City.

It is expected that by the end of this week enough stock of the North and West Side street-railway lines in Chicago will be deposited to insure the acceptance of the traction-settlement ordinance. Receiver Marshall E. Sampsell says that within a few days the reorganization plans prepared by the New York interests for the Chicago Railways Company will be made public.

The Chicago and Wisconsin Traction Company is the name of a new Illinois corporation which proposes to build an electric railway out of Chicago in a northerly and northwesterly direction. The incorporators are H. R. Yaryan, Lewis E. Starr, Walter F. Wantke, Philip R. Lynch and George W. Miller, all of Chicago. The nominal capital stock of the company is $10,000.

The ordinance for the electrification of the Evanston division of the Chicago, Milwaukee and St. Paul Railway, whereby it would connect with the Northwestern Elevated Railroad at Wilson Avenue, Chicago, will be considered by the Chicago City Council on July 1st. The question has been before the council four times and defeated. With amendments it is now recommended by the committee on local transportation. Either or both roads are permitted by the ordinance to operate the proposed electric service. It will be for passengers only. The third rail is not permitted on the surface.

The enormous development of 20 years in electric railways, says the New York Financial News, from eight miles of track in 1886 to nearly 33,000 miles in 1906, consisting of 1,081 railways operating approximately 77,000 motor and other cars, with capital stock aggregating nearly $2,000,000,000 and a funded debt of over $1,500,000,000, has been a very prominent factor in the expansion or evolution of certain lines of industrial manufacture.

The Chicago-New York Electric Air Line Railroad Company on June 19th entered into a traffic agreement with the Chicago, South Bend and Northern Indiana Railroad Company, giving the air line an entry into the heart of South Bend, together with a terminal loop. An agreement was also made with the Murdock lines for the joint use of wires and span construction in Laporte, Ind. President Price and Chief Engineer Mapledoram of the Co-operative Construction Company, which is building the air line, are in the East to select power equipment for the air line's new power house, to be built just east of Laporte.

POWER TRANSMISSION.

The Big Baldy Mining and Milling Company will erect a power plant at Grangeville, Idaho, to develop electric power for use in the mines.

The Beaver River Power Company of Telluride, Colo., has been capitalized at $500,000. I. E. Brown, S. A. Bailey and Cooper Anderson are the incorporators.

The Birmingham (Ala.) Railway, Light and Power Company will spend, it is said, $15,000,000 on improvements. A large power house will be erected, probably in the coal fields of the district.

The Escanaba Electric Power and Pulp Company of Escanaba, Mich., will develop waterpower on the Escanaba River to operate a large pulp mill. O. L. Hine, P. L. Utley and John Strange, all Wisconsin men, are the incorporators of the new company.

Sealed tenders will be received up to September 3d by the chairman of the Board of Control, Winnipeg, Man., for the construction of the general works and for the supply and erection of the various portions of the equipment for the hydro-electric works and station at Point du Bois, for a transmission line between Point du Bois and Winnipeg, and for a receiving transformer station in Winnipeg. The equipment will include five 4,000-horsepower turbines; two 450-horsepower turbines; five and two generators, each of 3,000 and 250 kilowatts capacity, respectively; one induction motor; five step-up transformers; five step-down transformers; seven turbine governors and a telephone system; a transmission system 75 miles long; steel towers; testing transformers and apparatus; three electric traveling cranes, and much auxiliary apparatus. Plans and specifications may be obtained from the power engineer's office, Carnegie Library Building, Winnipeg, or from C. B. Smith, Confederation Life Building, Toronto, Ont.

PUBLICATIONS.

Shawmut National Electrical Code standard porcelain cut-outs are the subject of a little flier sent out by the Chase-Shawmut Company, Newburyport, Mass.

"Methods and Work of an Engineering Organization" is the title of a booklet issued by Dodge & Day, engineers, Drexel Building, Philadelphia. It contains several illustrations of engineering work representative of that done by the firm.

The May Bulletin of the Bureau of Standards, issued by the United States Department of Commerce and Labor, contains several valuable technical papers, among which may be mentioned "The Mutual Inductance of a Circle and a Coaxial Single-layer Coil—the Lorenz Apparatus and the Ayrton-Jones Absolute Electrodynamometer," by Edward B. Rosa; "An Exact Formula for the Mutual Inductance of Coaxial Solenoids," by Louis Cohen; "The Mutual Inductance of Coaxial Solenoids," by E. B. Rosa and Louis Cohen; "The Production of High-frequency Oscillations from the Electric Arc," by L. W. Austin; and "An Explanation of the Short Life of Frosted Lamps," by Edward P. Hyde.

The Electric Storage Battery Company of Philadelphia has just issued a booklet entitled "Facts About Storage Batteries" for the guidance of dealers, supply houses and contractors. This booklet gives in concise form information which will be of assistance to the dealer in electrical supplies in determining what his customer will require in the way of storage batteries for use in connection with interior telephone systems, electric bells, low-voltage lamps, gas, gasoline-engine ignition, etc. The booklet is illustrated with cuts showing the different parts entering into the construction of the storage battery, and gives examples of figuring upon material required for different services, arrangements for charging, etc. It will be forwarded to those interested in this subject upon request to any of the sales offices of the company.

Wickes Brothers, machinery manufacturers and dealers, Saginaw, Mich., in their latest monthly stock list, show a large line of boilers, engines, dynamos, motors, pumps, etc.

In Bulletin No. 4507 on electric flatirons, the supply department of the General Electric Company, Schenectady, N. Y., points out many of the advantages to be obtained in the home, in commercial and hotel laundries, in tailor shops, in factories, by architects and draftsmen, in hospitals, by travelers, etc., from the use of the different types of irons being sold by that company. Interesting load curves are given, taken from typical lighting stations, and showing the increase in output during light-load hours due to the installation of electric flatirons on their lines. The bulletin gives interior views of laundries and other commercial applications of electric irons, and describes and illustrates the various sizes and types listed, ranging from three pounds, 250 watts, to 24 pounds, 1,000 watts. By the use of an indicating switch placed at the heel of the iron, the current can be turned off and on at will, and extremely close regulation of the temperature obtained.

MISCELLANEOUS.

The Nicholson File Works of Anderson, Ind., has closed a contract with Gustav Saaler of Germany for a $20,000 gas-producing plant, the third of its kind to be used in America, of which Mr. Saaler is the inventor. Indiana coal will be used, and gas will be produced at a cost not exceeding 15 cents per thousand cubic feet, it is said. Mr. Saaler will superintend the erection of the plant. He owns two large factories in the Black Forest Province, Germany, which use gas.

An ordinance to provide for the placing of all wires underground in a half-mile circle in the city of Detroit, Mich., with the exception of trolley wires, will shortly be presented to the City Council. If the ordinance is passed, the local street-railway company will probably have to expend several hundred thousand dollars in order to comply with the terms of the measure. It has many wires above ground, including the heavy feeder circuits on Rivard Street. The ordinance will also compel the placing underground of some wires by the Edison company and the telephone and telegraph companies.

TRADE NEWS.

The Gainer Electric Company of Cleveland, Ohio, has been incorporated for $25,000 by B. J. Sawyer, William Griffith and others.

The Federal Electric and Refrigerating Company of Colorado Springs, Colo., has been incorporated with a capital stock of $50,000.

The Doerr-Mitchell Electric Company of Spokane, Wash., has been incorporated for $100,000 by R. Doerr, J. R. Mitchell and others.

The Van Dorn-Elliott Electric Company of Cleveland, Ohio, has changed its name to the Van Dorn Electric and Manufacturing Company.

The Pacific Traction Company of Augusta, Me., has been capitalized at $3,000,000, to construct automobiles and appliances. J. Berry is president of the company.

The H. I. Sackett Electric Company of Buffalo, N. Y., has been incorporated for $85,000 by Herbert I. Sackett, John Hara, Jr., and others, to manufacture electrical apparatus.

The Pheoll Manufacturing Company of Chicago has been organized by Mason Phelps, Henry E. Barroll and Paul M. McCain. The company will manufacture electrical specialties, machinery and tools.

The Protective Electrical Supply Company of Fort Wayne, Ind., has been incorporated to manufacture all kinds of electrical and telephone apparatus and supplies. W. L. Moellering, M. B. Larimer and E. M. Popp are the directors.

Pass & Seyhour have taken over the business of the Sarco Company, 906 Sixth Avenue, New York, and will hereafter manufacture its electrical specialties, consisting of attachment plugs, pendant switches, key-arm switches, push buttons, etc. All orders and inquiries for this material should be addressed to Pass & Seymour, Inc., Solvay, N.

Alfred F. Moore of Philadelphia, manufacturer of insulated wire, advises the Western Electrician of some changes in contemplation in his representation in Chicago. His business relations with Mr. H. E. Cobb, 1501 Monadnock Building, will terminate on June 30th, and he expects to be able to announce soon who will represent him hereafter in the Chicago territory.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 o'clock p. m. July 12th, for an electric passenger and freight elevator in the postoffice, courthouse and custom-house building, St. Paul, Minn., in accordance with the drawing and specification, copies of which may be obtained at the above office.

BUSINESS,

The Monarch Telephone Manufacturing Company of Chicago has been granted a permit to do business in Texas, with a capital of $100,000. The company will manufacture telephone instruments and supplies.

The George Q. Hill Company of Boston, Mass., maker of screw-machine products and other metal goods, announces that it has opened a western office, in charge of William Pike, whose headquarters will be at 905 Plymouth Building, Chicago. The company has made the commercial production of small metal parts in quantities a particular study, and declares that its knowledge of this work often enables it to suggest methods of manufacture which improve the quality of the product or lessen its cost.

The Gregory Electric Company, Sixteenth and Lincoln streets, Chicago, has just bought the entire stock of three-phase 60-cycle induction motors contained in the plant of the Goyer Alliance Glucose Refining Company, Belle Alliance, La. This was a brand-new plant two years ago, and the company failed before it was entirely completed. There are 59 motors, ranging in size from 7½ to 40 horsepower, and the Gregory company offers them for sale for immediate delivery.

The Blake Signal and Manufacturing Company of Boston, Mass., says that its tube flux is taking very well among all classes of consumers. Some of its more recent and larger orders came from the Union Switch and Signal Company, Pennsylvania Steel Company, Long Island Railroad, Boston and Maine Railroad, Milford and Uxbridge Street Railway, Kny-Scheerer Company, H. W. Johns-Pratt Company, Electro-Dynamic Company and Emerson Electric and Manufacturing Company. Many small orders have also been received from telephone companies.

The Sheldon School of Salesmanship, 209 State Street, Chicago, says that it has received a number of requests for additional information regarding its plan, following Vice-president J. D. Kenyan's address at the Washington convention of the National Electric Light Association. To these requests the School gladly answers by sending interesting printed matter. It aims to help its customers to secure "increased profits and a more satisfactory working force in every direction." "Our success with 23,500 students, 85 per cent. of whom are proprietors, managers and veteran salesmen, is a guarantee of the value of our work in your organization."

As an essential safeguard in the movement of trains by a telephone dispatcher's system, the Blake signal system has been indorsed by L. E. Fischer, general manager of the Illinois Traction System. In a recent communication on the operation of trains Mr. Fischer states that it is his company's practice to require the dispatcher, at the instant he fixes a meeting point other than those provided on the time-card schedule, to lower the signal arm at the siding at which the opposing trains are to meet. Should the motorman overlook his order, and should the conductor fail to detect the fact that the motorman has overlooked the order, the Blake signal, according to Mr. Fischer, would still prevent the opposing trains coming together. A further advantage of the Blake system is pointed out in the fact that it places at the disposal of the dispatcher a device whereby he can reach cars on the road, a feat wholly impossible without the use of station agents.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 18, 1907.

857,021. Signaling System for Railroads. Francis M. Black, Kincaid, Kan. Application filed December 15, 1902.

In an electric circuit are two opposed electrical generators, a current-strength indicator, and means connected with a car for electrically connecting opposite sides of the circuit intermediate the generators.

857,024. Pendant Electric Fixture. Walter L. Bradshaw, Cambridgeport, Mass., assignor to John E. R. Hayes, Melrose, Mass. Application filed August 29, 1903.

An incandescent electric-light fixture is described.

857,027. Washing Machine. George D. Burton, Boston, Mass., assignor to the American Electrical Process Company, a corporation of Maine. Application filed November 20, 1905.

Combined with a tank adapted to contain liquids are a perforated revoluble receptacle therein, a perforated partition therein, and two electrodes so located within the tank as to cause a current of electricity to pass diagonally through the liquids.

857,035. Signal-light Apparatus. Gustaf Delén, Stockholm, Sweden, assignor to Aktiebolaget Gas-accumulator, Stockholm, Sweden. Application filed February 15, 1906.

The apparatus described has a casing provided with an expansible diaphragm, gas supply and delivery pipes and a valve inclosed in the casing and controlling the passages of the gas through the pipes. Magnetic means operate the valve, and there are means for operating the valve against action of the magnetism.

857,040. Trolley Retriever. Charles I. Earll, New York, N. Y. Application filed October 24, 1904.

Details are described.

857,041. Can or Receptacle for Storage Batteries. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed October 5, 1903.

A seamless can or receptacle made of electro-deposited iron and carbon is described.

857,045. Lightning Arrester. George L. Foote, New York, N. Y., assignor to Foote, Pierson & Co., New York, N. Y. Application filed December 29, 1906.

The arrester has a tapered core of insulating material having a helical groove in its surface, a bare conductor supported in the groove and an insulated conducting medium fixed parallel with the axis of the core and in close proximity to the conductor.

857,058. Automatic Interlocking Contact Mechanism for Electric-railway Systems. Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. Application filed September 11, 1905.

Contact mechanism for electric cars has a supporting bracket or casting and a number of contact members pivotally mounted upon independent pivots to rock or swing thereon, one of the contact members operating within the other.

857,059. Automatic Contact Mechanism for Electric-railway Systems. Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. Application filed October 7, 1905.

In a contact device for electric cars are a number of contact members movably mounted upon the car to be moved into or out of operative position, and a movable guide rail or section for moving one of the members out of operative position.

857,062. Electrical Transformer. John D. Hilliard, Albany, N. Y. Application filed November 20, 1906.

The transformer comprises a casing containing oil, two compartments in the casing, transformer windings immersed in the oil in one compartment and a regulating switch also immersed in oil in the other compartment, the switch having contact points on the transformer windings, and an operating handle projecting out of the casing.

857,079. Multiplex Telephony. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 26, 1903. Renewed March 19, 1907.

A method of multiplex telephony consists in modifying, respectively, in accordance with sets of sound waves, sets of single-phase alternating currents of different frequencies, and translating each modified alternating current into sound waves by sending it through a telephone receiver excited by an alternating current of its same frequency.

857,080. Apparatus for Transforming Continuous Currents. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 30, 1903.

A system for transforming unidirectional high-tension currents of constant strength into undirectional low-tension currents of constant voltage, comprises a line carrying the continuous high-tension currents, a resonator arranged to store an amount of energy which is large with respect to that consumed in an alternating period, an electric exploder in shunt of the resonator, a step-down transformer, a condenser in its secondary circuit to render zero its co-efficient of apparent self-induction, and an electric valve or valves for rectifying the low-tension alternating current thus produced.

857,087. Electric Snap Switch. Walter S. Mayer, Philadelphia, Pa., assignor to the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa. Application filed January 4, 1907.

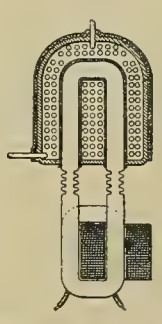
In the device described are a contact member, means for supporting the same, including a shifter, means for energizing the shifter, a controller for imparting energy to the energizing means, a link interposed between the controller and the shifter and operatively connected to each of them, and means co-operating with the link to hold and release the shifter.

857,112. Trolley Catcher. William S. Roath, Canton, Ohio. Application filed April 26, 1905.

Details are described.

857,122. Electric Heater. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 15, 1906.

The heater comprises a heat-generating transformer, the primary of which is a low-resistance conductor carrying a current of large volume, and means applied to the conductor to maintain a low temperature relatively to that of the transformer. (See cut.)



NO. 857,122.—ELECTRIC HEATER.

857,124. Photometer. Theodore Torda, London, England. Application filed February 26, 1906.

The photometer described has a timing device and a shutter in combination with a selenium cell and current meter, whereby the selenium cell is exposed to the light rays for a certain period, and shut off for another period in the required proportions.

857,132. Dynamo-electric Machine. Joseph R. Weselinovits, Chicago, Ill. Application filed July 14, 1906.

The machine has a main commutator connected to the main-line terminals, an auxiliary commutator connected to the field-exciting coil, a fixed number of armature turns in circuit with the auxiliary commutator, and a variable number of armature turns in circuit with the main commutator.

857,137. Binding Post. William G. Winter, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed January 9, 1907.

A central metallic member adapted to receive a binding device is provided at its lower end with an opening for receiving a conducting wire.

857,138. Regulating Resistance for Electric Currents. Paul Wöbber, Cuxhaven, Germany. Application filed November 20, 1906.

The device comprises a pair of contacts, an absorbent non-conducting rod connected to one of the contacts, a liquid element carried by the rod and means for metallically connecting the rod to the other contact.

857,142. Starting Rheostat. William C. Yates, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 1, 1905.

Combined with a motor are a starting rheostat therefor, an auxiliary switch, means whereby the motor may be controlled from the switch through a portion of the starting resistance with the controlling arm in the off position, a no-voltage release magnet, and means controlled by the switch for de-energizing the magnet.

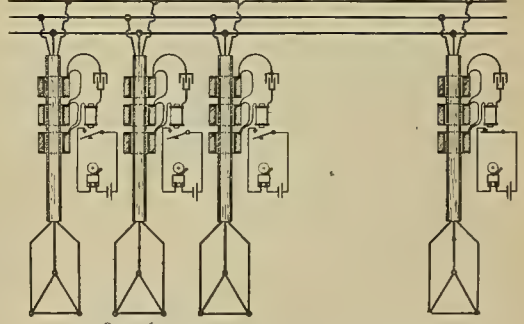
857,152. Support for Crown or Antenna Wires for Electric Masts. Alexander E. Brown, Cleveland, Ohio, assignor to the Brown Hoisting Machinery Company, Cleveland, Ohio. Application filed January 18, 1907.

The support comprises an oscillating frame structure upon the mast, booms vertically pivoted thereto, and flexible supports for the wires extending between and connected with the outer ends of the booms.

857,164. Automatic Weighing Device. Petronella Edtbauer, Chicago, Ill. Application filed December 24, 1906.

An automatic feed mechanism for weighing devices comprises a suitable hopper, an inclined tilting chute fulcrumed below and at one side of the hopper, a rock shaft to which the hopper is secured between its ends, a pawl projecting therefrom, an armature engaged by the pawl, magnets therefor, balance scales at the end of the chute farthest from the hopper, and an electric circuit connecting the balance scales and magnets.

857,165. Motor Control. Friedrich Eichberg, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 11, 1905.



NO. 857,262.—GROUND AND FAULT DETECTOR.

In combination with an alternating-current motor of the commutator type having two sets of commutator brushes, one on the line of the stator field and the second displaced 90 electrical degrees therefrom are means for connecting the stator winding and second set of brushes in series to an alternating-current source and short-circuiting the first set of brushes, and means for connecting the stator winding and second set of brushes in series to a direct-current source and preventing a flow of current between the brushes of the first set.

857,184. Dynamo-electric Machine or Electric Motor. Robert Lundell, New York, N. Y. Application filed January 11, 1906.

A dynamo-electric machine or electric motor of the commutator type has a distributed field winding having its main-field terminals arranged to produce field polarities at an angle of less than 90 electrical degrees to the axis of the armature field. There are auxiliary field terminals for the field winding connected with a speed-regulating controller, the controller being provided with means for diverting part of the excitation current for the field winding.

857,186. Electric Switch. Walter S. Mayer, Philadelphia, Pa., assignor to the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa. Application filed December 12, 1906.

The switch is provided with a casing, a block of insulated material located therein, a U-shaped strip for holding the block in place, contact springs secured to the block, a slide, means for guiding the slide, a contact block carried by the slide, a plunger adapted to slide in the casing, and means for normally forcing the plunger outward.

857,191. Automatic Motor-controlling Apparatus. Frederick W. Newell, Hastings-upon-Hudson, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed November 13, 1905.

Combined with a motor arc controlling means therefor, a doubly wound electromagnet, a number of resistances, and means controlled by the electromagnet for inserting one of the resistances in series with the motor armature, and another of the resistances in shunt thereto.

857,196. Circuit-breaker for Gas Engines. Flemion B. Packwood, Lincoln, Neb. Application filed January 2, 1906.

Combined in a circuit breaker are a case, a rotatable shaft extending into the case, and electric circuit terminals on the case, one of the terminals being arranged insulated from the case and made projecting thereinto.

857,203. Telephone Lineman's Grab Seat. Clayton Randall, Mabel, Minn. Application filed February 21, 1907.

The device has a seat, a pair of arms pivotally secured to the seat and adapted to be engaged by the knees of the lineman, and a coil spring which normally holds the arms apart.

857,215. Apparatus for Automatic Lighting of Gas Jets and their Extinction after a Predetermined Time. Fredrik Testor, Stockholm, Sweden. Application filed November 11, 1904.

In a contact-controlling device combined with stationary contacts are an electromagnet, an oscillating armature, an oscillating lever connected to the armature and arranged to move over the contacts and check mechanism for controlling the return movement of the armature.

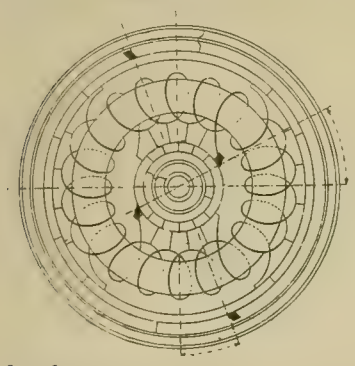
857,247. Apparatus for Fusing Metals. Adolph E. Menne, Crenzthal, Germany, assignor to Cölnmusener-Bergwerks-Actien-Verein, Crenzthal, Germany. Application filed July 9, 1906.

The device comprises in combination means connecting the metal to one pole of a source of electricity, an electrode, means connecting the electrode to the other pole of the source of electricity, whereby an arc may be formed between the electrode and the metal, and a nozzle insulated electrically from the electrode adapted to supply gas supporting combustion to the arc.

857,262. Ground and Fault Detector for Electric Distribution Systems. Philip Torchio and Thomas W. Varley, New York, N. Y. Application filed March 8, 1907.

The device includes a multiple conductor of normally balanced capacity, a number of ring transformers surrounding the conductor, and an alarm device constructed to be operated by the induced current due to disturbances of the balance, the transformers and alarm device being in series circuit. (See cut on preceding page.)

857,267. Redressing and Regulating Device Enabling to Transform a Single-phase Current into a Continuous One. Louis R. Auvert and Alphonse F. E. Ferrand, Paris, France. Application filed August 9, 1905.



NO. 857,267.—MEANS FOR CHANGING SINGLE PHASE INTO DIRECT CURRENT.

A rotary transformer comprises the following parts held to rotate in unison: A ring of magnetizable material, two series of coils on the ring, two collector rings connected with the respective coils, conducting rings each connected with one of the several collector rings to convey two separate alternating currents to the collector rings, each collector ring comprising insulated contact plates and stationary brushes engaging the collector rings to receive a direct current therefrom, the brushes being adjustable circumferentially to vary the mean potential of the transformed current. (See cut.)

857,277. Electrolytic Process of Purifying Liquids. John T. Harris, New York, N. Y. Application filed June 20, 1903. Renewed November 20, 1906.

The process consists in passing an electric current through the impure liquid from a metallic anode which will yield a coagulant, simultaneously agitating the liquid and subjecting the anode and liquid to the action of a magnetic field, coagulating the impurities, and separating the coagulum from the liquid.

857,301. Automatic Weighing Machine. Oliver C. Patton, Denver, Colo., assignor of the whole to others. Application filed June 18, 1906.

An electromagnet is employed to unlatch a valve in the bottom of the hopper whereby a spring closes the valve.

857,311. Regulating Attachment for Electric Lights. Chetwood Smith, Worcester, Mass. Application filed January 2, 1903.

A cut-out for an electric lamp having a heater circuit comprises a magnet, a pivoted armature adapted to make and break the heater circuit, and adjustable means for counter balancing the armature to make the circuit in either normal, inverted, or horizontal position, whereby the lamp may be operatively employed in all of such positions.

857,341. Terminal Box for Electric Cables. Sergius P. Grace and Richard A. L. Snyder, Pittsburg, Pa., assignors to the Western Electric Company, Chicago, Ill. Application filed August 3, 1906.

The box comprises a casing forming a chamber for receiving the cable ends, a block forming a cover for the chamber, terminal posts mounted in the block, wings extending at an angle from the front of each side of the casing, the wings being provided with openings through which electric conductors may be led to the terminal posts, and a cover for the wings and terminal block.

857,375. Receiving Apparatus for Wireless Telegraphy. Ludwig Arnson, New York, N. Y. Application filed December 20, 1905.

The apparatus comprises an aerial, a hysteresis motor, means for imposing upon the field of the latter wave oscillations from the aerial, a sympathetic oscillator having coils in connection with the motor, a local energizer of oscillations and an inclosing metallic box.

857,378. Electrolytically Refining Metals. Anson G. Betts, Troy, N. Y. Application filed February 20, 1905.

The process of electrolytically refining a set of metal anodes arranged in multiple consists in first passing from the anodes through a suitable electrolyte to suitable cathodes practically the full volume of the refinery circuit until the active anode area begins to diminish largely, and then shunting around the tank containing the anodes, part of the refinery current, which part increases thereafter functionally with the diminishing active anode area.

857,381. Heating Bar for Electric Furnaces. Archibald L. Brougham, New York, N. Y. Application filed October 26, 1906.

A molded electrical heating bar has terminal portions of high electrical conductivity, an intervening portion of high electrical resistance, and connecting portions merging the terminals gradually into the intervening portion.

857,384. Electric-light Switch. Harry R. Coffey, Chicago, Ill. Application filed January 7, 1907.

An attachment for electric switches is described.

857,394. Generator for Alternating Electric Currents. William Hallock, New York, N. Y. Application filed September 21, 1906.

An alternating electric generator has stationary staggered pole pieces in the field, a rotor traversing the field and having connecting pieces turning opposite the polar projections, and concentrically arranged field and generating coils, each comprising a single coil, and the coils being placed on opposite sides of the inner polar projections.

857,404. Electric-lamp Regulator. Emery Johnson, Newberg, Ore. Application filed January 25, 1907.

Means are provided including a switch for throwing one or more resistance coils into the lamp circuit.

857,446. Block-signal System for Railways. Homer G. Comstock, San Francisco, Cal. Application filed November 24, 1903.

Signals are located in pairs at the end of each block, and depression buttons are disposed in series at points adjacent each signal. Batteries and connections are employed whereby the depressions of the buttons close circuits.

857,447. Exercising Apparatus. John J. Cooper, New York, N. Y. Application filed October 22, 1906.

An electric motor actuates the apparatus.

857,458. Contact Breaker for Induction Coils. Frank B. Griffin, Oshkosh, Wis., assignor to Frank S. Fell and William R. Hill, Oshkosh, Wis. Application filed December 3, 1906.

A circuit breaker comprises a base, a vibrator secured thereto, adjustable means for varying the length of vibration of the vibrator, adjustable means for regulating the tension of the vibrator, and means for permitting the vibrator to operate with but one vibration for each rupture of the circuit.

857,480. Telephone System. Lewis B. Niemann, Staplehurst, Neb. Application filed March 8, 1907.

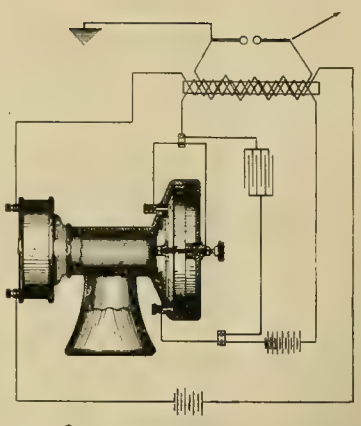
In the system are combined a subscriber's station including a source of ringing current, means for establishing a grounded circuit, an exchange station including a grounded signal drop, and a clearing-out drop, a circuit connecting the subscriber and exchange stations together, and a supplemental signal at the exchange station connected in circuit to be operated by a current derived from a subscriber's station.

857,485. Electric Heater. James A. Reardon, Seattle, Wash. Application filed February 28, 1906.

The heater comprises an annular casing arranged to form a central liquid passage, projections arranged at one end of the casing to permit free circulation of the liquid when the casing is placed on end, a handle secured to the opposite end of the casing, and a high-resistance conductor arranged within the casing and insulated therefrom.

857,530. Wireless Telephone. Francis J. McCarty, San Francisco, Cal.; Henry A. McCarty, administrator of Francis J. McCarty, deceased, assignor to the McCarty Wireless Telephone Company, San Francisco, Cal. Application filed February 12, 1906.

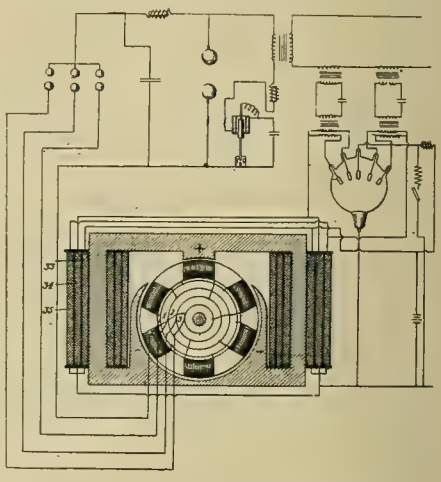
In the wireless telephone described are means for intensifying the vibrations from a transmitting device, the means consisting of a transmitting diaphragm with metallic contact points upon opposite sides, and connecting means, an induction coil, local battery and connections therethrough and with the coil, a spark gap interposed in the secondary circuit and a microphone transmitter. (See cut.)



NO. 857,530.—WIRELESS TELEPHONE.

857,560. Process for Generating High-frequency Alternating Currents. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 5, 1904.

The process described of transforming unidirectional currents into practically sinusoidal alternating currents of effectively constant frequency, consists in charging a resonator with unidirectional currents for one portion of each alternating period, and so that it shall store an amount of electrical energy which is large with respect to the energy consumed in the system in a period, and discharging the resonator through a path of low resistance during the other portion of this alternating period. (See cut.)



NO. 857,560.—GENERATING HIGH-FREQUENCY ALTERNATING CURRENTS.

857,561. Apparatus for Generating High-frequency Alternating Currents. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Original application filed February 5, 1904. Divided and this application filed March 14, 1906.

A system for transforming unidirectional currents into alternating currents of constant frequency comprises a line carrying continuous currents, a resonator, an induction coil having its primary connected with the resonator, and an electric exploder in shunt of the resonator.

PATENTS THAT HAVE EXPIRED.

Following is a list of patents (issued by the United States Patent Office) that expired on June 24, 1907:

430,606. Magnetic Power-equalizer. W. W. Alexander, Kansas City, Mo.
430,607 and 430,608. Electro-mechanical Combination-lock. W. W. Alexander, Kansas City, Mo.
430,622. Electric-lamp Support. J. Chase, Rochester, N. Y.
430,633. Electric Temperature-regulator. L. F. Easton, La Crosse, Wis.
430,634. Regulator for Dynamos. W. H. Elkins, Boston, Mass.
430,637. Automatic Signal and Switch-controlling Apparatus and Verifying Mechanism. E. R. Gill, Jr., Pleasant Hill, Mo.
430,686. Switch for Electric Locomotives. F. B. Rae, Detroit, Mich.
430,688. Commutator for Induction Generators for Telegraph Lines. W. S. Richards, Boston, Mass.
430,690. Electric Railway. W. Robinson, Boston, Mass.
430,722. Arc Lamp. J. J. Wood, Brooklyn, N. Y.
430,747. Telephone-exchange Apparatus. J. J. O'Connell, Chicago, Ill.
430,748. Telephone-exchange Keyboard Apparatus. J. J. O'Connell, Chicago, Ill.
430,764. Electric Lock. C. B. Beers and W. B. Tuttle, Bridgeport, Conn.
430,804. Electrical Calculating System. H. Hollerith, St. Louis, Mo.
430,838. Method of Electric Welding or Metal Working. M. W. Dewey, Syracuse, N. Y.
430,839. Apparatus for Working Metals by Electricity. M. W. Dewey, Syracuse, N. Y.
430,865. Electrical Indicator. H. W. Leonard, New York, N. Y.
430,868. Regulation System for Electric Circuits. C. O. Mailloux, Brooklyn, N. Y.
430,934. Electric-lighting System. T. A. Edison, Menlo Park, N. J.
430,960. Telephone System. I. Kitsee, Cincinnati, Ohio.
430,991. Carbon for Electrical Purposes and the Process of Making It. J. H. Davis, Findlay, Ohio.
430,992. District Police and Fire Telegraph. C. C. Drake, Trenton, N. J.